ACEIVE 2019

Proceedings of the Third Annual Conference of Engineering and Implementation on Vocational Education

Universitas Negeri Medan, North Sumatra, Indonesia
16 November 2019

EDITORS
Sriadhi Sriadhi
Ernesto Silitonga
Zulkifli Matondang
M. Dominic Mendoza
Tansa Trisna Astono Putri
Robbi Rahim
Proceedings of the Third Annual Conference of Engineering and Implementation on Vocational Education

ACEIVE 2019
16 November 2019, Universitas Negeri Medan, North Sumatra, Indonesia

General Chairs
S Sriadhi, Ph.D (Chair)
Dr. Eka Daryanto, M.T (Co-Chair)
Prof. Dr. Baharuddin, M.Pd (Publication Chair)
Dr. Rosnelli, M.Pd (Secretary I)
Dr. Nathanael Sitanggang, M.Pd (Secretary II)
Dr. Adi Sutopo, MT (Treasurer I)
Dr. Nahesson Panjaitan (Treasurer II)
Dr. Essi Emilia (Program Chair)
Sahala Siallagan, Ph.D (Editorial)
Dr. Erma Yulia (Secretariat)
Dr. Dina Ampera (Sponsorship)

Technical Programme Chair
Prof. Dr. H. Tambunan, M.Pd (Universitas Negeri Medan, Indonesia)
Dr. Lisyanto, M.S (Universitas Negeri Medan, Indonesia)
Dr. Zulkifli Matondang, M.Pd (Universitas Negeri Medan, Indonesia)
Dr. Nahesson Panjaitan (Universitas Negeri Medan, Indonesia)
Dr. Agus Junaidi, MT (Universitas Negeri Medan, Indonesia)
Dr. Farihah, M.Pd (Universitas Negeri Medan, Indonesia)
Conference Organization

Steering Committee

Prof. Manihar Situmorang, M.Sc., Ph.D (Universitas Negeri Medan, Indonesia)
Prof. Motlan, M.Sc., Ph.D (Universitas Negeri Medan, Indonesia)
Prof. Dr. Sahat Siagian, M.Pd (Universitas Negeri Medan, Indonesia)
Prof. Dr. Mona Masood (Universiti Sains Malaysia, Malaysia)
Prof. Dr. H. Tambunan, M.Pd (Universitas Negeri Medan, Indonesia)
Dr. Ade Gafar Abdullah (Universitas Pendidikan Indonesia, Indonesia)
Dr. Isma Widiaty (Universitas Pendidikan Indonesia, Indonesia)
Dr. Eng. Asep Bayu Dani Nandyanto, M.Eng (Universitas Pendidikan Indonesia, Indonesia)
Dr. Juniastel Rajagukguk (Universitas Negeri Medan, Indonesia)
Ernesto Silitonga, DEA Ph.D (Universitas Negeri Medan, Indonesia)
Andri Zainal, Ph.D (Universitas Negeri Medan, Indonesia)
Dr. Darmawan Napitupulu (LIPI, Indonesia)
Dr. Wahyuddin Albra, SE, M.Si, Ak, CA (Universitas Malikussaleh, Indonesia)
Dr. Muhammad Ikhsan Setiawan, ST, MT (Universitas Narotama, Indonesia)
Dr. Heri Nurdiyanto, S.Kom., M.T.I (STMIK Dharma Wacana, Indonesia)

Organizing Committee

General Chair
Dr. Eka Daryanto, MT Universitas Negeri Medan

General Co-Chairs
Dr. Rosnelly M.Pd Universitas Negeri Medan

TPC Chair and Co-Chair
Dr. Esi Emilia Universitas Negeri Medan
Dr. Farihah Universitas Negeri Medan

Sponsorship and Exhibit Chair
Dr. Dina Ampera Universitas Negeri Medan

Publicity & Social Media Chair
Dr. J. Simarmata, M.Kom Universitas Negeri Medan

Publications Chair
M.Dominic Mendoza, S.Kom., SE., M.M Sekolah Tinggi Ilmu Manajemen Sukma

Web Chair
Tansa Trisna Astono Putri, S.Kom., M.Ti Universitas Negeri Medan

Panels Chair
Deni Sinaga, M.T Universitas Negeri Medan
Preface

The 3rd Annual Conference of Engineering and Implementation on Vocational Education (3rd ACEIVE) is a scientific forum for scholars to disseminate their research and share ideas. This conference will take place at the Le Polonia Hotel Medan, North Sumatera Province, Indonesia, on 16 November 2019. The 3rd ACEIVE’s theme is Engineering for Education and Society in IR 4.0. This conference will be an annual event hosted by Faculty of Engineering, Universitas Negeri Medan, Indonesia.


The conference invites delegates from across Indonesian and South East Asian region and beyond, and is usually attended by more than 100 participants from university academics, researchers, practitioners, teachers, students of postgraduate program and professionals across a wide range of industries.

S Sriadhi, Ph.D
# Contents

Automotive Competence in Vocational High Schools and The Needs World of Industry  
*Siti Ulgari, Herminarto Sofiyan, Dwik Muda Yulanto, Henry Iskandar*  

Development of Weaving Module Based on Local Loading in SMKN 1 Mesjid Raya Aceh Besar  
*Erni Erni, Vita Pujawanti Dhana, Novita Novita*  

Raw Material Production Revenue Optimization Using Information Technology-Based Distribution Modifications  
*M.D. Mendoza, H.D. Hutahaean*  

Combination of Single Tuned Filter and Double Tuned Filter to Reducing Current Harmonics  
*Azmi Rizki Lubis, Marwan Affandi, Mustamam Mustamam*  

Development of Interactive Learning Media with Adobe Animate CC in Basic Programming Learning at SMK Negeri 1 Kabanja  
*Horasman Simanihuruk, Mukhtar Mukhtar, Samsidar Tanjung*  

Development of Microcontroller ATMega128 Based Injection Molding Machines With Motor Variations  
*Izwar Lubis, Selamat Triono, Kasman Rukun*  

Production Flow Optimization By Using Theory of Constraints  
*Hasianna Nopina Situmorang, Nazaruddin Matondang*  

Increasing Students’ Environmental Education and Awareness Through Campus Owned Waste Management Unit  
*Rachmat Mulyana, Eka Daryanto, Eko Wahyu Nugrahadi, Jubaidah Jubaidah, Rini Selly*  

Analysis of The Use of Lecture Facilities in The Department of Mechanical Engineering Education Welcoming the Opening of New Study Program  
*Robert Silaban, Eka Daryanto, Selamat Riadi*  

Language Maintenance In New Millenium: A Case Of Javanese-Batak Toba Families  
*Vivi Novalia Sitinjak, Anna Tambunan, Nurlaidy Simamora, Pahotan Sinaga*  

Development of Web-Based Learning Media in The Research Methodology Course in The Department of Electrical Engineering Medan State University  
*Abdul Muin Sibuea, Mohammad Amin, Joni Syafrin Rambey*  

Development of Digital Learning Media on Entrepreneurship Subject Using Creative Productive Learning Strategies  
*Bonaraja Purba, Benyamin Situmorang*  

The Development of Learning Media Based On Visual Using Snake and Ladder Board Games to the Learning Outcomes of Early Age Children in TK Karya Darma Medan  
*Andrew Ryan Hasudungan Siallagan, Julaga Situmorang, Harun Sitompu*
The Development of Interactive Computer-Based Learning Models to Improve Student Learning Outcomes in Integrated Social Studies Education at SMP Negeri 4 Tarutung

Wesli H Situmeang, Sahat Siagian, Efendi Napitungulu

Applying Video Learning of Media Tutorials and Actual Media Objects to Increase Student Interest and Learning Outcomes on the Clutch System Material

Henry Iskandar, Dwiki Muda Yulanto, Sapitri Januariyansah, Siti Ulgari, Ahmad A. Sandi

The Effect of Tourist Facilities on Visitor Satisfaction in Tourist Attractions in Pamutusan Island, Bungus West Sumatera

Yuzia Eka Putri, Fatma Tresno Ingtyias

The Relationship of Innovative Working Activity with The Self-Development of Productive Teachers Automotive Engineering Programs

Dwiki Muda Yulanto, Sapitri Januariyansah, Henry Iskandar, Siti Ulgari, Didik Rohmantoro

Prediction System of Police Officer Admissions Number using Analysis of Variance Method

TTA Putri, HD Hutahaean, RD Sari, R Rahmadani

Implementation of User Centered Design Method in E-Commerce Book Sales Application

R Rahmadani, Mendoza, M. D, RD Sari, TTA Putri

Mixed Heuristic Algorithm As String Matching For Search Document

RD Sari, R Rahmadani, TTA Putri

The Influence of Pillar Form to Local Mechanism

Sarra Rahmadani, Syarvina Syarvina

Investigating The Use of Smartphone Disorders in Learning by Students of Mechanical Engineering Expertise Program (MEEP)

Sapitri Januariyansah, Dwiki Muda Yulanto, Safri Gunawan, Hanapi Hasan, Henry Iskandar

Analysis of Using Gasoline-Corncob Waste Bioethanol Blends in Four-Stroke Motorcycle Engine onto Exhaust Emission and Compression Ratio

Hanapi Hasan, Hasan Maksum, Safri Gunawan, E Eswanto, Sapitri Januariyansah

Project Based Learning to Enhance Students' Science Process Skills in Science Learning

Halimatussa’diah Halimatussa’diah, H. Sitompul, R. Mursid

Assessment Standardization of Music Art Work in Music Education Study Program FBS Universitas Negeri Medan

Uyuni Widiastuti

Influence of Organizational Culture, Job Satisfaction, and Work Motivation to The Commitment of The Organization of Primary School Teachers of The Sub District Sumbul Pegagan District Dairi

Romaulina Siburian, Paningkat Siburian, Khairil Ansari
Analysis of Implementation of Standards for Facilities and Infrastructure of State Aliyah Madrasah in Medan City Based on Minister of National Education Regulation Number of 2007

Lia Khairia Harahap, Ibnu Hajar, Arif Rahman

Needs Analysis of Junior High School Teachers at Kecamatan Hamparan Perak, Deli Serdang

Muhammad Rizki Syahputra, Darwin Darwin, Salman Bintang

The Implementation of Management Training Model Diploma in Mechanical Engineering, Faculty of Engineering, State University of Medan

Leni Purwati, Rosmala Dewi, Darwin Darwin

The Influence of Learning Strategy (Blended Learning and Expository) and Prior Knowledge on Information Technology and Communication (ICT) Learning Outcomes

Resien Resien, Harun Sitompul, Julaga Situmorang

The Effect of Direct Instruction Strategy and Students’ Social Interaction on Learning Achievement of Pancasila and Civic Education

Evi Susilawati, Harun Sitompul, Julaga Situmorang

The Influence of Learning Models and Cognitive Styles on Geography Learning Outcomes at SMAN 2 Percut Sei Tuan

Zuilen V Bay Sinaga, Abdul Hamid K, Sugiharto Sugiharto

The Effectiveness of Student Worksheet (LKM) Based on Guided Discovery Learning on Matrix Material of Building Engineering Education Students

Enny Keristiana Sinaga, Zulkifli Matondang, Suhairiani Suhairiani, Siti Zulfa Yuzni

Development of E-Learning Based On “SMILE” Learning Model to Improve Economic Learning Outcomes of Class X Students of Senior High School 1 Pahae Jae 2019/2020

Dwi Fany Butar-butar, Efendi Napitupulu, Dina Ampera

Development of Tutorial Video Media Based on Project Based Learning in Class XI State of SMKN 1 Lubuk Pakam

Fahrul Rozi, Abdul Hamid K, Keysar Panjaitan

Antnet Algorithm in Route Searching on Computer Networks

Harvei Desmon Hutahaean, R. Mahdalena Simanjorang, Penda Sudarto Hasugian

Development of the Body Care E-Modul Learning Based on Discovery Learning in Department of Cosmetology Education on Students at Universitas Negeri Medan

Wuri Dwiyati, Harun Sitompul, R. Mursid

Fiber Optic Sensor Array for Perfume Detection Using Neural Network

Bakti Dwi Waluyo, Arwadi Sinuraya, Salman Bintang

The Ability of Coco Fiber Material in Reducing Heat as An Insulation of Building Walls on Accepted Temperature Level

Kemala Jeumpa, Selamat Triono, Rusnardi Rahmat

Dry Leaf Litter Extraction as Natural Dye for Dye-Sensitized Solar Cell

Muhammad Aulia Rahman Sembiring, Bakti Dwi Waluyo
Needs Analysis and Implementation Training Management Model Development
_Eka Daryanto, Darwin Darwin_

Effectiveness of Fieldwork Practice Implementation at Engineering Faculty of Unimed in RI 4.0
_Harun Sitompul, Rosnelli Rosnelli, Eka Daryanto, Nathanael Sitanggang, Zulkifli Matondang_

The Effectiveness of The Use of Statistics Textbooks in Improving The Statistical Reasoning of Building Engineering Education Students
_Zulkifli Matondang, Enny Keristiana Sinaga, Harun Sitompul_

Need Assessment of Video Learning Media as The Supporting Media for Nutrients Analysis Practice
_Esi Emilia, Rasita Purba, Iis Siti Jahro, Risti Rosmiati_

The Concept of Bloom Taxonomic Revision and Critical Thinking in Fashion Design Learning
_Nining Tristantie, Syahril Syahril, Armaini Rambe, Juliarti Juliarti_

Job Sheet Development of Electrical Installation in Improving Student Competencies of Electrical Engineering Education Study Program
_Dadang Mulyana, Arif Rahman, Mustamam Mustamam_

Development of Occupational Safety, Health (K3) Courses for Makeup Students in the Engineering Faculty of the State University of Medan
_Siti Wahidah, Nur Basuki, Lina Pangaribuan_

Development of Machining Technology Material by Using Teaching Factory Based on Metacognitive Skill Model
_Selamat Riadi, Selamat Triono, Muslim Muslim, Syahril Syahril_

The Development of Fantasy Make Up Instructional Dictate for Students in the Cosmetology Study Program of the Faculty of Engineering, State University of Medan
_Marnala Tobing, Irmiah Nurul Rangkuti, Dian Maya Sari, Desy Afyanty Lubis_

Development of Job sheet-Aided Module in Children Clothing Courses Fashion Study Program off Universitas Negeri Medan
_Hotmaria Tampubolon, Surniati Chalid, Ermidawati Ermidawati, Eka Rahma Dewi_

Development of E-Book Learning Media in Drawing Manswear Sewing Pattern in Fashion Study Program
_Halida Hanim, Fariah Farahah, Nurmaya Napitu, Surani Surani_

The Syllabus Development of Welding Technology Course SKNNI-Based PTM-FT UNIMED to Support The SMAW Welding Competence Test
_Hidir Efendi, Izwar Lubis, Firdaus Firdaus_

The Feasibility and Effectiveness of Interactive Multimedia using Gerlach and Ely Model in Learning Planning Courses
_Erma Yulia_

Development of Integration Learning Models Industrial Engineering Courses in Fakultas Teknik Universitas Negeri Medan
_Rosnelli Rosnelli, Sarwa Sarwa, Fahmy Syahputra_
Development of Teaching Materials Based on Blended Learning on The Special Room Decoration Art Course
Sulistiawikarsih Sulistiawikarsih, Mastarina Barus, Siti Sutanti, Mawadda Azizah Sari Waruwu

Learning Media Based on Website Development of Courses in Patisserie Culinary Student of IT Unimed
Adikahriani Adikahriani, Ana Rahmi, Riana Friska

The Development of Blended Learning Model to Improve Students Learning Outcomes in Drawing Technique and AutoCAD
R. Mursid, Yuniarto Mudjisusatyo, Andi Bahar

The Development Of Learning Media Based On Collaborative Discovery Learning And Problem Based Learning In Instructional Design
Keysar Panjaitan, Khoiri Khoiri, R. Mursid

Net Balance Analysis Relationship of Learning Interests and Student Learning Outcomes of Teacher Explanation Skills in Medan City
Syafiatun Siregar, Harun Sitompul, Kinanti Wijaya, Ahmad Andi Solahuddin, Mey Theresa Naibaho

Inquiry Base Learning Model in Electrical Machine Learning
Marwan Affandi, Adi Sutopo, Mustamam Mustamam

Improvement of Quantum Teaching Model Assisted by Comics against Student Learning Outcomes
Marnoko Marnoko, Sriadhi Sriadhi, M. Martiano

Developing Google Classroom Based Learning Media for Patisserie Subject to Improve Students’ Learning Outcomes in Culinary Art Education Unimed
Yuspa Hanum, Nila Handayani, Mastarina Barus, Erli Mutiara

The Use Of A Tutorial Video-Aided Learning Module On Soil Mechanical Practicum
Suhairiani, Nahesson. H. Panjaitan, Enny Keristiana Sinaga

Analysis of Mechanical Properties and Micro Structure of Body Valve Bolts, Alloy Steel Grade B7 Material as a Result of Offshore Application
Qamaruddin, Mochamad Iwan Nur Irawan, Dwi Wahyuni Wulandari, Iskandar Adj Purnomo

Power System Modeling and Network Simulation: The Content Validity of the E-MAP Model in Electric Power Transmission Technology
Agus Junaidi, Joni S Rambe, Rudi Salman, Rahmaniar, Rosnelli

The Use Of Excel Macro Feature On Cost Estimation Calculation
Putri Lynna A. Luthan, Nathanael Sitanggang

Green Infrastructure Emergency: Abandoned Development
Nurul Fitria Marina

Analysis of the Effect of Using Camshaft Racing on Power and Torque in Motorcycle
Hasan Maksum, Wawan Purwanto, Miky Andes Putra, Hanapi Hasan

Biomass as An Alternative Energy Source: Recent Progress and Development Based on Thermal Processes to Respond to the Future Energy Mix in Indonesia
J.P. Simanjuntak, E. Daryanto, B.H. Tambunan
Blended Learning for Vocational Teacher Candidates
Muhammad Amin, Salman Bintang

Virtual Fairy Tale Based on Wulangreh as a Learning Media in Javanese Lesson
S Agustin, Sunardi, D Rochsantiningsih, Gunarhadi, R Perdana
Automotive Competence in Vocational High Schools and The Needs World of Industry

Siti Ulgarī1, Herminarto Sofiyan2, Dwīki Muda Yulanto3, Henry Iskandar3

Universitas Negeri Medan, Indonesia1,3,4
Yogyakarta State University, Indonesia2,
siti_ulgari@unimed.ac.id

Abstract: The purpose of the research was to know: (1) the mapping of vehicle engineering competency in vocational high school with competency that needed in the world of work/world of industry, (2) the level of automotive competency relevancies with work competency work needs in the world of work/world of industry. This research was quantitative descriptive research with survey method. Data collection technique that used was questionnaire. Data analysis technique in the study was quantitative descriptive statistics. The result of this study indicate that: (1) the mapping competence showed that the competency in the vocational high school’s curriculum documents but was not the work competence that needed into the world of the industry including 67 items of competence with its percentage was 94%; (2) the rate of relevance showed that there were 4 rounds of competence that did not relevant; 3 items of competence were in category relevant enough; 50 rounds were the competence that in the relevant categories and 14 competencies were highly relevant category.

Keywords: work competency needs, world of work/world of industry, relevance.

1. Introduction

Vocational high school can’t be apart from the context of the present life and the anticipation of dynamic future context that growing systematically accordance with the globalization. Education in Indonesia is experiencing changes in the era of globalization today, which gives two adjoining impacts i.e. opportunities and challenges [1]. The readiness of a country to make a problem will become opportunities. Rather, unpreparedness of a country will make the chance of turning into a problem. The enactment of the Public Policies of the ASEAN economy (MEA) will bring the impact of intense competition not only in the market of goods and services but also the labor market to earn a chance at the job. If it is not ready with the condition that Indonesia will lose and become a user of products and foreign labor that is more competitive.

Maclean & Wilson [2] said that “Technical and vocational education training (TVET) is concerned with the acquisition of knowledge and skills for the world of work”. Within the framework of preparing and improving competitive advantage, then human resources into a "major
force" for the industry in generating national excellence in the context of a more comprehensive and innovative.

One of the most decisive sectors in preparing human resources (HR) to have a competitive edge is the most strategic sectors as education in national development, with education expected in addition to being able to provide provision of knowledge, skills and attitudes can also have developed a wide range of skills needed by every Member of the community. TVET is concerned with the acquisition of knowledge and skills for the world of work. Vocational training as important as the other point; it is no longer enough to think that prisoners will acquire 'good work habits' if they spend the day in unskilled factory work, because times have moved on [3].

One of the strategic steps that can be done to create the quality of human resources is through formal education. Formal education is education that structured and tiered. It consists of primary education, secondary education, and higher education. The secondary level of education was the Vocational High School. Vocational learning is what happens for vocational purposes at the local level". The field of vocational education is subject to sets of long-standing sentiments and precepts that have arisen through history and are reinforced by societal mores and practices that pervade both societal and professional discourses [4].

The purpose of the vocational education is very diverse. There are four purposes of vocational education based on the projects i.e. vocational education that focuses on (1) preparation for working life including informing individuals about their choice of an occupational; (2) the initial preparation of the individual to work life including developing the capacity for practice the work that has been selected; (3) the development was from individuals during their work according to the requirements of the performances of the transformation work time by time; and (4) the provisions of educational experience that supports the transition from one job to another job because a individuals choice or are forced to change jobs throughout their working lives [4].

Competence is very basic for vocational high school graduates to enter the workforce. Competencies acquired through learning activities in vocational high school from good theory or practice. Vocational education does not separate between theory and practice but integrates the skills practice with the relevant lessons that are the basis of knowledge for these skills. “Competency is the climax of rule guided learning and discovering how to cope in crowded, pressured contexts, where the proficiency marks the onset of quite a different approach to the job” [5]. Competency is a combination of skills, abilities, and knowledge needed to perform a specific task that is in its simplest meaning, “competency” means to be capable of doing something, often denoting a mastery or exceptional talent or skill” [6].

This concerns to the development of vocational high school that have been done through program development expertise that is relevant to the needs of the labor market. This program became the cutting edge of creating link and match with the world of work. The curriculum is a field of enquiry and action on all that bears on schooling, including content, teaching, learning and resources. The curriculum is concerned with what is planned, implemented, taught, learned, evaluated and researched in schools at all levels of education [7].

However, the success education will create graduates were absorbed by the field of business and employment, namely the issue of the suitability of the competence of graduates of each competency expertise with the needs of the world of work. Happening at this moment, the existence of the vocational high school is not fully based on analysis of labor requirements (demand and supply analysis). The facts on the ground that happens are supply driven.
The solution of the problems that presented above is to conduct a study on the suitability of the curriculum that implemented in vocational high school with competencies that are needed in the workforce. The study was conducted to find out the competencies that taught in vocational high school but is not needed in the world of work and know the competencies are not taught in vocational high school however needed in the workforce. Ideally, the competencies taught in Vocational High School are also used in the world of work. The existence of the ideal conditions is then expected to occur the suitability between the educational world and the industrial world. Based on the description above, researcher interested to do a study about the "Automotive Competence in Vocational High Schools and The Needs of World of Industry".

2. Research Method

This research used descriptive quantitative research designs with the survey as an approach method. The purpose of this study to describe the data quantitatively and then dig up the facts and described in quantitative (numbers) based on the data of the population represented by sample about Light Vehicle Engineering competence of Vocational High School with the competence required by the business world or the world of industry.

Survey method that used to collect data from a particular natural place (unnatural), but researcher do the treatment in the data collection for example, by passing a questionnaire, structured interviews, tests, and so on [8]. This is in accordance with the statement of previous study that said that "... survey research involves the collection of information from a sample of individuals through their responses to questions" that is survey research is research that using collection of information from samples based on the response from the given questions.

The research’s subject was the competence of Engineering Vehicle Lightweight, Automotive Engineering Program with work competency needed by the business world or the world of industry. Data source are taken from the head of the workshop, the head of the mechanics, the mechanics of world of work/world of industry automotive, Vehicle Engineering Program Teachers, and students of engineering Vehicle Lightweight competencies.

Data collection techniques used were interview documentation of observations. The technique of data analysis in this study used descriptive statistics data analysis techniques. The presentation of the data is done by data processing instrument competency curriculum of engineering Vehicle Lightweight of Vocational High School and competence required in the automotive industry in Medan. In the presentation of the descriptive statistical data will be presented the measures of descriptive statistics, namely the size of the Byway, Sum, Mean, Median, and Mode of each item instrument.

The presentation of data use SPSS software (Statistical product and service Solution) version 23 for Windows and Microsoft Excel software 2016. SPSS version 23 is used to manipulate and present data about the determination of the classification of the category is irrelevant, Less relevant, quite relevant, relevant, and highly relevant, and presents data in the form of a table of distribution the frequency and percentage. Microsoft Excel software used 2016 presenting data in the form of graphs and manipulate data research instrument, henceforth becoming the data ready to be processed using the Software SPSS version 23.
3. Results and Discussion

The description of research’s result about the analysis of Light Vehicle Engineering, automotive program competence in Vocational High School and its relevance with the world of industry’s competence in the engineering of light vehicle field are presented in descriptive statistic measurement, distribution of frequency table, and the percentage graph of each competence item that examined on quantitative data.

1) The Structure of The Light Vehicle Engineering Competence

Vehicle Engineering program curriculum was a lightweight in vocational high school refers to the regulation of the minister of education and culture of the Republic of Indonesia number 60 in the year 2013 of the curriculum of vocational high school 2013, where there were 70 competences. Based on the results of the data processing here was the structure of the charge light vehicle engineering competency program skills of automotive.

<table>
<thead>
<tr>
<th>No.</th>
<th>Subject</th>
<th>Competency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Light Vehicle Engine Maintenance</td>
<td>Maintain the main engine system and valve mechanism</td>
</tr>
<tr>
<td></td>
<td>Periodically</td>
<td>Maintain periodic lubrication system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Periodically maintain the cooling system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Periodically maintain the gasoline fuel system conventional / carburetor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Periodically maintain the gasoline fuel injection system (Electronic Fuel Injection / EFI)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Periodically maintain the Engine Management System (EMS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Periodically maintain the In-Line injection pump diesel fuel system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Periodically maintain the rotary injection pump diesel fuel system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Periodically maintain the Common Rail diesel fuel system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perform periodic maintenance checks of vehicle engines</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improve the cylinder head mechanism and accessories</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improve cylinder block mechanism and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The completeness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improve the Lubrication system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improve the Cooling system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improve the gasoline fuel system conventional / carburetor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improve the fuel injection gasoline system (Electronic Fuel Injection / EFI)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improve Engine Management System (EMS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improved the In-Line injection pump diesel fuel system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Repairing the Rotary injection pump diesel fuel system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improved the Common Rail diesel fuel system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reporting the results of improvements to light vehicle engines</td>
</tr>
<tr>
<td>2</td>
<td>Chassis Maintenance and Vehicle Power</td>
<td>Maintain periodic clutches</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maintain periodic Manual transmissions</td>
</tr>
<tr>
<td>No.</td>
<td>Subject</td>
<td>Competency</td>
</tr>
<tr>
<td>-----</td>
<td>------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
|     | Transfer                     | Maintain periodic Automatic transmission  
 |     | Light                        | Periodically maintain the Propeller shaft  
 |     |                              | Maintain periodic Differential  
 |     |                              | Periodically maintain the axle  
 |     |                              | Periodically maintain the conventional brake system  
 |     |                              | Periodically maintain the Antilock Break System (ABS)  
 |     |                              | Periodically maintain the Suspense system  
 |     |                              | Periodically maintain the steering system and Power Steering  
 |     |                              | Carry out Removing, Installing and Adjusting the Wheel  
 |     |                              | Carry out Dismantling, Repairing and Installing Inner and Inner Tires  
 |     |                              | Carry Out Choosing Tires and Rims For Special Use  
 |     |                              | Conduct final testing of the results of regular maintenance of the chassis and the transfer of power  
 |     |                              | Fix the clutch  
 |     |                              | Repair Manual transmission  
 |     |                              | Repair Automatic transmission  
 |     |                              | Repair the propeller shaft  
 |     |                              | Fix Differential  
 |     |                              | Repairing the axle  
 |     |                              | Repairing Conventional brake systems  
 |     |                              | Repairing Antilock Break System (ABS)  
 |     |                              | Repair the suspense system  
 |     |                              | Improve the steering system  
 |     |                              | Improve Spooring  
 |     |                              | Fix Wheel / Tire Balans  
 |     |                              | Repairing the rim  
 |     |                              | Conduct final testing of the results of the chassis repair and transfer of power  

3 | Maintenance of Electric Vehicle Light | Maintain periodic electrical system  
 |                              | Installing Additional Electrical Equipment (Accessories)  
 |                              | Periodically maintain the starter system  
 |                              | Periodically maintain the charging system  
 |                              | Maintain regular ignition systems  
 |                              | Conventional  
 |                              | Maintain regular electronic ignition systems  
 |                              | Periodically maintain the lighting system and instrument panel  
 |                              | Maintain periodic Air Conditioning (AC) systems  
 |                              | Periodically maintain the audio system  
 |                              | Periodically maintain the safety system  
 |                              | Perform the results of periodic maintenance of electrical light vehicles  
 |                              | Improve the electricity system and additional equipment  
 |                              | Improve system start  
 |                              | Improve the charging system  
 |                              | Improve conventional ignition systems  
 |                              | Improve electronic ignition systems  


<table>
<thead>
<tr>
<th>No.</th>
<th>Subject</th>
<th>Competency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Improve lighting and panel systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Instrument</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improve the Air conditioning (AC) system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improve audio system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improving the safety system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manage the results of electrical improvements in light vehicles</td>
</tr>
</tbody>
</table>

2) **Map Light Vehicle Engineering Competency Program Automotive Expertise SMK Negeri needed by business/industry**

The identification of competencies into the needs of the business world/industrial Vehicle engineering package Lightly had done in 10 (ten) main dealers of Vehicle Engineering Light in Medan city. Identification of competences had done by either using the enclosed questionnaire technique with the number of 40 respondents from 10 (ten) main dealers.

The description of the results of the study showed that there were 70 items of competency package engineering Vehicle Lightweight Vocational High School. It consists of 21 items of engine maintenance light vehicle competence, 28 items competence maintenance chassis and a lightweight vehicle power mover, and 21 rounds of competence maintenance electrical light vehicles.

The number of 70 competencies needs of the world of work became a business/industrial world needs identified regarding levels – (the important). The level of urgency of every item of competence was obtained from the sum of the value (score) is obtained at any granule competence, the higher the amount of value (score) is obtained when the higher the degree of urgency of the item also competence. Vice versa, the lower the number value (score) that is obtained at the low level of urgency of the item also competence. Presented the following level of urgency of every grain of competency package engineering Vehicle Lightweight Vocational High School.

**a. Vehicle Engine Maintenance Light**

The engine maintenance light vehicle consists of 21 competence, based on the results of research to the competence of the maintenance of the competence of all light vehicle mean became competency work needed business/industry. In the field of competence maintenance, light vehicle engines are the lowest level of urgency is the grain of the competence to understand the fuel system with a total value of 125 being and percentage of 62.5%. The level of urgency of the highest was the grain of the competence to understand how to take care of the machine at regular intervals (periodic service with a total of 163 value and percentage of 8.15%).

Explained that the subject vehicle lighter machine maintenance all competencies are in the category of less relevant with the percentage of 9.5%, the category was quite relevant to 14.3%, the percentage of relevant categories with percentages 52.4%, the category was very relevant to the percentage of 24.8%. Based on images can be outlined that required the presence of relevance between Vocational High School curriculum with competency work contained in the world of work and the industry to increase levels of graduate absorbed Vocational High School.
b. Maintenance of the Chassis and a lightweight Vehicle Power Mover

Maintenance of the chassis and the transfer of power light vehicles consist of 28 competencies, based on the results of research for competence maintenance chassis light vehicle power mover and all basic competencies into the competency of the work required by the world of business/industry. In the field of competence maintenance chassis light vehicle power mover and this is the lowest level of urgency is the grain of competence keep driving wheel with 138 total value and percentage of 69%. The level of urgency of the highest is the grain of the competence to understand the transmission with a total value of 176 and percentage 88%.

Explained that the subjects of the chassis and vehicle power mover lightweight competence are in the category of categories is quite relevant to 10.7%, the percentage of categories relevant to the percentage of 71.4%, the category is very relevant with the percentage of 17.9%. Based on figure 02 can be outlined that it needs the presence of relevance between vocational high school curriculum with competency work in the business world or the world of the industry to increase levels of graduate absorbed vocational high school.

c. Electrical Light Vehicle Maintenance

Maintenance of electrical light vehicles consists of 21 basic competences, based on the results of research for electrical light vehicle maintenance competence all basic competence be competency work needed by the business world/world industry. In the field of electrical light vehicle maintenance, competence is the lowest level of urgency is the grain of the competence to understand the system of radio with 132 total value and percentage of 66%. The level of urgency of the highest is keeping the competence of grain/service system fuel injection petrol engines with a total value of 178 and percentage of 89%.

The percentage of each category on the subjects of electricity light vehicle maintenance can be outlined as in Figure 03 below. Explained that the subjects light vehicle electrical competencies were in the category of categories was quite relevant to the percentage of 9.5%, the category was relevant to the percentage of 71.4%, the category was very relevant with the percentage 19.1%. Based on figure 3 passable that it needs the presence of relevance between Vocational High School curriculum with competency work in the business world or the world of the industry to increase levels of graduate absorbed Vocational High School.

The competency percentage entered in the category of less relevant 2/71 x 100% = 2.82%, the percentage of competence quite relevant 8/71 x 100% = 11.27%, the percentage of relevant competence is 52/71 x 100% = 73.23, percentage and highly relevant competence is 9/71 x 100% = 12.68%.

3. The level of relevance of competencies between the competencies of engineering Vehicle Light Vocational High School with competency that needed by the business world or the world of industry.

The analysis on the level of relevance of competencies needed to work in the business world or the world industry had done in 10 (ten) main Vehicle Lightweight Engineering dealers. Analysis on the level of competence of relevance had done using the technique of calculate the percentage values (% score) was obtained by each grain of competence, the higher the percentage values (% score) was obtained when the higher levels also the relevance of the competencies of the grains. So
is a good idea, the lower the percentage values (% score) obtained when the lower level also the relevance of the competencies of the grains. Here were presented the level of relevance of each grain of Light Vehicle Engineering competencies, namely:

a. Vehicle Engine Maintenance Light

The engine maintenance light vehicle consists of 21 competencies. In a review of the level of competence of relevance to engine maintenance light vehicle that all competencies included in categories relevant to the order level of relevance as the following table:

Table 2. Relevance Rating of Competence Vehicle Engine Maintenance Light

<table>
<thead>
<tr>
<th>No.</th>
<th>Competence</th>
<th>Relevance Rating (%)</th>
<th>No.</th>
<th>Competence</th>
<th>Relevance Rating (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PM1</td>
<td>95.32%</td>
<td>12</td>
<td>PM12</td>
<td>89.24%</td>
</tr>
<tr>
<td>2</td>
<td>PM2</td>
<td>95.58%</td>
<td>13</td>
<td>PM13</td>
<td>90.57%</td>
</tr>
<tr>
<td>3</td>
<td>PM3</td>
<td>91.69%</td>
<td>14</td>
<td>PM14</td>
<td>88.99%</td>
</tr>
<tr>
<td>4</td>
<td>PM4</td>
<td>93.25%</td>
<td>15</td>
<td>PM15</td>
<td>92.32%</td>
</tr>
<tr>
<td>5</td>
<td>PM5</td>
<td>92.73%</td>
<td>16</td>
<td>PM16</td>
<td>95.23%</td>
</tr>
<tr>
<td>6</td>
<td>PM6</td>
<td>87.68%</td>
<td>17</td>
<td>PM17</td>
<td>89.93%</td>
</tr>
<tr>
<td>7</td>
<td>PM7</td>
<td>93.54%</td>
<td>18</td>
<td>PM18</td>
<td>92.14%</td>
</tr>
<tr>
<td>8</td>
<td>PM8</td>
<td>88.94%</td>
<td>19</td>
<td>PM19</td>
<td>89.77%</td>
</tr>
<tr>
<td>9</td>
<td>PM9</td>
<td>92.44%</td>
<td>20</td>
<td>PM20</td>
<td>89.59%</td>
</tr>
<tr>
<td>10</td>
<td>PM10</td>
<td>93.24%</td>
<td>21</td>
<td>PM21</td>
<td>88.99%</td>
</tr>
<tr>
<td>11</td>
<td>PM11</td>
<td>91.56%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on explanation above this level of relevance, then it can be concluded that the degree of relevance on a vehicle's engine light maintenance of competence between the vehicle's engineering curriculum documents Lightweight Vocational High School with competency work needed by the world business or industry is 21/21 x 100% = 100%, fall into the category of high relevance level.

b. Maintenance of the Chassis and a lightweight Vehicle Power Mover

Maintenance of the chassis and the power light vehicle mover consists of 26 competences, based on the results of data analysis all the competencies required by the business world or the world of industry. In a review of the level of relevance of the 28 competencies maintenance chassis and a lightweight vehicle power mover that was as the following table:

Table 3. Relevance Rating of competence maintenance chassis and a lightweight vehicle power

<table>
<thead>
<tr>
<th>No.</th>
<th>Competence</th>
<th>Relevance Rating (%)</th>
<th>No.</th>
<th>Competence</th>
<th>Relevance Rating (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PSPT1</td>
<td>91.25%</td>
<td>15</td>
<td>PSPT15</td>
<td>88.24%</td>
</tr>
<tr>
<td>2</td>
<td>PSPT2</td>
<td>88.99%</td>
<td>16</td>
<td>PSPT16</td>
<td>91.23%</td>
</tr>
<tr>
<td>3</td>
<td>PSPT3</td>
<td>90.54%</td>
<td>17</td>
<td>PSPT17</td>
<td>92.42%</td>
</tr>
<tr>
<td>4</td>
<td>PSPT4</td>
<td>91.36%</td>
<td>18</td>
<td>PSPT18</td>
<td>91.67%</td>
</tr>
<tr>
<td>5</td>
<td>PSPT5</td>
<td>89.44%</td>
<td>19</td>
<td>PSPT19</td>
<td>89.86%</td>
</tr>
<tr>
<td>6</td>
<td>PSPT6</td>
<td>92.42%</td>
<td>20</td>
<td>PSPT20</td>
<td>88.74%</td>
</tr>
<tr>
<td>7</td>
<td>PSPT7</td>
<td>91.33%</td>
<td>21</td>
<td>PSPT21</td>
<td>89.73%</td>
</tr>
<tr>
<td>8</td>
<td>PSPT8</td>
<td>89.99%</td>
<td>22</td>
<td>PSPT22</td>
<td>92.52%</td>
</tr>
</tbody>
</table>
Based on explanation above this level of relevance, then it can be concluded that the degree of relevance on a vehicle's engine light maintenance of competence between the vehicle's engineering curriculum documents Lightweight in vocational high school with work competency needed by the business world or the world industry is $28/28 \times 100\% = 100\%$, enter in the categories the level of relevance is high.

### Table 4. Relevance Rating of Competence Electrical Light Vehicle Maintenance

<table>
<thead>
<tr>
<th>No.</th>
<th>Competence</th>
<th>Relevance Rating (%)</th>
<th>No.</th>
<th>Competence</th>
<th>Relevance Rating (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PL1</td>
<td>89.32%</td>
<td>12</td>
<td>PL12</td>
<td>89.97%</td>
</tr>
<tr>
<td>2</td>
<td>PL2</td>
<td>91.33%</td>
<td>13</td>
<td>PL13</td>
<td>92.77%</td>
</tr>
<tr>
<td>3</td>
<td>PL3</td>
<td>90.88%</td>
<td>14</td>
<td>PL14</td>
<td>92.14%</td>
</tr>
<tr>
<td>4</td>
<td>PL4</td>
<td>89.53%</td>
<td>15</td>
<td>PL15</td>
<td>90.94%</td>
</tr>
<tr>
<td>5</td>
<td>PL5</td>
<td>89.85%</td>
<td>16</td>
<td>PL16</td>
<td>91.42%</td>
</tr>
<tr>
<td>6</td>
<td>PL6</td>
<td>90.89%</td>
<td>17</td>
<td>PL17</td>
<td>90.79%</td>
</tr>
<tr>
<td>7</td>
<td>PL7</td>
<td>91.42%</td>
<td>18</td>
<td>PL18</td>
<td>88.98%</td>
</tr>
<tr>
<td>8</td>
<td>PL8</td>
<td>92.31%</td>
<td>19</td>
<td>PL19</td>
<td>91.24%</td>
</tr>
<tr>
<td>9</td>
<td>PL9</td>
<td>89.89%</td>
<td>20</td>
<td>PL20</td>
<td>89.73%</td>
</tr>
<tr>
<td>10</td>
<td>PL10</td>
<td>88.96%</td>
<td>21</td>
<td>PL21</td>
<td>90.42%</td>
</tr>
<tr>
<td>11</td>
<td>PL11</td>
<td>89.56%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on explanation above this level of relevance, then it can be concluded that the degree of relevance in light of the vehicle's electrical maintenance of competencies between the vehicle's engineering curriculum documents Lightweight Vocational High School with competency work needed by the corporate world or the world industry is $21/21 \times 100\% = 100\%$, fall into the category of high relevance level.

Based on the results of the research in general, the percentage of the overall level of relevance between the documented curriculum on Light Vehicles with engineering competence that needed by the business world or the world of industry, there were 70 grains of competencies consists of 21 grains competency engine maintenance light vehicles, 28 grains competence maintenance chassis and a lightweight vehicle power mover, and 21 rounds of competence maintenance electrical light vehicles. There are 4 categories of entry less relevant competence with a percentage of 5.7%, 10
incoming competencies categories quite relevant to the percentage of 14%, 51 competencies entry categories relevant to the percentage of 71.8%, and 6 entrance competencies the category is very relevant to the percentage of 8.5%.

Based on the research’s result above, it provide a description of that vehicle engineering curriculum documents Lightweight Vocational High School hadn’t been able to meet all the work competency that needed by the business world or the world automotive industry field. It is important to note in the course of curriculum development that all the competencies taught at Vocational High School working competence need the business world or the world of industry. So graduates have the Vocational High School high competitiveness to enter the world of work.

4. References

Development of Weaving Module Based on Local Loading in SMKN 1 Mesjid Raya Aceh Besar

Erni¹, Vita Pujawanti Dhana², Novita³

Department of Family Welfare Education, Universitas Negeri Medan, Indonesia¹,²,³ ernisyuman@gmail.com

Abstract. Weaving is one of the subjects in the Design and Textile Craft Products study program at SMK N 1, Mesjid Raya in Aceh Besar. Songket craft that studied by students untouched by Aceh’s local’s content. The learning’s process only uses textbook as student guide. The result is, the class becoming monotonic and can’t motivated student to learn independently. Therefore, need to develop the teaching materials that can support students independently in studying and can making the active study conditions. The research has a goal to produce valid, practically, and effective’s locals content base’s module. This type of research is the 4-D Models research development. The research has three stages that are define stage, design stage, and develop stage. Define stage done by analyzing the learning syllabus’s loom, analyzed weaving’s material and discussions with colleagues. In the design stage produced the local content-based modules. Develop stage consist of validations stage that is consultation with material’s expert, media’s and linguistic expert; practicalities of using practicalities questionnaires, observing the learning implementations, interview students and teachers; effectiveness of using motivation’s questionnaire, and observing cognitive and psychomotor learning activity outcomes of students The result showed the locals content base’s module for making craft textile with songkets weaving technique is valid in term of the content and construction. Local content base’s module is practically because can used without major obstacle, and effective because can increase student’s motivation, activation, cognitive study result and psychomotor at making craft textile with songkets weaving’s technique.

Keywords: module, vocational, weaving

1. Introduction
Education is the most important investment for the nation of Indonesia, because it is a means to form human resources that are qualified, both in terms of physical, mental and operational. The quality of education one is determined by learning. The quality of education lately is often the main highlight in the world of education.

Where today’s cultural heritage is often thought to have no relevance to the present especially in the future, and has made some cultural heritage then weathered aged, displaced, and neglected. Preservation of a culture is effective when delivered through education. Because education is the process of forming a quality human resource that is capable of the knowledge of science, skills and positive attitude.

In PP number 19 Year 2005 Article 20, it is said that teachers are expected to develop learning materials, which is then emphasized through regulation of the Minister of National Education (Permendiknas) No.41 year 2007 about the standard process, which among others Govern the learning process planning that requires educators in the education unit to develop a Learning Plan (RPP).

One element in RPP is a learning resource. Therefore, teachers are expected to develop learning modules as one of the learning resources. Permendiknas No.16 year 2007 on the academic qualification and competency Standards Part B also mentions that teachers as professional educators are expected to have the ability to develop learning modules according to the existing mechanisms With regard to students’ social characteristics and environment.

Results of observations and interviews conducted with the teachers of subjects weaving in the design and product study Program Kriya Tekstil in SMK N 1 Masjid Raya Aceh Besar which is a vocational middle school of arts, crafts, and technology mentions, Problems that arise in the learning of weaving, especially in the material making crafts weaving with songket weaving techniques that the teacher does not teach songket weaving that is typical Aceh regional.

Another fact is in general the weaving learning has not used the module of learning completely. Generally, teachers only use the book of packages as a reference in the learning process. In addition, teachers also mention the unavailability of teaching materials that are designed in accordance with the material characteristics and conditions of students in the classroom and lead students to self-study.

Another thing that is also a problem is that it is based on the fact that at this time songket weaving Aceh has been very rare so that the more unknown it exists, and it is unfortunate that the number of traditional weavers in Aceh today Very little is even feared lost at all. This was delivered by the chairman of the UPTD Aceh Museum in the traditional weaving exhibition of Nusantara in Aceh Museum complex.

The statement was also strengthened by observations and other interviews obtained from the owner of the center of Weaving in Aceh Besar where craftsmen are now very few and almost lost. For the moment only, the process of weaving songket Aceh can only be done by middle-aged mothers who only have the ability to roll yarn, to punish, weave, while to produce a piece of woven fabrics of songket Aceh.

There are several work processes to do, such as: inhabiting, designing motifs, weaving, making tassel shawls and decorating the edges of songket woven fabrics for men's head coverings. From the mentioned work process, designing motifs and decorating the edges of Songket weaving is a staple that demonstrates the feature of Songket weaving in Aceh.

While in the weaving of songket Aceh There are several work processes to be able to produce the Aceh songket weaving cloth that is kneared yarn, inhabit, designing motifs,
weaving, making tassel shawl and decorate the edges of the songket woven cloth for the head cover Men. From the process of work mentioned, designing motifs and decorating the edges of songket woven Aceh is a staple that demonstrates the characteristic of the songket weaving of Aceh area.

Based on the problems expressed above, as the passage of songket weaving Aceh can no longer be inherited by the younger generation. Therefore, it is important to develop the material about songket weaving Aceh. Therefore, researchers take the initiative to develop materials on weaving subjects with materials making crafts weaving with songket weaving techniques in the form of modules for students of Class XI SMK N 1 Masjid Raya Aceh Besar that can facilitate teachers and students in the practice of weaving the songket weaving fabrics Aceh and also as a form of preservation of cultural and handicraft area of Aceh.

2. Research Methods

The research was conducted in SMK N 1 Masjid Raya Aceh Besar in design study and textile products. Development of local load-based learning module focuses on the learning of weaving for the material of weaving Kriya woven with songket weaving technique, and module trials are implemented only in the students of class XI SMK N 1 Masjid Raya Aceh Besar which is the number of 20 Students.

The instruments in this study are instruments of validity. The instrument is used to determine whether a local payload-based module has been designed to be valid or not. In other words, all instruments that have been designed will be validated in advance to determine the level of validity of the instrument. The validation sheet on this research, namely:

a. Local load Module validation sheet,
b. RPP validation Sheet,
c. Validation sheet of teacher and student interviews,
d. Validation sheet of student activity observation,
e. Validation questionnaires Motivation Sheet
f. Validation sheet questionnaires practicality,
g. Effective questionnaires Validation Sheet

The instruments above is validated by 5 experts, namely: material experts, media experts, and linguists. The development procedure of this module uses 4-D models that are discovered by Thiagarajan. This Model consists of four stages, namely 1) definition, 2) design, 3) development, and 4) dissemination. In this research researchers only conducted 3 stages, namely the definition, design, and development of the fourth stage because of the long time, the number of SMK and samples are many and require more funds. More research plans can be described as follows: (a) phases of definition, including: syllabus analysis, material analysis and analysis of students (b) phases of designing, including: compiling modules and components of detailed drafting modules (c) Phase development, including: module validation phase, by requesting faculty and teacher degrees to: (1) View the feasibility of developed modules and the truthfulness of learning concepts that have been made, (2) Lecturers and teachers are required to provide a module review that has been Created based on the item on the validity questionnaire, and (3) after the assessment, the researcher revises the learning module according to the advice given by the validator and subsequently in the exam, (d) The practical stage, this practical test By providing questionnaires to students, and also conduct interviews with teachers
and students. (e) The level of effectiveness, activities centered to evaluate whether local payload-based weaving modules can be used to achieve effective objectives in improving learning quality and student achievement.

Data Analysis

Data obtained from various instruments is divided into data validity, practicality, and effectiveness. Validity data is obtained from the validation sheet, practical data is obtained from a practical Questionnaire, interview guide, and observation sheet for the implementation of the learning. While data effectiveness is obtained from the poll sheet motivation and observation of student activities and learning outcomes (cognitive and psychomotor). Data is analyzed qualitatively and quantitatively. The results gained from observation of interviews and learning execution are analyzed qualitatively ideally. While the data obtained from the validation sheet, questioner practicality, activity observation sheets, will be analyzed quantitatively.

3. Results and Discussion

Defining Phase Results

a. Syllabus Analysis

The analysis of the syllabus was conducted against SK and KD in the syllabus obtained from the teacher weaving subjects, the explanation material weave incorporated in the SK, namely "make craft textiles with weaving techniques", and the basic competence is "make craft weaving with songket weaving techniques".

b. Material Analysis

The results of the analysis of SK and KD are used to formulate indicators for learning achievement in the material. To assemble the material in the module is also done by analyzing the reference book used by the teacher in the study and also from the research observations at the center of Weaving.

c. Student Analysis

Based on the results of interviews with teachers and students, locally developed load-based modules have been in line with the students' conditions and characteristics. So that during the execution of the learning process is not found a meaningful obstacle and there are multi-directional interactions from students to students and from students to teachers.

Design Phase Results

At this stage has been generated learning module of weaving based on local load according to the specifications of the product that has been designed, made, validated and also tested. The resulting module has a detailed array of module components.

Results Stage Development

a. Validity

The validation process can last more than once, according to the results obtained. Validation is terminated if it meets the predefined valid criteria. From a validator sheet obtained, then processed, analyzed, and revised according to the Comments and validator suggestions. The last average validation value that is obtained can be seen in the following table:
Table 1. Score Eligibility Module

<table>
<thead>
<tr>
<th>No</th>
<th>Aspect Assessed</th>
<th>Validation Score</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Goal</td>
<td>3.4</td>
<td>Very Valid</td>
</tr>
<tr>
<td>b.</td>
<td>Rational</td>
<td>3.533</td>
<td>Very Valid</td>
</tr>
<tr>
<td>c.</td>
<td>Contents of the module</td>
<td>4</td>
<td>Very Valid</td>
</tr>
<tr>
<td>d.</td>
<td>Characteristics of modules</td>
<td>3.863</td>
<td>Very Valid</td>
</tr>
<tr>
<td>e.</td>
<td>Conformity between components</td>
<td>3.8</td>
<td>Very Valid</td>
</tr>
<tr>
<td>f.</td>
<td>Pictures</td>
<td>4</td>
<td>Very Valid</td>
</tr>
<tr>
<td>g.</td>
<td>Language</td>
<td>3.7</td>
<td>Very Valid</td>
</tr>
<tr>
<td>h.</td>
<td>Physical form</td>
<td>3.5</td>
<td>Very Valid</td>
</tr>
<tr>
<td>i.</td>
<td>Flexibility</td>
<td>4</td>
<td>Very Valid</td>
</tr>
</tbody>
</table>

Amount 33.79
Average 3.75 Very Valid

b. Practicality

The practical poll is distributed throughout the students in the test class, aiming to measure how practical the modules are developed for students’ learning. As for the distribution of the scores of practical poll as shown in the table below:

Table 2. Results of the analysis of the practicability of students

<table>
<thead>
<tr>
<th>No</th>
<th>Aspects</th>
<th>Practical Value</th>
<th>category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ease of Use</td>
<td>3.55</td>
<td>Very Practical</td>
</tr>
<tr>
<td>2</td>
<td>Benefits</td>
<td>3.4</td>
<td>Very Practical</td>
</tr>
<tr>
<td>3</td>
<td>Time-compliance</td>
<td>3.51</td>
<td>Very Practical</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>3.48</td>
<td>Very Practical</td>
</tr>
</tbody>
</table>

c. Effectiveness

The effectiveness of the module is obtained by analyzing four indicators, namely: activity, motivation, and results of cognitive learning and psychomotor learning outcomes. To obtain data from all four indicators, a validated instrument of effectiveness is used. The following outlined analysis results in the effectiveness of modules.

1) Student’s Activities

The student activities observed include the following aspects; 1) Pay attention to and listen to the explanation of the teacher, 2) Read the learning module carefully, 3) Ask questions related to the material learned, 4) discuss with students and teachers, 5) Work out the question on the module, and 6) conclude the material. The results of observations on each aspect can be said that a lot of activity happens every meeting.
average activity for every aspect of the category is very high i.e. in aspects of 1, 2, 5; and the high category on aspects of 3, 4, and 6, while the activity is generally in the high category with a percentage of 86%. This gives an indication that if it is reviewed from student learning activities, the effective use of local payload-based modules is in the high category.

(2) Learning Motivation

Results of the analysis of the motivation questionnaire in the outline as shown in the table below:

<table>
<thead>
<tr>
<th>No</th>
<th>Indicators</th>
<th>Motivation value</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Desire to learn</td>
<td>3,46</td>
<td>Very high</td>
</tr>
<tr>
<td>2</td>
<td>Hope to succeed</td>
<td>3,46</td>
<td>Very high</td>
</tr>
<tr>
<td>3</td>
<td>Encouragement to learn</td>
<td>3,75</td>
<td>Very high</td>
</tr>
<tr>
<td>4</td>
<td>Perseverance</td>
<td>3,65</td>
<td>Very high</td>
</tr>
<tr>
<td></td>
<td><strong>Average</strong></td>
<td><strong>3,58</strong></td>
<td><strong>Very high</strong></td>
</tr>
</tbody>
</table>

(3) Cognitive Learning Outcomes

The results of cognitive learning are derived from the test results given to students after learning using local payload-based modules. The question of the test is a multiple choice question. Each correct answer is given a score of 1, one 0, and then the overall result is converted at intervals of 0-100 so that it becomes a value for each student. The recapitulation of the learning outcomes which includes the average value and the classical learning submission can be seen in the following table:

<table>
<thead>
<tr>
<th>Average</th>
<th>Completed Students</th>
<th>Students Not Finished</th>
<th>KKM</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>88.75</td>
<td>20</td>
<td>-</td>
<td>75</td>
<td>Due Diligence</td>
</tr>
</tbody>
</table>

(4) Psychomotor learning outcomes

The results of learning in the realm of psychomotor obtained from the assessment/observation of students’ activities during the practice of making Kriya weaving with the techniques of songket weaving Aceh through the student psychomotor assessment instruments. Student assessments are performed individually in their respective groups. The results of learning data on the psychomotor aspects of students can be seen in the following:

| Table 5. Student learning outcomes in psychomotor aspects |
The development of local payload-based modules should have a baseline that is backed by local content learning. In this case, learning to weave on materials make crafts weaving with songket weaving techniques. As the problem has been disclosed, the development of modules that are deemed appropriate for such material is local payload based that can deliver students to learn the material related to the region.

Therefore, there is a need to follow up to optimize the utilization of local potentials as well as preservation efforts. This can be realized through education that is oriented towards local potentials by staying aimed to improve students’ abilities and achievements, because the education process is not only done by transferring the knowledge from the teacher to the students, but students must be able to learn from the environment and daily life.

After the analysis of the syllabus and observations on the center of weaving to collect additional data needed in the design of a local payload-based weaving learning module, then the draft is consulted to get input about Need to do revision in order to guarantee the validity of the product.

Some of the improvements made are about the cover and language structure, shape or clarity of the image and the material writing systematics. From data analysis of the content validity and validity of the design that has been assessed by the validator indicates that the validity of the locally developed load-based module included in the criteria is very valid, this indicates that the developed learning module can measure what is supposed to be measured appropriately, and there is a connection between modules one and other modules/materials.

For practical testing, the results of a practical poll, observation and results of interviews on students and teachers regarding the use of learning modules during the learning process can generally be stated that the use of local payload-based modules Do not get any meaningful obstacles, in other words learn can run normally. Students happily learn by using modules, students also admitted easy in using the module. Criteria that obtained from the results of the questionnaire practical has a very practical criteria.

Test the effectiveness of modules based on the analysis of data observation of students’ activity during the learning activities with the module shows that learning by using the module has been encouraging to increase activity, motivation and Student learning outcomes.

Learning modules developed can help and facilitate teachers in explaining the learning materials and students in the study of weaving materials, especially materials making crafts weaving with songket weaving techniques Aceh.

### 4. Conclusion and Suggestion

Based on the data of development and test results that have been done, conclusions are obtained:

1) Has been produced learning module of local payload-based weaving on material making kriya weaving with songket weaving techniques Aceh.
2) The locally generated payload-based weaving module is in the valid category, both from the didactic aspect, the construction aspect and the technical aspects.

3) The resulting module resides in a practical code both reviewed from ease of use, benefits gained and compliance with time.

4) The effectiveness of the module is in the effective category is indicated by the indicator of activity in the high category, the motivation to learn in a very high category of learning results are due category and the results of psychomotor learning are in good category.

Based on the conclusion that has been submitted, it is given some suggestions, namely:

1) The modules that are developed can be used by teachers and students in weaving lessons especially on the material making craft textiles with songket weaving techniques as a medium of learning and as an additional reference in weaving learning.

2) The modules that have been developed can also be used by the tourism office, the social service, and the Regional National Crafts Council in the implementation of songket weaving training in Aceh to list the crafts of Aceh.

3) For the management of time in learning with modules, it is recommended that the module be given a day before the study takes place so that students and teachers can better understand the material to be learned.

5. References


ARaw Material Production Revenue Optimization Using Information Technology-Based Distribution Modifications

M.D. Mendoza¹, H.D. Hutahaean²
\{aenaen@unimed.ac.id¹, harvei11@unimed.ac.id²\}

Universitas Negeri Medan, Medan, Indonesia¹,²

Abstracts. The economy and business world that continues to develop very rapidly lately, demands every organization to enter a very hard level of competition, demanding that all business organizations, large or small, private or government sector that compete in the modern world must make plans to face future plans, including income for the production benefits. Optimization is a process, a method or an act to make the best and highest of things, a more efficient (smaller and faster) production process program through the selection and design of data structures, algorithms, and sequence of instructions and others. The best known tool for storing and optimizing a system is a computer. The Modified Distribution (MODI) method is one of the profit income models used in this study as a method that provides a minimum cost solution to the transportation problem. Revenue is the amount of money received by the company from its activities, mostly from the sale of products and services to customers. The better the revenue results, the better the benefits obtained at the company. Profit is a revenue or benefit obtained from investments in securities, such as stocks, bonds or in the property sector, where the value exceeds the purchasing price. The application of the Modified Distribution method in the system in optimizing the production profit income based on the delivery of raw materials should be used to obtain conditions that provide maximum or minimum value so as to minimize the effort required or to maximize what is desired.

Keywords: Optimization System, Modified Distribution, Profit Revenue

1. Introduction

Optimization is a process, method or act to make the best and highest of things, a more efficient (smaller and faster) production process program through the selection and design of data structures, algorithms, and sequence of instructions and others. The best-known tool for storing and optimizing systems is a computer. In general, all existing companies use computers as processors and data importers in a company. One of them is PT. Medan Jaya Pangan mutu, this company already uses computers in its business activities.

PT. Medan Jaya Pangan Mutu is a company engaged in the production of food from raw materials into basic materials, which provides, sells and distributes various types of snacks and others. Sometimes companies experience problems in the accumulation of goods that are not sold at a certain time, and vice versa, namely the lack of goods when there is a lot of demand from customers, this of course will harm the company. With the optimization of the demand for goods from the customer, the company is expected to be able to produce goods efficiently.
Revenue is the amount of money received by the company from its activities, mostly from the sale of products and services to customers. The better the revenue results, the better the benefits obtained at the company. Profit derived from investments in securities, such as stocks, bonds or in the field of property, where the value exceeds the purchase price. One of the most appropriate profit-earning methods to obtain production results efficiently is to use the MODI (modified distribution) method which is based on the assumption that the factors that influence the level of demand by consumers in the past and present tend to be the same because income is manual.

MODI method or often called modified distribution is one of the optimality testing methods of transportation problems. This means that the higher the level of demand, the greater the benefits and vice versa, the decline in demand, the benefits will also be reduced.

2. Research Method

Optimization

Optimization is a process, way or act to make something the best and highest. According to the KBBI, the word optimization is a process, a way, an act of optimizing. Whereas the word optimize means to make the best, to make the highest.

Optimization is the process of maximizing or minimizing the functions given to several types of constraints. Optimization is a series of processes carried out systematically aimed at increasing the volume and quality of traffic on visits through a search engine to the website. Certain by making use of the mechanism of action or the logarithm of the search engine.

Optimization System

Optimization systems are always used to obtain conditions that provide maximum or minimum value of a system of work functions so as to minimize the effort required or to maximize the desired benefits. In this optimization system acts to obtain the best results given the circumstances in obtaining production profits based on raw materials.

MODI (Modified Distribution)

MODI (Modified Distribution) method is a method used to regulate the distribution of sources that provide the same products in places. which requires optimal. This product allocation must be arranged in such a way because there are differences in transportation costs (allocation) from a source to several different destinations and from several sources to a destination also varies, and the formula is:

$$\text{Minimum } Z = \sum_{i=1}^{m} \sum_{j=1}^{n} C_{ij}X_{ij}$$

Where

- \( m \) = Number of Rows
- \( R \) = Value of each Row
- \( n \) = Number of Columns
- \( K \) = Value of each Columns
- \( i \) = Value of Row
- \( j \) = Value of Columns
- \( C \) = Freight Cost
- \( X \) = Freight Volume
- \( Z \) = Minimum Value
3. Results and Discussion

Developments in the sales business field must always be considered, this is because it is supported by the activities of the company in the sales process, one of the activities is to make optimal sales. The fluctuation of income achieved can be used as a measurement of the development of a company. Cash inflows or other increases in assets of a business entity or the repayment of debt (or both) during a period originating from the delivery or manufacture of goods, delivery of services or from other losses that are main activities of business entities. In carrying out sales activities there are many opportunities both in the present and in the future. However, opportunities that come to a company do not always produce good opportunities or generate good profits.

3.1 Analysis of Profit Revenue Design with the Modified Distribution Method

Data collection on the number of snacks in warehouses in July 2018, the amount of product distribution in July 2018, and the transport rates from warehouses to distribution points. These data can be seen in the following tables:

<table>
<thead>
<tr>
<th>Table 1. Product Inventory Amount for July 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
</tr>
<tr>
<td>----</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2. Distribution in July 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
</tr>
<tr>
<td>----</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

The initial solution with VAM is then re-evaluated using the MODI method to get optimal results. The first step is to determine the value of the row (Ui) and column (Vj) for each base variable by using the relationship $C_{ij} = U_i + V_j$, where $C_{ij}$ is the transport cost and the value of $U_1 = 0$.

- $X_{12} = 78,13 = U_1 + V_2$, if $U_1 = 0$, then $V_2 = 78,13$
- $X_{14} = 91,13 = U_1 + V_4$, if $U_1 = 0$, then $V_4 = 91,13$
- $X_{24} = 90,73 = U_2 + V_4$, if $V_4 = 91,13$, then $U_2 = -0,4$
- $X_{25} = 86,33 = U_2 + V_5$, if $U_2 = -0,4$, then $V_5 = 86,73$
- $X_{26} = 93,74 = U_2 + V_6$, if $U_2 = -0,4$, then $V_6 = 94,14$
- $X_{56} = 89 = U_5 + V_6$, if $V_6 = 94,14$, then $U_5 = -5,14$
- $X_{53} = 73,5 = U_5 + V_3$, if $U_5 = -5,14$, then $V_3 = 78,64$
After determining the value of rows and columns, then the cost change value of each non-base variable will be searched using the relationship $X_{ij} = C_{ij} - U_i - V_j$, where $X_{ij}$ is a non-base variable.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Calculation</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_{11}$</td>
<td>$71,22 - 0 - 70,23$</td>
<td>$0,99$</td>
</tr>
<tr>
<td>$X_{13}$</td>
<td>$100,39 - 0 - 78,64$</td>
<td>$21,75$</td>
</tr>
<tr>
<td>$X_{15}$</td>
<td>$87,12 - 0 - 86,73$</td>
<td>$0,39$</td>
</tr>
<tr>
<td>$X_{16}$</td>
<td>$94,53 - 0 - 94,14$</td>
<td>$0,39$</td>
</tr>
<tr>
<td>$X_{21}$</td>
<td>$71,62 - (-0,4) - 70,23$</td>
<td>$1,79$</td>
</tr>
<tr>
<td>$X_{22}$</td>
<td>$77,73 - (-0,4) - 78,13$</td>
<td>$0$</td>
</tr>
<tr>
<td>$X_{23}$</td>
<td>$99,60 - (-0,4) - 78,64$</td>
<td>$21,36$</td>
</tr>
<tr>
<td>$X_{32}$</td>
<td>$81,69 - 2,77 - 78,64$</td>
<td>$21,75$</td>
</tr>
<tr>
<td>$X_{33}$</td>
<td>$94,69 - 2,77 - 91,13$</td>
<td>$0,79$</td>
</tr>
<tr>
<td>$X_{35}$</td>
<td>$89,89 - 2,77 - 86,73$</td>
<td>$0,39$</td>
</tr>
<tr>
<td>$X_{36}$</td>
<td>$97,30 - 2,77 - 94,14$</td>
<td>$0,39$</td>
</tr>
<tr>
<td>$X_{42}$</td>
<td>$84,45 - 5,93 - 78,13$</td>
<td>$0,39$</td>
</tr>
<tr>
<td>$X_{43}$</td>
<td>$105,92 - 5,93 - 78,64$</td>
<td>$21,35$</td>
</tr>
<tr>
<td>$X_{44}$</td>
<td>$97,45 - 5,93 - 91,13$</td>
<td>$0,39$</td>
</tr>
<tr>
<td>$X_{46}$</td>
<td>$100,07 - 5,93 - 94,14$</td>
<td>$0$</td>
</tr>
<tr>
<td>$X_{51}$</td>
<td>$102,44 - (-5,14) - 70,23$</td>
<td>$37,35$</td>
</tr>
<tr>
<td>$X_{52}$</td>
<td>$111,14 - (-5,14) - 78,13$</td>
<td>$38,15$</td>
</tr>
<tr>
<td>$X_{54}$</td>
<td>$119,45 - (-5,14) - 91,13$</td>
<td>$33,46$</td>
</tr>
<tr>
<td>$X_{55}$</td>
<td>$90,98 - (-5,14) - 86,73$</td>
<td>$9,39$</td>
</tr>
</tbody>
</table>

From the calculations using the MODI method, all non-base variable values are positive.

4. Conclusion

Based on the research results, the conclusions that can be drawn from this study are, based on the results of the process of production profits based on the delivery of raw materials at PT Medan Jaya Pangan Mutu found that cash flow income or other increases in assets derived from the sale of goods or services in the form of activities or activities of the company. With the establishment of an optimization system of production profit profits based on the delivery of raw materials at PT Medan Jaya Pangan Mutu obtained five forms namely: Login Form, main menu form, customer data form, income statement form, income data form. So it can facilitate the company produced more effectively and efficiently.
5. References


Combination of Single Tuned Filter and Double Tuned Filter to Reducing Current Harmonics

Azmi Rizki Lubis¹, Marwan Affandi², Mustamam³
{azmirizkilubis@unimed.ac.id¹, mr1.affandi@gmail.com²}
Universitas Negeri Medan, Indonesia¹,²,³

Abstract. This paper presents the results of the analysis of a combination of a single tuned filter (STF) and a double tuned filter (DTF) to reducing harmonic currents in a three-phase system. From the research that has been done, obtained significant results in reducing the current harmonic content in the three-phase system. THDi from 25.49% reduced to 14.84% and the 5th harmonic content is 21.69% reduced to 13.45%, the 7th harmonic content is 10.26% reduced to 4.63%, the 11th harmonic content is 6.42% reduced to 2.33%, and the 13th harmonic content is 4.46% reduced to 1.32%.

Keywords: Harmonic, Single Tuned Filter, Double Tuned Filter.

1 Introduction

The quality of electric power lately has been very worrisome which will affect electric power equipment [1]. Harmonic currents arise due to nonlinear loads such as power electronic equipment, UPS, arc furnaces, adjustable speed drives (ASD) so that the current waveform is no longer sinusoidal. Damaging effects have also been proven to be caused by the presence of harmonics such as overheating of transformer equipment, rotating machines, switchgear, bank capacitors. Induction motors also work at sub synchronous speeds and won't start cogging. The breaker equipment also does not work normally. Capacitors also fail to work due to increase dielectric pressure and excessive heat. The condition of the safety relay will also become more erratic and also the current regulation over time on the fuse may also change [2].

To reduce harmonics one of the cheapest and most economical ways is to use passive filters. The use of passive filters has also been widely used in high voltage direct current systems (HVDC) [3].

Single Tuned Filter (STF) is one of several types of passive filters used in reducing harmonics. STF consists of capacitors and reactors connected in series that is set to low harmonic frequencies. In the harmonics STF set is the value of the capacitor and reactor so that later the reactance value is the same, and the filter has a pure resistive value. Filter impedance is a capacitive value for low harmonics and inductive values for high harmonics, so that eventually the impedance value will get worse under the lowest regulated frequency [4]. To reduce two harmonics at once you can use Double Tuned Filter (DTF) because the scope of work area of DTF is wider than STF [5]. In this paper two passive filters, namely STF and DTF, will be combined to be designed to reduce the harmonic content in three-phase system.
Harmonic Distortion

The condition of deviating voltage and current waves from sinusoidal waves at the ideal frequency of the electrical energy channel is the understanding of harmonics. Harmonics are also considered as the sum of different sine waves at different frequencies which are integral to the fundamental frequency. The sum ratio of all harmonic components and fundamental components is also called total harmonic distortion (THD). Equipment that is widely used in industries such as inverters, converters, cyclo-converters, battery charging, uninterruptible power supply (UPS). In electric power distribution system, if it supplies a nonlinear load, it will cause harmonic so there will be a mixture of voltage and fundamental current with harmonic voltage and current, eventually forming distortion [6].

![Harmonic Spectrum](image)

Fig. 1. Harmonic Spectrum

With the existence of harmonic currents, the cable in the distribution channel will be hot, an error in breaking the circuit breaker and also produce excessive heat in the transformer so that the life of the transformer will also be reduced [7].

Harmonic Passive Filter

The use of passive filters can reduce harmonics efficiently, where basically the principle of this passive filter is to regulate the components of the reactor and inductor at the frequency to be reduced harmonic content. The impedance of the filter is set low so that the harmonics will flow through the filter that has been set [8]. According to the connection, the passive filter consists of two types, namely the series passive filter and shunt passive filter. Current at full load will flow in the series passive filter while some current at full load will flow at the shunt passive filter. The use of passive shunt filters also requires a low cost and also reactive power at fundamental frequencies can also be flowed, therefore passive shunt filters are good for harmonic filters.

Single Tuned Filter

In the filter industry the most widely used to overcome harmonics in electric power systems is the Single Tuned Filter (STF). The resonant frequency at STF has a small impedance so that the current that has a value equal to the resonant frequency will be flowed through the filter so it does not flow into the system. The components contained in the STF are resistance (R), inductance (L), and capacitance (C) connected in series with configurations as in Fig. 2. following.
To design STF the first thing to do is to determine the right capacitor value so that it gets a good power factor at fundamental frequencies. Previously, the capacitor reactance value \( X_c \) and the capacitor reactive power must be determined as in the following equation,

\[
X_c = \frac{V^2}{Q_c}
\]  

Where \( V^2 \) is the line to line voltage of the capacitor, \( Q_c \) is the reactive power of the capacitor. After the \( X_c \) value is obtained, the capacitance of the capacitor can be calculated using the following equation,

\[
C = \frac{1}{2 \pi f_0 X_c}
\]

Where \( f_0 \) is the fundamental frequency. After the capacitor value is obtained, the next step is to find the reactor value of the filter which was previously searched for the inductive reactance value of the \( X_L \) reactor using the following equation,

\[
X_L = \frac{X_c}{h_n^2}
\]

Where \( h_n^2 \) is the harmonic \( n \). After the \( X_L \) value is obtained, the reactor value can be found by using the equation,

\[
L = \frac{1}{2 \pi f_0}
\]

The last step is to determine the value of the resistance (R) filter, to get the resistance value (R) filter first to find the characteristic reactance of the filter \( X_n \) by using the equation,

\[
X_n = h_n X_L
\]

After obtaining the characteristic reactance value of the filter, the resistance (R) of the filter can be found by using the following equation,

\[
R = \frac{X_n}{Q}
\]
Double Tuned Filter

The simplest use of DTF has almost pure inductive impedance at all frequencies. Resonance will be generated if the impedance of the system is approximately equal and opposite to the filter at several harmonic frequencies. The resonance generated in time will cause large harmonic currents coupled with excessive voltage harmonics from filter components and in the system. So that this does not happen it is necessary to add a dampening resistor in a different way so that some damped DTF configurations can be shown in Fig. 3.

![Fig. 3. Configurations of damped-type double tuned filter](image)

Of the several types of DTF in Fig. 3 most used are in Fig. 3 (a). Conventional DTF is a series resonant circuit consisting of two inductors and two capacitors as in Fig. 1.
From DTF on Fig. 4 can be searched for series resonance frequency and parallel resonance frequency using the following equation,

$$ \left[ \frac{\omega_s}{\omega_p} \right] = \begin{bmatrix} 1 \\ \sqrt{L_1C_1} \\ 1 \\ \sqrt{L_2C_2} \end{bmatrix} $$  \hspace{1cm} (7)

To find the large DTF impedance in Fig. 2 then you can use the following equation,

$$ Z_f = j\omega L_1 + \frac{1}{j\omega C_1} + \left( j\omega C_2 - j \frac{1}{\omega L_2} \right)^{-1} \left( 1 - \frac{\omega^2}{\omega_p^2} \right) \left( 1 - \frac{\omega^2}{\omega_s^2} \right) - \omega^2 L_2 C_1 $$  \hspace{1cm} (8)

It takes the calculation of the parameter $C_1$ to analyze the coefficient of $\omega$ using the following equation,

$$ C_1 = C_a + C_b $$  \hspace{1cm} (9)

Next find the value of $L_1$ on DTF by using the following equation,

$$ L_1 = \frac{1}{C_a \omega_s^2 + C_b \omega_p^2} $$  \hspace{1cm} (10)

Then find the value of $L_2$ on DTF by using the following equation,

$$ L_2 = \frac{\left( 1 - \frac{\omega_s^2}{\omega_p^2} \right) \left( 1 - \frac{\omega_p^2}{\omega_s^2} \right) \omega^2}{C_1 \omega_a^2} $$  \hspace{1cm} (11)
Next find the value of $C_2$ can use the following equation,

$$C_2 = \frac{1}{L_2 \omega_2^2}$$  \hspace{1cm} (12)

Where to get the value of $\omega_1$ and $\omega_2$ using the following equation,

$$\omega_c = \frac{1}{\sqrt{L_1 C_1}}$$  \hspace{1cm} (13)

$$\omega_p = \frac{\omega_1 \omega_2}{\omega_c}$$  \hspace{1cm} (14)

3 Experimental Results

This paper presents the reduction of current harmonic content in a three-phase system with a voltage of 220 volts with a frequency of 50 Hz which will be installed in a combination of STF and DTF. There are two STF used to reduce harmonic currents 5th and harmonic currents 7th, while DTF is used to reduce harmonic currents 11th and harmonic currents 13th. Fig. 6 shows modeling of the three-phase system after the installation of STF and DTF, Fig. 7 shows the current wave before filter installation and Fig. 8 shows the current waveform after the installation of STF and DTF.

![Fig. 5. Modeling three-phase systems before filter installation](image)

![Fig. 6. Modeling three-phase systems after filter installation](image)
Fig. 7. Current wave before filter installation

Fig. 8. Current wave after filter installation

Fig. 9. Current Harmonic before filter installation

Fig. 10. Current Harmonic after filter installation
5 Conclusion

The results obtained from the study by combining STF and DTF in a three-phase non-linear load system have succeeded in reducing the harmonic content caused by non-linear loads. The combination of STF and DTF has succeeded in reducing current THD from 25.49% to 14.84%, and the 5th harmonic content was 21.69% reduced to 13.45%, the 7th harmonic was 10.26% reduced to 4.63%, the 11th harmonic was 6.42% reduced to 2.33% , and the 13th harmonic by 4.46% reduced to 1.32%.

6 References

Development of Interactive Learning Media with Adobe Animate CC in Basic Programming Learning at SMK Negeri 1 Kabanjahe

Horasman Simanihuruk¹, Mukhtar², Samsidar Tanjung³
{manru31@gmail.com¹}
Universitas Negeri Medan Postgraduate Education¹,²,³

Abstract. This study aims to: (1) Develop interactive learning media with Adobe Animate CC applications in Basic Programming Subjects, (2) Know the feasibility of using Interactive learning media with Adobe Animate CC applications in Basic Programming Subjects, (3) Know the effectiveness of media use Interactive learning with the Adobe Animate CC application on Basic Programming Subjects. This research is a Research and Development (R&D) research with research procedures using the ADDIE model. Development of interactive learning media, consisting of 5 stages, namely: (1) Analysis: Conducting needs analysis, (2) Design: Determine the performance achieved and the selection of appropriate test methods, (3) Develop: Generate and validate learning resources, (4) Implement: Preparing the Learning Environment and Including Students, (5) Evaluate: Make final improvements according to the advice and processing of data obtained. Determination of the feasibility level of interactive learning media based on the validation test of experts and trials to students and continued with the effectiveness test. Overall, based on the assessment of material experts and media construction experts as well as the results of student trials and effectiveness tests, it can be concluded that interactive learning media with Adobe Animate CC on learning is appropriate and more effective in improving student learning outcomes.

Keywords: Interactive Learning Media, Basic Programming, Development.

1. Introduction

Education plays a major role in the process of developing human resources. Improving the quality of education is a process that cannot be separated from the process of improving the quality of human resources themselves. Education is the main key to the success of a nation in competing at the global level. The importance of education is a process of transferring information and existing values. During this process, there will be a change in reasoning and attitude towards better things.

National education objectives contained in Law no. 20 of 2003 is developing the potential of students to become human beings who believe and devote to God Almighty; noble, healthy, knowledgeable, capable, creative, independent and be a democratic and responsible citizen. The 2013 curriculum sets out the specific objectives of vocational schools, including: (1) Producing graduates who have competencies that are in accordance with the demands of the business world and industry both nationally and globally. (2) Producing graduates who have vocational skills in technical expertise programs that meet the competencies and certifications required by the
world of work and professional technical associations that are relevant and able to compete in the global market. (3) Producing a variety of innovative research products and programs in PTK (Vocational Technology Education) disciplines and engineering disciplines that are useful for improving the quality of human resources in national development. (4) Being a center of information and dissemination of technology and vocational education and engineering (5) Producing educators / trainers in the field of vocational technology that has an entrepreneurial spirit (entrepreneurship).

As teachers, we must have good quality learning in order to become professional teachers. The maximum learning process can be seen from the process of learning activeness and student learning outcomes so that what is the goal of improving the quality of learning and educational goals in Indonesia can be implemented optimally. Learning outcomes that can be mastered by students according to Bloom include three aspects, namely cognitive aspects, affective aspects and psychomotor aspects.

Learning facilities and resources are naturally developed by schools in accordance with what is outlined in the National Education Standards, ranging from procurement, maintenance and improvement. This is based on the fact that schools are the most aware of the needs of learning facilities and resources, both adequacy, suitability, and the latest, especially learning resources designed (by design) by teachers for the benefit of learning.

The teacher has a strategic position towards the success of student learning. In learning, it is not uncommon to find teachers dominating learning by applying old teaching methods, even done from year to year without innovation. Old teaching methods tend to be applied with lecture methods with monotonous learning media so that they can inhibit interactivity, absorptive capacity, and student interest in subject matter. The old learning system at school is believed to be a system that is no longer effective. In this case the creativity of the Basic Programming teacher in managing learning has a very big influence in improving student learning outcomes.

In the process of implementing Basic Programming learning, the teacher must make preparations with full consideration because the success of the implementation of a learning major lies with the teacher. Besides being useful as a control tool, teaching preparation is also useful as a guide for the teacher himself. One of the preparations that must be prepared carefully by the teacher is learning media. Learning media are all things that can be used by educators as a means to facilitate learning.

The media component in the learning process is a communication process that takes place in a system. Therefore, learning media occupies an important position as one of the components of the learning system. One important element in learning components and planning is determining the learning media that will be used in the learning process. It is intended that the understanding of the material and concepts can be clearly understood by students.

The accuracy of choosing learning media will greatly affect students' understanding of the basic competencies being studied by students. According to Ampera (2016), if learning media is chosen properly and correctly, it can overcome obstacles that occur in the learning process. The use of appropriate learning media can influence the achievement of learning objectives. This will improve the quality of learning, especially learning achievement Basic Programming. Media is a learning tool that can be used to facilitate ongoing learning activities. The media can be interpreted as an intermediary that connects teachers and students. The media is used to help and support the creation of effective, efficient and interesting learning processes.
2. Method

The method used in this research is research and development with ADDIE development design. The subject in this study was the material "Implementing the use of data types, variables, constants, operators and expressions" contained in the 2018 Multimedia revised syllabus. While the object in this study was SMK Negeri 1 Kabanjahe students who were studying basic competencies "Applying the use of types data, variables, constants, operators and expressions ". Data obtained by giving questionnaires and objective tests of learning outcomes. The data obtained were then tested for normality and homogeneity. The hypothesis of this study will be tested using t-test analysis.

3. Results

The data obtained from this study are the results of the assessment by material experts and instructional media experts and student learning outcomes of SMK Negeri 1 Kabanjahe. Based on the results of the assessment of learning material experts assess that learning media with adobe animate cc with subject matter applying the use of data types, variables, constants, operators and expressions have had eligibility on three aspects of assessment which include aspects of guidance and information with a mean score of 3.75 with a reasonable interpretation, aspects of multimedia content / material with a mean score of 3.42 with a decent interpretation and an evaluation aspect with a mean score of 3.63 with a decent interpretation. This shows that interactive learning media developed can meet the demands of learning needs. The mean score of the assessment of material experts on learning media with adobe animate cc in learning "Applying the use of data types, variables, constants, operators and expressions" is shown in Table 1.

<table>
<thead>
<tr>
<th>Aspect of assessment</th>
<th>Mean score</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guidelines and Information</td>
<td>3.75</td>
<td>feasible</td>
</tr>
<tr>
<td>Multimedia content / material</td>
<td>3.42</td>
<td>feasible</td>
</tr>
<tr>
<td>evaluation</td>
<td>3.63</td>
<td>feasible</td>
</tr>
<tr>
<td>Total</td>
<td>3.6</td>
<td>feasible</td>
</tr>
</tbody>
</table>

Furthermore, the data results of the assessment on interactive learning media using Adobe Animate CC as shown in table 2.

<table>
<thead>
<tr>
<th>Aspect of assessment</th>
<th>Mean score</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guidelines and Information</td>
<td>4.33</td>
<td>Very feasible</td>
</tr>
</tbody>
</table>
Furthermore, the results of the questionnaire from students about the level of student acceptance of interactive learning media with adobe animate cc in individual trials are shown in table 3.

Table 3. Mean scores of Interactive Learning Media Assessment Results with adobe animate cc in individual trials.

<table>
<thead>
<tr>
<th>Aspect of assessment</th>
<th>Mean score</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guidelines and Information</td>
<td>3.75</td>
<td>High Acceptance</td>
</tr>
<tr>
<td>Media material</td>
<td>4.06</td>
<td>High Acceptance</td>
</tr>
<tr>
<td>Evaluation</td>
<td>3.87</td>
<td>High Acceptance</td>
</tr>
<tr>
<td>Media facility design</td>
<td>3.82</td>
<td>High Acceptance</td>
</tr>
<tr>
<td>Pedagogic effect</td>
<td>4.16</td>
<td>High Acceptance</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3.93</td>
<td>High Acceptance</td>
</tr>
</tbody>
</table>

Furthermore, the data obtained in this study are student learning outcomes with interactive learning media with adobe animate cc on basic competencies applying data types, variables, constants, operators and expressions. Based on the results of the study it can be seen that the minimum, maximum, average and standard deviation learning outcomes in the media development group at SMK Negeri 1 Kabanjahe can be seen in Table 4.

Table 4. Minimum Learning Outcomes, Maximum, Mean and Standard Deviation of students in the Intervention Group (experimental class) at SMK Negeri 1 Kabanjahe.

<table>
<thead>
<tr>
<th>Learning Outcomes</th>
<th>Min.</th>
<th>Max.</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre Media Development</td>
<td>3</td>
<td>12</td>
<td>8.09</td>
<td>2.786</td>
</tr>
<tr>
<td>Post Media Development</td>
<td>10</td>
<td>26</td>
<td>19.65</td>
<td>4.762</td>
</tr>
</tbody>
</table>

Table 5. Data Normality Test for Experiment Class and Control Class

<table>
<thead>
<tr>
<th>Data</th>
<th>Class</th>
<th>l-count</th>
<th>l-table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>Experiment</td>
<td>0.1383</td>
<td>0.1566</td>
</tr>
<tr>
<td>Posttest</td>
<td>Experiment</td>
<td>0.1396</td>
<td>0.1566</td>
</tr>
<tr>
<td>Pretest</td>
<td>Control</td>
<td>0.1276</td>
<td>0.1498</td>
</tr>
<tr>
<td>Posttest</td>
<td>Control</td>
<td>0.1463</td>
<td>0.1498</td>
</tr>
</tbody>
</table>

Based on the results of normality testing in the experimental class and the control class in Table 4, it is known that the pretest and posttest data in both classes produce l-count values ≤ l-tables. Thus, it can be concluded that the learning outcomes data in the experimental class and the control class are normally distributed. Normality test conducted in this study uses the Lilifors test.
Table 6. Test Homogeneity of Pretest and Posttest Data

<table>
<thead>
<tr>
<th>Data</th>
<th>Class</th>
<th>p-value</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest experiment</td>
<td>1.28</td>
<td>1.79</td>
<td></td>
</tr>
<tr>
<td>Pretest control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posttest experiment</td>
<td>1.46</td>
<td>1.79</td>
<td></td>
</tr>
<tr>
<td>Posttest control</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on the results of homogeneity testing in the experimental and control classes in Table 5, the results of the pretest calculations from the experimental and control classes obtained f-count 1.28 and the posttest of the experimental and control classes obtained 1.46. According to the test criterion, if f-count ≤ f-table means homogeneous data. Thus, it can be concluded that the pretest and posttest learning outcome data in the experimental class and the control class are homogeneous.

4. Discussion

4.1. Discussion of Product Development Results

Development of interactive learning media with adobe animate cc based on the stages as stated in the procedure. The results of further development are carried out due diligence or validation by experts who have been determined. Based on the results of the validation done, the product in the form of an interactive learning cd was declared eligible to be continued in the field trials. The learning media developed have met the standards based on the design standards of instructional media development and learning material standards.

The product development research carried out is directed to produce products in the form of interactive learning media with adobe animate cc with basic competencies applying data types, variables, constants, operators and expressions in SMK Negeri 1 Kabanjahe which are used to improve student learning outcomes. The aspects were revised and refined based on data analysis and tested and input from material experts, instructional media experts. It aims to explore some aspects that are common in the process of developing a product.

The results of the assessment presented by the material experts about the development of interactive learning media with adobe animate cc gave an average mean score of 3.89 so that the learning media were included in the "proper" interpretation so that they could be accepted and suitable for use in the learning process. Learning media experts on interactive learning media with Adobe Animate CC gave an average mean score of 4.02 so that the development of instructional media with adobe animate cc was included in the "Decent" interpretation. Meanwhile, from the results of individual trials the mean score was 3.93 with the interpretation of "high acceptance". From the discussion above it can be concluded that the development of interactive learning media with adobe animate cc on basic competencies "applying data types, variables, constants, operators and expressions" is suitable for use as a learning medium in SMK Negeri 1 Kabanjahe.

4.2. Discussion on Research Results of Product Effectiveness Test
Based on statistical tests that have been done, the results of hypothesis test analysis are obtained, namely t-count = 3.678 and t-table = 2,000 which is t-count > t-table, this means the use of interactive learning media with adobe animate cc can improve student learning outcomes in basic competencies "applying data types, variables, constants, operators and expressions" at SMK Negeri 1 Kabanjahe with an influence on improving learning outcomes by 41.17%.

Interactive Learning Media with adobe animate cc can improve student learning outcomes at SMK Negeri 1 Kabanjahe. This research was related to improving the quality of design in a digital format, with specific targets to produce multimedia-based animation as a learning medium and an effective learning resource for learning fashion design [1]. Using multimedia-based interactive animation, effective to improve the mastery of concepts and skills to make fashion designs in digital format, and relevance with another research [5, 6].

Interactive Multimedia based on Adobe Flash CS6 in the pattern making lesson is approved by media experts and material experts, each of whom communicates with two validators [2]. Media experts rated interactive multimedia in very good ratings with a percentage (86.67%), and experts in interactive multimedia assessment materials with a percentage of 89.5%. In the small group trials obtained 63%, the moderate group trials gained 74.49%, and the large group trials gained 90.54% with very agreed criteria which meant that interactive multimedia based on Adobe Flash CS6 was suitable for use in learning activities.

5. Conclusions

Based on the results of research that has been done and the results of data analysis obtained can be concluded as follows. Based on statistical tests that have been done, the results of hypothesis test analysis are obtained, namely t-count = 3.678 and t-table = 2,000 which is t-count > t-table, this means the use of interactive learning media with adobe animate cc can improve student learning outcomes the basic competencies apply data types, variables, constants, operators and expressions in SMK Negeri 1 Kabanjahe, with an influence on improving learning outcomes by 41.17%.

The results showed that the development of interactive learning media with adobe animate cc had a positive effect in creating an active and enjoyable learning process. The development of interactive learning media with adobe animate cc has proven to make students more enthusiastic and responsible for learning more actively, which in turn has an impact on student learning outcomes better than without using media. Therefore, the development of interactive learning media can be recommended for use in vocational student learning processes. Suggestions that can be given to teachers, so that they can implement interactive learning media with adobe animate cc by planning better learning, so that the results obtained are more optimal and efficient.

6. References


Development of Microcontroller ATMega128 Based Injection Molding Machines With Motor Variations

Izwar Lubis1, Selamat Triono2, Kasman Rukun3
Universitas Negeri Medan1,2,3
izwar@unimed.ac.id

Abstract: This research is a technology development that requires microcontroller-based innovation. The problem currently faced is developing injection molding machines by replacing the drive system in order to get maintenance costs, cheaper repairs and save electricity. The purpose of this study was to apply the microcontroller ATMega128 on a small industrial machine that is an injection molding machine using a dc motor and a stepper motor in the process. The design process starts from machine design, manufacturing of mechanical machinery, electronics and programming. Tests using a mini ammeter-D02A, digital laser infrared tachometer rpm and infrared thermometer. The results of this study adjust the character of the motor used, in accordance with the respective working principles where the stepper motor works on molding that requires accuracy of position and the dc motor works more precisely for the screw press process that does not require accurate positioning of the pressure distance, from the results of motor rpm testing the maximum stepper motor is 93.9 rpm and the maximum DC motor is 132.3 rpm. The result of the power produced by the injection molding machine is 509.1 watts at a temperature of 260 °C, so that this injection molding machine can be used in small industries.

Keywords: Microcontroller ATMega128, DC Motor, Stepper Motor, Temperature.

1. Introduction

The development of the plastic goods industry in Indonesia continues to increase, both in small, medium and large industries. This development occurs because the potential consumption of plastic products is still quite large, so that it becomes an opportunity for plastic goods manufacturers to develop their businesses. The problem currently faced is developing injection molding machines by replacing the drive system in order to get maintenance costs, cheaper repairs and save electricity. There are many factors that affect the yield rate of injection products such as material characteristics, mold design, and manufacturing parameters [1]. There are different ways of molding a plastic some of them are blow molding, injection molding, rotational molding and compression molding. Each technique has its own advantages in manufacturing of specific items. Injection molding is perhaps the most common and important of all plastic processing processes. The process is extremely versatile, and can produce very complex shaped parts, with the use of multi-sided molds [2]. Injection molding control involves many aspects of machine operation and plastic behavior, most importantly their interactions. In principle, the processing pressure and temperature over time determine the quality of the printed product. The control system design must combine the logical sequence of all these basic
functions, including injection speed (which depends on pressure), clamping and opening the mold, opening and closing the drive device, barrel temperature profile, melting temperature, mold temperature, cavity pressure, holding pressure [3].

The injection molding machine uses the microcontroller ATmega128 as a breakthrough microprocessor and microcomputer technology which is a new technology to meet market needs. Microcontroller as a new technology that is semiconductor technology with more transistor content but only requires a small space so that the microcontroller can be mass produced (in large quantities) makes the price cheaper (compared to the microprocessor). The purpose of this study is to apply the microcontroller ATmega128 on small industrial machines, one of which is injection molding machines using DC motors and stepper motors in the process. The development of small injection molding machines for forming small plastics in small scale industries has been developed by Oyetunji [4].

The development of the microcontroller ATmega128 which is applied to the injection molding machine continues to innovate to get results as needed with a small industry. Microcontroller ATmega128 is an AVR family microcontroller that has 128KB of flash memory capacity. AVR (Alf and Veg's Risc Processor) is a series of 8-bit CMOS microcontrollers made by ATMEL, based on the RISC (Reduced Instruction Set Computer) architecture [5].

Toshiba DC Gearbox Motor DGM-3522-2A is one type of motor that uses a DC source as its power supply. To adjust the direction of rotation of the motor by adjusting the input polarity of the DC motor. How to regulate the rotation speed of the motor by controlling the amount of voltage entering the motor or by giving PWM (Pulse With Modulation) to the DC motor. PWM is basically turning on and off the DC motor quickly. A principle of PWM. The longer the time of his life, means the motor will spin faster. As an illustration, the period of one wave of time is fixed, which changes only the life time and the time of death.

Nema23 stepper motor JK57HS82-3004B double shaft, ATmega128 trainer uses a Nema23 stepper motor with a resolution of 1.8°. Nema23 is a bipolar stepper motor, so it only has 4 wires. The following is the cable configuration of the Nema23 stepper motor.

<table>
<thead>
<tr>
<th>Wire Color</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>A+</td>
</tr>
<tr>
<td>Green</td>
<td>A-</td>
</tr>
<tr>
<td>Yellow</td>
<td>B+</td>
</tr>
<tr>
<td>Blue</td>
<td>B-</td>
</tr>
</tbody>
</table>

2. Method

The location of this research was conducted at the Mechatronics Lab, Department of Mechanical Engineering Education, Faculty of Engineering, State University of Medan. This research was carried out in 2019. The design process of the injection molding machine based on the microcontroller ATmega128 can be seen in the figure below;
Control system is a combination of several components that work together in a reciprocal manner and form a system configuration that provides a desired result [6]. The components or processes to be arranged in the injection molding machine that are designed can be seen in the image below:

Fig. 1. Flow chart of the injection molding machine design process

Fig. 2. The control system on an injection molding machine
3. Results and Discussion

Making a design using AutoCAD software whose results can be seen in the image below;

![Injection molding machine design](image)

**Fig. 3. Injection molding machine design**

The process of making mechanical machinery is carried out through several stages starting from the selection of materials and the forming process, the results of which can be seen in the figure below;

![Mechanical Injection Molding Machines](image)

**Fig. 4. Mechanical Injection Molding Machines**

The electronic manufacturing process starts from designing with eagle 7.2.0 Software, by designing a schematic, board and the results of the electronic injection molding machine controller, can be seen in the picture below;
Fig. 5.(a). Schematic control of injection molding machines, (b). Board injection molding machine controls

Fig. 6. Electronic control system based on the microcontroller ATMega128
Fig. 7. Injection Molding Machine Design Results

Test equipment used in this study was the Mini ammeter-D02A, Digital laser infrared tachometer rpm and Infrared thermometer;

![Test equipment images](image)

**Fig. 8.** (a) Mini Ammeter-D02A, (b) Digital laser infrared tachometer rpm (c) Infrared thermometer

The results of tests using Digital laser infrared tachometer rpm can be seen in Table 2 and Table 3;

Table 2. Test results of stepper motor using digital laser infrared tachometer rpm

<table>
<thead>
<tr>
<th>No</th>
<th>Input (rpm)</th>
<th>Test Result (rpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>10.7</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>20.8</td>
</tr>
<tr>
<td>3</td>
<td>30</td>
<td>31.1</td>
</tr>
<tr>
<td>4</td>
<td>40</td>
<td>41</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
<td>52.3</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
<td>75.3</td>
</tr>
<tr>
<td>7</td>
<td>100</td>
<td>93.6</td>
</tr>
<tr>
<td>8</td>
<td>150</td>
<td>93.6</td>
</tr>
<tr>
<td>9</td>
<td>200</td>
<td>93.9</td>
</tr>
</tbody>
</table>
Table 3. Testing results of DC motor using digital laser infrared tachometer rpm

<table>
<thead>
<tr>
<th>No</th>
<th>Input (pwm)</th>
<th>Test Result (rpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>24.7</td>
</tr>
<tr>
<td>2</td>
<td>100</td>
<td>45.9</td>
</tr>
<tr>
<td>3</td>
<td>150</td>
<td>77.8</td>
</tr>
<tr>
<td>4</td>
<td>200</td>
<td>98.8</td>
</tr>
<tr>
<td>5</td>
<td>250</td>
<td>128</td>
</tr>
<tr>
<td>6</td>
<td>300</td>
<td>129.5</td>
</tr>
<tr>
<td>7</td>
<td>350</td>
<td>132.5</td>
</tr>
<tr>
<td>8</td>
<td>400</td>
<td>132.1</td>
</tr>
<tr>
<td>9</td>
<td>450</td>
<td>132.3</td>
</tr>
</tbody>
</table>

The measurement results use a mini ammeter-D02A and infrared thermometer;

Table 4. Measurement results using the mini ammeter-D02A and infrared thermometer

<table>
<thead>
<tr>
<th>No</th>
<th>Input Stepper Motor</th>
<th>Input DC Motor</th>
<th>Temp. Input Heater 1 (°C)</th>
<th>Temp. Input Heater 2 (°C)</th>
<th>Temp. Input Heater 3 (°C)</th>
<th>Temp. Measurement Results in Cylinders (°C)</th>
<th>Measurement Results (Watt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30</td>
<td>150</td>
<td>90</td>
<td>90</td>
<td>90</td>
<td>130</td>
<td>491.1</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>200</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>145</td>
<td>493.6</td>
</tr>
<tr>
<td>3</td>
<td>50</td>
<td>250</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>160</td>
<td>500.7</td>
</tr>
<tr>
<td>4</td>
<td>75</td>
<td>300</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>180</td>
<td>508.1</td>
</tr>
<tr>
<td>5</td>
<td>100</td>
<td>350</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>260</td>
<td>509.1</td>
</tr>
</tbody>
</table>

4. Conclusion

The results of this study to see the microcontroller ATMega128 in controlling stepper motors and DC motors work according to their functions, then the conclusions can be obtained that (1) Stepper motors and DC motors work in accordance with the respective working principles where the stepper motors work on molding which requires accuracy of position and DC motors work more precisely for the process of screw press that does not require accuracy of the position of the compressive distance, from the results of testing the maximum stepper motor rpm 93.9 rpm and the maximum DC motor rpm 132.3 rpm (2) The result of the power required by the injection molding machine is 509.1 watts at a temperature of 260 °C, so this injection molding machine can be used in small industries.

5. References

[1] Chung-Neng. Determination of Optimal Manufacturing Parameters for Injection Mold by Inverse Model Basing on MANFIS. Journal of Intelligent Learning Systems and


Production Flow Optimization By Using Theory of Constraints

Hasianna Nopina Situmorang1, Nazaruddin Matondang2
{hasiannanopina@unimed.ac.id}

Department of Mechanical Engineering, Faculty of Engineering, Universitas Negeri Medan1,
Department of Industrial Engineering, Faculty of Engineering, Universitas Sumatera Utara2

Abstract. The use of Theory of Constraints (ToC) is very necessary in overcoming problems in
the production automation system in the industry. This research aims to overcome the rate of
instant noodle production automatically in the factory. The study was conducted in a national
company that produces instant noodles at Tanjung Morawa, North Sumatera, Indonesia. The
experience of constraints of bottlenecks were observed at mixing station and cooking station
caused by the different capacities between the work stations. This research uses the principle
of continuous improvement. A linear programming method is used to optimize master
production schedule (MPS) and determine the maximum throughput. The results showed that
applying the theory of constraint in the flow rate can solve the problems in the production of
instant noodle in the factory. The ToC eliminate the constraints on the bottleneck work stations
so that the overall production flow can run effectively and efficiently. After optimal MPS
results has been known, rough-cut capacity planning (RCCP) revisions are calculated and the
results showed that the bottleneck work stations have become non-bottleneck work stations,
and the maximum throughput has been achieved.

Keywords: bottleneck; theory of constraints; master production schedule;

1. Introduction

Product flow optimization is very important in the production process in industry, because
it deals with the effectiveness and efficiency within a company [1,2]. It is known that production
planning is very crucial in the success of the company, especially in the context of measuring
the ability of a company to provide the products and its balance with the production process in
the factory [3,4]. Thus, the compatibility between raw materials, production processes, and
machine capacity must be carefully considered. If the production planning is not well regulated,
the production process can cause bottlenecks in intermediate or final products [5]. Bottle necks
occur when work stations have a smaller capacity than production requirements. One work
station experiences a bottle neck if there is an increase in demand that exceeds the capacity of
the machine, it will cause a delay in production or fulfillment of demand. Thus, the process of
reducing bottlenecks must be carried out with a search starting from the materials, machines,
and people who involve work in the factory. Several studies have been conducted to reduce the
bottleneck for the effectiveness of the companies. The use of theory of constraints (ToC) is very well applied to explore parts of the production steps that experience obstacles in the production flow automatically [6,7,8].

In this study, the observations on the production process have been carried out, namely in a company engaged in the manufacturing of products that produce machinery and human production works automatically, namely instant noodle production in Tanjung Morawa, Deli Serdang, North Sumatra, Indonesia. Briefly, the production process in the factory is carried out at six work stations, and it is known that not all production flows run smoothly from raw materials into the packaging. The observations results and the data analysis have shown that there were problems with slowing down in several work stations, namely the case of product buildup caused by differences in production capacity at one station with the previous work station, and ultimately becomes a bottleneck case. Sifting and mixing work stations always experience bottlenecks due to differences in work capacity which causes delays in the production process, and ultimately decreases in the number of products produced by the company. To overcome this problem efforts need to be made so that the working power of all stations can take place effectively.

The application of theory of constraints (ToC) is very suitable to be used to overcome the problem of a production flow that runs automatically [9,10]. Several studies have been conducted using the theory of constraints to overcome bottleneck problems in a production process [11,12]. Thus, the strategy to overcome this bottleneck is appropriate to be used to solve the problem of instant noodle production which is carried out in this study. The ToC method is considered to be suitable for handling the bottleneck problems experienced by the company, because this method focuses attention on finding constraints that can slow down the production process, and help to maximize the amount of inventory and throughput [13,14]. Theory of constraints will be able to be used to trace and examine constraints to find out how those constraints affect the desired goals within the company. The purpose of this research is to overcome the problem of instant noodle production flow rate in companies that work automatically within the company by using theory of constraints.

2. Materials and Methods

Research Procedures

The research is classified as applied research through the stages of problem identification to the stage of taking corrective actions in an effort to solve the problems experienced by the company. Observation and data collection is done by observation. Retrieval of research data was carried out directly at each work station as shown in Figure 1. Furthermore, research data are analyzed to ascertain the position of the bottleneck problem, and proceed with the application of theory of constraints to solve the problem. Continuous improvement will continue until the optimum production conditions are obtained so that the bottleneck problem of the production process can be overcome. The research step begins by observing the sequence of production processes and processing time of each work station, followed by calculating the production capacity at each work station. The next stage is to analyze the data aiming to find work stations experiencing bottlenecks, increasing capacity at the workstation section, and proceeding to recalculate the new capacity that has been successfully obtained. Production flow and capacity at work stations experiencing bottlenecks is further optimized by applying ToC. ToC application is also done to maximize throughput.
Fig 1. The conceptual framework on doing the study starting from problem identification to the stage of taking corrective actions to overcome the bottleneck problem of the production process.

3. Results and Discussion

The Description of Production and Rating Factor Analysis

In general, the process flow and production capacity of each work station (WS) for making instant noodles in the factory are shown in Figure 2. Each of the work station has a different production capacity and also resulted in various rating factors of production analysis.

Fig. 2. Process flow and production capacities in each work station of the production of instant noodles

The results of observations have shown that the average percentage of the realization of the company's daily production plan is 90.1% and there is a buildup of 9.9% was found at the workstations. The small number of constraints in the form of bottlenecks will affect the overall company performance. Therefore, this obstacle must be resolved so that the company's
performance can be improved. Improving company performance can be done by tightly scheduling the production process to optimize the work stations so that bottlenecks do not occur. In this case the standard time at each work station was calculated, the value of the rating factor of the observed operator was analyzed, and the allowance compensation given to the operator becomes a consideration in the management of instant noodle production. The results of the calculation of the standard time from manufacturing P-1, P-2, P-3 and P-4 products are summarized in Table 1.

### Table 1. Standard time for each work station and product where RF = Rating Factor, A = Allowance, and ST = Standard Time (sec)

<table>
<thead>
<tr>
<th>Work Station</th>
<th>Product-1 (P-1)</th>
<th>Product-2 (P-2)</th>
<th>Product-3 (P-3)</th>
<th>Product-4 (P-3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RF</td>
<td>A</td>
<td>ST</td>
<td>RF</td>
</tr>
<tr>
<td>1</td>
<td>1,0</td>
<td>0,15</td>
<td>11,4</td>
<td>1,0</td>
</tr>
<tr>
<td>2</td>
<td>1,0</td>
<td>0,13</td>
<td>23,1</td>
<td>1,0</td>
</tr>
<tr>
<td>3</td>
<td>1,0</td>
<td>0,15</td>
<td>13,1</td>
<td>1,0</td>
</tr>
<tr>
<td>4</td>
<td>1,1</td>
<td>0,18</td>
<td>22,5</td>
<td>1,1</td>
</tr>
<tr>
<td>5</td>
<td>1,1</td>
<td>0,13</td>
<td>21,9</td>
<td>1,1</td>
</tr>
<tr>
<td>6</td>
<td>1,1</td>
<td>0,13</td>
<td>12,0</td>
<td>1,1</td>
</tr>
</tbody>
</table>

#### 3.2. Product Demand Forecasting

The product demand forecasting has been done on instant noodle products by using quantitative forecasting methods, and trend projection method with regression. Based on the data distribution, the forecasting method chosen for the production at workstation for P-1 and P-4 products are the cyclical and linear methods, and for the P-2 and P-3 products are used the cyclical and exponential methods. From the smallest SEE value obtained, it is decided to use the linear forecasting method ate the workstation for P-1 product, where the P-2 uses the exponential method, while the P-3 and P-4 are using the cyclical method. Forecasting results for the next twelve months can be shown in Table 2.
### Table 2. The results of product demand forecasting in the next twelve months

<table>
<thead>
<tr>
<th>X (month)</th>
<th>Y (boxes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P-1</td>
</tr>
<tr>
<td>13</td>
<td>53187</td>
</tr>
<tr>
<td>14</td>
<td>52242</td>
</tr>
<tr>
<td>15</td>
<td>51298</td>
</tr>
<tr>
<td>16</td>
<td>50353</td>
</tr>
<tr>
<td>17</td>
<td>49409</td>
</tr>
<tr>
<td>18</td>
<td>48464</td>
</tr>
<tr>
<td>19</td>
<td>47520</td>
</tr>
<tr>
<td>20</td>
<td>46575</td>
</tr>
<tr>
<td>21</td>
<td>45630</td>
</tr>
<tr>
<td>22</td>
<td>44686</td>
</tr>
<tr>
<td>23</td>
<td>43741</td>
</tr>
<tr>
<td>24</td>
<td>42797</td>
</tr>
</tbody>
</table>

#### 3.3. Master Production Schedule (MPS)

The preparation of the master production schedule is carried out to plan the number of products to be produced over the next year. From the results, it is known that the master production schedule prepared for the four products is the same as the forecasting results. It is showed that the forecasting results from month 13 until 24 represented a master production schedule from January until December.

#### 3.4. Application of Theory of Constraints

The application of theory of constraints (ToC) has been carried out to optimize the production of instant noodle products, and constraints on work stations have also been identified. From the calculation results, it is known that the variance obtained is the difference between the required capacity (CR) and the available capacity (CA). The load percentage calculations have also been carried out to find out which work stations are experiencing bottlenecks and non-bottlenecks. The variance that is negative and the percentage of loads that are below 100% indicate the category of non-bottleneck work stations, while the variance that is positive and the percentage of loads that are greater than 100% indicate the bottleneck work station category. Calculation of required capacity and available capacity is calculated using rough-cut capacity planning (RCCP) as summarized in Table 3. It is known that work stations 2 and 4 are work stations that have bottlenecks. With this result, improvements were made so that the bottleneck problem can be overcome. Several activities carried out such as (1) Decide how to exploit the constraint, (2) Subordinate everything else, (3) Elevation of the existing constraints, and (4) Go back to step 1 and avoid inertia. Each of which is explained briefly.
## Table 3. Results of Rough-Cut Capacity Planning

<table>
<thead>
<tr>
<th>Month</th>
<th>Workstation 1</th>
<th>Workstation 2</th>
<th>Workstation 3</th>
<th>Workstation 4</th>
<th>Workstation 5</th>
<th>Workstation 6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Variance</td>
<td>% load</td>
<td>Description</td>
<td>Variance</td>
<td>% load</td>
<td>Description</td>
</tr>
<tr>
<td>Jan</td>
<td>-69649</td>
<td>59.96</td>
<td>NBN</td>
<td>306752</td>
<td>117.1</td>
<td>BN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-472421</td>
<td>71.84</td>
<td>NBN</td>
</tr>
<tr>
<td>Feb</td>
<td>-924279</td>
<td>52.07</td>
<td>NBN</td>
<td>37204</td>
<td>101.87</td>
<td>BN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-763669</td>
<td>60.4</td>
<td>NBN</td>
</tr>
<tr>
<td>March</td>
<td>-928006</td>
<td>51.88</td>
<td>NBN</td>
<td>29259</td>
<td>101.47</td>
<td>BN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-767954</td>
<td>60.18</td>
<td>NBN</td>
</tr>
<tr>
<td>Apr</td>
<td>-1020926</td>
<td>50.47</td>
<td>NBN</td>
<td>-27741</td>
<td>98.67</td>
<td>NBN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-830220</td>
<td>58.55</td>
<td>NBN</td>
</tr>
<tr>
<td>May</td>
<td>-679221</td>
<td>60.87</td>
<td>NBN</td>
<td>339875</td>
<td>118.95</td>
<td>BN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-609608</td>
<td>70.64</td>
<td>NBN</td>
</tr>
<tr>
<td>June</td>
<td>-936444</td>
<td>53.75</td>
<td>NBN</td>
<td>104827</td>
<td>105.01</td>
<td>BN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-761331</td>
<td>62.4</td>
<td>NBN</td>
</tr>
<tr>
<td>July</td>
<td>-728404</td>
<td>60.24</td>
<td>NBN</td>
<td>334175</td>
<td>117.65</td>
<td>BN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-550592</td>
<td>69.95</td>
<td>NBN</td>
</tr>
<tr>
<td>Aug</td>
<td>-836105</td>
<td>50.66</td>
<td>NBN</td>
<td>211513</td>
<td>110.61</td>
<td>BN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-660019</td>
<td>65.77</td>
<td>NBN</td>
</tr>
<tr>
<td>Sept</td>
<td>-1096028</td>
<td>49.6</td>
<td>NBN</td>
<td>-68545</td>
<td>96.87</td>
<td>NBN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-899492</td>
<td>57.6</td>
<td>NBN</td>
</tr>
<tr>
<td>Oct</td>
<td>-1228666</td>
<td>44.6</td>
<td>NBN</td>
<td>-295365</td>
<td>87.11</td>
<td>NBN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-1006570</td>
<td>51.77</td>
<td>NBN</td>
</tr>
<tr>
<td>Nov</td>
<td>-1013741</td>
<td>47.43</td>
<td>NBN</td>
<td>-145941</td>
<td>92.68</td>
<td>NBN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-866968</td>
<td>55.04</td>
<td>NBN</td>
</tr>
<tr>
<td>Dec</td>
<td>-1180390</td>
<td>41.71</td>
<td>NBN</td>
<td>-386789</td>
<td>81.51</td>
<td>NBN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-1045274</td>
<td>48.38</td>
<td>NBN</td>
</tr>
</tbody>
</table>

BN = bottleneck, NBN = non-bottleneck

(1) Decide how to exploit the constraint

Optimization of the master production schedule is carried out using the theory of constraints so as to produce maximum throughput by utilizing the entire capacity of the work station bottleneck. To optimize the master production schedule in the application of the ToC linear programming methods are used. The target function is maximizing throughput. The constraint function in the equation formed is the capacity of the work station bottleneck and the number of requests for each product. The equations that can be formulated, for example for January, in WS-2 can be seen in Equation (1) - (7).
Maks. : \( Z = C_1 X_1 + C_2 X_2 + C_3 X_3 + C_4 X_4 \) \hspace{1cm} (1)

s.t. : \( t_{n1} X_1 + t_{n2} X_2 + t_{n3} X_3 + t_{n4} X_4 \leq AC_n \) \hspace{1cm} (2)

\( X_1 \leq D_1 \) \hspace{3cm} (3)

\( X_2 \leq D_2 \) \hspace{3cm} (4)

\( X_3 \leq D_3 \) \hspace{3cm} (5)

\( X_4 \leq D_4 \) \hspace{3cm} (6)

\( X_1, X_2, X_3, X_4 \geq 0 \) \hspace{3cm} (7)

Where:

\( X_1, X_2, X_3, X_4 \) = the amount of each product that must be produced,

\( C_1, C_2, C_3, C_4 \) = throughput of each product type,

\( t_{n1}, t_{n2}, t_{n3}, t_{n4} \) = product processing time \( X_1, X_2, X_3, X_4 \) at the \( n \)th work station,

\( d_1, d_2, d_3, d_4 \) = the demand of each product type, and

\( AC_n \) = available capacity of each work station

(2) Subordinate everything else

Optimization of the master production schedule at the work station experiencing bottlenecks, and the results of the calculation of the resulting throughput are summarized in Table 4.

### Table 4. Optimal Production Master Schedule after application of theory of constraints

<table>
<thead>
<tr>
<th>Month</th>
<th>P-1 (boxes)</th>
<th>P-2 (boxes)</th>
<th>P-3 (boxes)</th>
<th>P-1 (boxes)</th>
<th>Throughput</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>53187</td>
<td>15067</td>
<td>12011</td>
<td>0</td>
<td>1971057000</td>
</tr>
<tr>
<td>Feb</td>
<td>52241</td>
<td>13675</td>
<td>17446</td>
<td>8418</td>
<td>2121778000</td>
</tr>
<tr>
<td>March</td>
<td>51298</td>
<td>12410</td>
<td>18881</td>
<td>9761</td>
<td>2103884000</td>
</tr>
<tr>
<td>May</td>
<td>49409</td>
<td>10222</td>
<td>22877</td>
<td>0</td>
<td>1902928000</td>
</tr>
<tr>
<td>June</td>
<td>48464</td>
<td>9277</td>
<td>32560</td>
<td>9072</td>
<td>2143781000</td>
</tr>
<tr>
<td>July</td>
<td>47520</td>
<td>8419</td>
<td>29649</td>
<td>0</td>
<td>1908286000</td>
</tr>
<tr>
<td>Aug</td>
<td>46575</td>
<td>7641</td>
<td>37365</td>
<td>3265</td>
<td>2033208000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Month</th>
<th>Production (boxes) on Workstation 4</th>
<th>Throughput</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>P-1 53187</td>
<td>P-2 15067</td>
</tr>
<tr>
<td>May</td>
<td>49408</td>
<td>10222</td>
</tr>
<tr>
<td>July</td>
<td>47520</td>
<td>8419</td>
</tr>
</tbody>
</table>

(3) Elevate the constraint

Revised rough-cut capacity planning (RCCP) has been carried out to see whether the obstacles experienced by instant noodle production have been overcome. In this case all work stations are observed, that is, there are no more work stations experiencing bottlenecks. The results of the revised RCCP can be seen from the results summarized in Table 5.
Table 5. RCCP Revision Results for Bottleneck Work Station

<table>
<thead>
<tr>
<th>WS</th>
<th>Month</th>
<th>Variance</th>
<th>Percentage of Load (%)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>January</td>
<td>0</td>
<td>100.00</td>
<td>non-bottleneck</td>
</tr>
<tr>
<td></td>
<td>February</td>
<td>0</td>
<td>100.00</td>
<td>non-bottleneck</td>
</tr>
<tr>
<td></td>
<td>March</td>
<td>-7</td>
<td>100.00</td>
<td>non-bottleneck</td>
</tr>
<tr>
<td></td>
<td>May</td>
<td>-6</td>
<td>100.00</td>
<td>non-bottleneck</td>
</tr>
<tr>
<td></td>
<td>June</td>
<td>-9</td>
<td>100.00</td>
<td>non-bottleneck</td>
</tr>
<tr>
<td></td>
<td>July</td>
<td>-61080</td>
<td>96.77</td>
<td>non-bottleneck</td>
</tr>
<tr>
<td>4</td>
<td>August</td>
<td>-5</td>
<td>100.00</td>
<td>non-bottleneck</td>
</tr>
<tr>
<td></td>
<td>January</td>
<td>-6</td>
<td>100.00</td>
<td>non-bottleneck</td>
</tr>
<tr>
<td></td>
<td>May</td>
<td>0</td>
<td>100.00</td>
<td>non-bottleneck</td>
</tr>
<tr>
<td></td>
<td>July</td>
<td>-2</td>
<td>100.00</td>
<td>non-bottleneck</td>
</tr>
</tbody>
</table>

(4) Go back to Step 1.

The Evaluate if the bottleneck has been broken, and return to the beginning. All workstations have become non-bottleneck workstations, so that the constraints on the system have been completely overcome.

Bottleneck work stations, which are mixing work stations (WS-2) and cooking work stations (WA-4), are the weakest link in the production flow that experiences bottlenecks. At these two workstations, buildup occurs that limits production capacity and can hamper overall production flow. With the theory of constraints (ToC), the bottleneck work station will be optimized so that it can smooth the overall production flow. Thus, at both bottleneck work stations there are constraints that must be removed to maximize the company's throughput [15,16]. The principle of continuous improvement theory of constraints (TOC) is applied to optimize capacity planning so there are no more bottleneck work stations. By using the linear programming method, the revised production master schedule is done by adjusting the capacity of the mixing and cooking work stations [17,18].

Work in process (WIP) occurs because of an imbalance of capacity that occurs at work station facilities, causing buildup of semi-finished products or work facilities that are idle and cannot be used maximally [19]. With the optimization of the master production schedule, the company can minimize in the following cases: (1) Work in process (WIP), where the more optimal the amount of production done on the production floor, based on the optimal JIP results a reduction in the amount of production, the amount of product inventory half-finished will be lower, (2) The amount of waste (waste that does not add value and can inhibit activities in the production process) caused by the work in process at the bottleneck work station, namely the mixing and cooking work stations, can be minimized, and (3) The average completion time of the production process can be minimized by reducing waste which can cause poor production flow and material flow on the production floor. Thus, the application of the principle of theory of constraints can eliminate obstacles that cause bottlenecks and increase profit or output levels (throughput) [20].
5. Conclusion

The application of theory of constraints has been able to overcome the bottleneck experienced by instant noodle factories. The average value of the standard time required at each work station to complete the four products, namely in WS-1 is 10.22 seconds, WS-2 is 20.62 seconds, WS-3 is 11.89 seconds, WS-4 is 20.38 seconds, WS-5 is 20.03 seconds, and WS-6 is 11.40 seconds. The rough-cut capacity report results show that the mixing work stations (WS-2) in January, February, March, May, June, July, and August and cooking work stations (WS-4) in January, May, and July are bottleneck work stations. After optimizing the master production schedule by applying the principle of theory of constraints and using the linear programming method, the results show that WS-2 and WS-4 become non-bottleneck work stations and the constraints that cause bottlenecks can be removed. Based on the revised results of the master production schedule, a maximum throughput was obtained in January amounting to Rp 2,170,635,000.00.

6. References


Increasing Students’ Environmental Education and Awareness Through Campus Owned Waste Management Unit

Rachmat Mulyana¹, Eka Daryanto², Eko Wahyu Nugrahadi³, Jubaidah⁴, Rini Selly⁵

1. Introduction

The environment we live in is very important as it affects us directly. Even so, environmental problem has raised and resulted in such a global concern, in which around the world efforts are being made to make people aware about environmental protection. One of the main causes of environmental degradation is improper management waste. Waste is a major cause of pollution and outbreak of diseases in many parts of the world Proper management of the waste generated is most important in this matter. Waste management is a science that
addresses the logistics, environmental impact, social responsibility and cost of an organizations’ waste disposal. For example, in solid Waste Management (SWM), there were three basic components to consider including waste collection, transportation and disposal. Comprehensive waste management incorporates a diverse range of activities including reduction, recycling, segregation, modification, treatment and disposal that have varying levels of sophistication [1].

Thirty percent of the total 54 hectares area owned by Universitas Negeri Medan (Unimed), consist of open green space that also belongs to Medan city forest. Unimed consists of seven faculties with total number of 25,000 students, academic staff and employees. A calculation was made to estimate the number of waste this university generates within a single day. If one person produced 0.1 kg / day garbage and average plant litter was 2.5 ton / day trees, to sum it up about 5 ton / day or 6000 ton / year waste was created. In total, 75% of this waste is organic consisting of leaf, food scraps and paper waste, while the rests, 25% is inorganic waste such as plastic packaging, cans, glass bottles, etc. In addition to this, there is a considerable waste potential coming from other agencies and institution around Unimed campus.

Despite the apparent capacity, waste produced by Unimed and potential waste management has not been utilized properly until integrated waste management owned by this campus established in 2016. Before, trash after garbage collected is mostly transported and discharged to landfill located far outside the campus that is cost required. While others, such as leaves was collected and burned. It takes 24 hours more for the burning process to complete. The thickness of burnt garbage that lasted throughout the day often resulting in shortness of breath and eye irritation.

Waste management especially in one located specifically inside campus area is seen as a great potential that if used seriously can be a source of income generate. Good waste management in the campus environment can be used as an action and efforts to educate the environment to the campus community to realize Eco-campus, Green-Campus and Sustainable Development Campus. [1.2]

The impact of integrated solid waste management unit in Unimed (P2ST Great Unimed) is expected to create a clean and environmentally friendly campus area. This activity is expected to increase awareness and build environmentally friendly culture to all students, academics and surrounding community. One of expected Educational benefits brought by the formation of integrated waste management in Unimed is to provide an example for the community to participate in waste managing and to inform its activity so that more people becoming aware and taking interest in not only waste recycling but also managing.

2. Method

The study was carried out during students’ visits to Campus owned integrated waste management unit (P2ST Great), in May 2017. It includes a study to a total of 269 participants form two different faculty, namely mathematics and natural sciences faculty (FMIPA) and faculty of engineering (FT). The type of study was experimental study. The data collection was done by a pretested, predesigned close-ended and open-ended questionnaire. Most of the questions had multiple-choice options, which made it easy for the respondents to answer them appropriately.

The open-ended question gave the respondents enough time and space to express their views. The open-ended questions were chosen to strengthening the close-ended questions and
served to provide qualitative information to the study. The test consisted of 15 questions and was used to determine the knowledge (10 questions) and attitude (5 questions) toward 3R (reuse, reduce and recycle), hazardous waste, waste management, segregation and methods used for disposal, and potential economic value.

A brief talk was given to students about campus waste management, activities inside P2ST Great workshop and their doubts were solved after open and free discussion time was given. Each knowledge question has 1 point, while attitude questions is graded by using scale; 1) 8 and more points was given to answers which considered as “good”, 5 to 8 points as “moderate” and less than 5 points as “weak”. Three experts and faculty members confirmed validity and reliability was confirmed in a pilot study with 30 students by Cronbach’s alpha method as 0.77.

The questionnaires were distributed among all students of each faculty twice, before briefing, sharing, and discussion session held and after informal lecturing. During the course of the study, informal interactions were also done with respondents to familiarize them with the objectives of the present study, their role and benefits to them from the study. Data was analyzed on a computer using SPSS (Statistical Package for Social Sciences) version 21.0. Descriptive statistics like percentage, mean, and SD (standard deviation) were computed for data presentation.

3. Result and Discussion

The study sample consisted of 98 males and 171 females with the mean age of 20.4±6.3 years. Total 102 students were studying biology education, 74 from chemistry education and 83 were engineering students. 92.4% of the students defined the recycling properly, 82.2% were aware of the importance of recycling after visitation session. The knowledge of students was the highest about the definition of recycling (84.4%) and lowest about disposal and delivery of recycled materials (23.6%). Most biology education (71.1%) and chemistry education (75.3%) students had “moderate” and most engineering students (69.1%) had “moderate” knowledge about waste management after treatment. Further analysis showed that Most biology education (80.1%) and chemistry education (80.9%) students had “poor” and most engineering students (71.1%) had “moderate” understanding and awareness about the connection of business which involve generating lots of trash. Students were fairly unsure when asked about conducting a waste audit.

Regarding practice of proper waste management, students’ participants showed they have proper idea and practice of waste segregation, conversion of waste to kitchen compost, in which biology education (61.1%) and chemistry education (60.3%) students had “moderate” and most engineering students (69.1%) had “moderate” knowledge regarding these issues. Both groups were agreed that a full of commitment to minimize the wastes and to avoid throwing the wastes outside is seriously important.

Towards attitude, both groups have responded positively for minimizing the house holds waste (p>0.05) on post-test. Student who were came from either joint family or nuclear family showed equal percentage of awareness, practice and attitude toward issues directed to 3R (reuse, reduce and recycle), hazardous waste, waste management, segregation and methods used for disposal, and potential economic value of it.

A large amount of solid wastes is generated from homes. Household waste is major source of solid waste. The quantity of solid waste grows faster than population [4]. Solid waste disposal has been identified as a major cause of pollution and environmental threat globally. The findings
of the present study have made it clear that they are well aware of the importance of waste management. But they are lacking in the practice of proper waste management. This study findings support the studies conducted by [5].

Moreover, a series of paired t tests for within-group comparisons was used to determine if significant differences existed before and after visitation to P2ST Great Unimed. The results showed that there were statistically significant differences (p<.05) before and after visitation and discussion session regarding students’ knowledge and attitude toward waste management and its issues.

The results showed that in the beginning the number of correct answers given to the questions regarding to the awareness of recycling was good (60.2%), but making the students becoming more aware of the knowledge about waste recycling program in P2ST workshop was show to give positive impact in increasing students’ knowledge as much as 20%. A study was conducted by Bagheri Ardabylyan & Islami and to understand students’ knowledge about similar issue. They have reported that more than 65% of the students are aware of recycling and suggested that in order to succeed in the recycling of solid waste, having an educational program using mass media can be an effective way to increase Knowledge and Attitude Level of Students about Solid Waste Recycling; awareness and public participation [6].

Tehrani, Hosseindoos, and Miranzadeh stated that students, family, media, newspaper and magazines, and schools and universities together could be the best way to acquire knowledge in the field of recycling [7]. There is a need for cooperation between these media, and the results are greater than ever and the mass media, e.g. television and radio, can have the greatest impact in this regard. Ehrampoush & Moghadam [8] and Ugulu have mentioned that according to the students’ opinion, the municipality should be in charge of the management of recycling in the society.

Students showed to highly agree that organizing workshops on solid waste management and recycling at the university level, presenting optional course with the theme of solid waste management in all academic fields, information given through brochures and pamphlets, holding competitions with the theme of waste recycling and management, and organizing a more scientific visitation would familiarize them with the problems of waste disposal and waste management. These are, according to students are among highly recommended acts to raise awareness of waste. There is no permanent solution for environmental problems, only thing we can reduce and control waste generation by proper awareness and practice.

An event like this helps to promote not any environmental and waste management awareness but also help students to realize the economic value as an outcome of P2ST activities.

The Integrated Waste Management Unit of Medan State University (UNIMED) is a waste processing service to manage waste generated in UNIMED and surrounding campus environment. The long-term goal of this business unit is to open up opportunities for revenue generation for UNIMED and to create new entrepreneurs among lecturers and students, as well as waste management units. Organic waste will be processed into various types of fertilizer such as compost, liquid fertilizer, bokashi fertilizer, and kascing fertilizer.

Inorganic waste will be processed into creative products (Unimed merchandise), fuel, and block / paving block. This business unit will be managed using simple and efficient technology developed by the UNIMED Mechanical Engineering Study Program so that it will produce economically and ecologically useful products. The first-year results, P2ST managed to process organic waste into compost fertilizer, with a production amount of 5 tons / month. While the inorganic waste processed into creative products, about 500 pieces / month. The second year's special target is to improve product and product innovation. The production of compost fertilizer is increased about 10 tons / month, while the inorganic waste will be processed into creative
product (merchandise Unimed) about 2,000 pieces / month, plastic count (1.4 tons / month), BBM (245 liter / month). Innovation in the second year is making product innovation that comes from organic waste is bokashi fertilizer (1500 kg / month) and fertilizer kascing (1000 kg / month) and liquid fertilizer (1450 liter / month). In addition to product innovation, in the second year also targeted the expansion and improvement of marketing. The third year's special target is to increase production and expand marketing.

4. Acknowledgment

We are thankful to Dean, School of Universitas Negeri Medan, Medan, Sumatera Utara for giving us support in carrying out the study.

5. References

Analysis of The Use of Lecture Facilities in The Department of Mechanical Engineering Education Welcoming the Opening of New Study Program

Robert Silaban¹, Eka Daryanto², Selamat Riadi³
robertsilaban@unimed.ac.id

Department of Mechanical Engineering Education, Universitas Negeri Medan

Abstract. This research aims to: 1) provide information for policy making related to strategies for meeting the needs of lecture spaces for opening new study programs, 2) making a map of space requirements based on KKN for each study program at the Faculty of Engineering. The research design is a type of ex post facto research with a descriptive approach. Ex post facto research aims to conduct a variable analysis or review of the conditions of existing infrastructure in the field. The results showed that the amount of study space needed for opening a new study program was 5 rooms. Availability obtained for the purposes of 5 new study programs is obtained from the efficient use of lecture rooms obtained as much as 1 study group room and mapping of existing infrastructure is obtained as many as 4 study groups.

Keywords: Analyst, facilities, opening of new study programs

1. Introduction

The need for adequate educational facilities, both in terms of the amount / ratio, variations in the types needed, and the quality is very necessary for the continuity of a quality learning process. Law No. 20 of 2003 concerning the National Education System, among others, emphasizes the need to develop national education standards, which include: content standards, process standards, graduate competency standards, teacher and education staff standards, facilities and infrastructure standards, management standards, financing standards, and assessment standards. and educational infrastructure is one of the important educational input elements and is a vital need for the implementation of a quality educational process [1]. Without adequate facilities and infrastructure, it is difficult to expect high-quality educational processes and results. The need for educational facilities is not enough that is directly related to learning and learning activities in the classroom such as: resource books, equipment, furniture, and educational media only.

The education process also requires educational facilities that indirectly support the implementation of learning and learning activities in the classroom such as the need for land, buildings or space, as well as equipment and furniture for the implementation of quality management [2]. The need for supporting facilities is needed to provide optimal services for the ongoing quality education process.

The Faculty of Engineering, Medan State University (FT Unimed) has experienced various important moments of change that have a significant influence on the development of the faculty. The conversion of FPTK to FT had a significant impact on the number of study
programs held and thus the increasing number of students studying at FT. The number of study programs held by FT in 2017 totaled 13 consisting of 8 undergraduate education study programs, 3 non-educational study programs and 2 non-educational D3 study programs. The current number of FT Universitas Negeri Medan students is 2,887 students. Meanwhile the design of facilities to support education by IDB donors is still at the stage of proposing proposals.

Thus, efforts are still needed to make efficient the existing infrastructure. In 2017 the Department of Mechanical Engineering Education has 6 classrooms, 6 labs / workshops. The construction of lecturer and laboratory rooms which are still lacking efforts will be completed within the next 5-7 years. The development costs are from PNBP Universitas Negeri Medan and the Islamic Development Bank (IDB). This study aims to determine:

a. Mapping of lecture rooms at the Faculty of Engineering JPTM at this time.
b. The possible space mapping is used as a lecture room in the Engineering Faculty JPTM at the opening of the new study program in 2020.
c. Providing information for overall policy making related to lecture space fulfillment strategies for the new study program 2020.

The need for adequate educational facilities, both in terms of the amount / ratio, variation in the types needed, as well as the quality for the ongoing educational process and the achievement of excellent quality educational outcomes, is not negotiable. Therefore, educational facilities are very important and some of them (sources and learning media) are often referred to as the window of science and technology [3]. The absence of educational facilities in learning tends to make students learn verbally, and this is a form of intellectual suppression.

The need for educational facilities is not enough that is directly related to learning and learning activities in the classroom such as: resource books, equipment, furniture, and educational media only. Education in schools also requires educational facilities that indirectly support the implementation of learning and learning activities in the classroom such as the need for land, buildings or space, as well as equipment and furniture for the implementation of quality school management. The need for educational facilities like this is minimally adjusted to the level of needs, types, and functions [2]. The need for supporting facilities is needed to provide optimal services for the ongoing quality education process.

In recent years the government has begun to realize the importance of clear education standards that can be referred to by every education provider both at the national and regional levels. In connection with standards for educational facilities, Government Regulation No. 19 of 2005 concerning National Education Standards states that each education unit must have facilities which include furniture, educational equipment, educational media, books and other learning resources, consumables, and other equipment needed to support an orderly and continuous learning process, such as building and land use [4]. This Government Regulation does not further elaborate on the types and specifications of essential education facilities and the minimum level of need for each school at each level and type of education program. Likewise, the details regarding the need for essential and minimal facilities for each type of education management activities, teaching and learning process, and program evaluation process. In connection with that, we need an analysis of the needs of educational facilities in accordance with the expected standards both regarding the number / ratio, variations in type, and quality level.

In accordance with Law No. 20 of 2003, funding for the implementation of education is a joint responsibility of the central government, regional governments and the community [1]. This means that the budget for the provision of educational facilities is also a shared responsibility between the central government, regional governments and the community. The
limited budget that is owned by the central and regional government implies that the local government has a clear data base on the type and minimum level of need for educational facilities at every level of education, even for each type of education implementation activity. In addition, the ability of the community to provide educational facilities in their regions in accordance with their socioeconomic conditions also needs to be identified. Therefore, scientific studies are needed about the feasibility of existing educational facilities, their urgency, targeting accuracy, and their contribution to improving the educational process and outcomes.

The availability of adequate school education facilities is suspected to have a strong correlation with improving the quality of the process and learning outcomes of education programs in schools [5]. In this case, educational facilities, especially those concerning learning facilities, learning resources, and learning media are thought to have a strong influence on the expected learning outcomes [6]. Appropriate learning tools, in addition to being an educational medium (learning) that will help facilitate the child’s thought process through the concretization of abstract objects and can also be the learning objects itself that will help students understand natural, social, cultural phenomena, and technology directly. Involving the learning process directly, intactly, comprehensively, and powerful clearly helps students realize their learning potential optimally [5][2].

Educational facilities and infrastructure, especially land, buildings and educational equipment should describe the ongoing curriculum implementation program of the institution. The building and learning equipment are held based on the applicable curriculum or educational programs, so that with the suitability it allows the existing facilities to really support the process of education and learning.

2. Research Methodology

The place of research is JPTM Faculty of Engineering, Medan State University. This research is planned for 6 months, starting from May 2017 until October 2017. The research design that will be used is classified as ex post facto research using a descriptive approach. Ex post facto research aims to conduct a variable analysis (data) or a review of the condition of infrastructure especially lectures in the field. Based on the facts of the review of the conditions in the field, a mapping of the required infrastructure will be made based on the IQF curriculum which will be applied in the new Study Program in 2020.

3. Results and Discussion

3.1 Development of JPTM Laboratories and Workshops

In 2017 JPTM FT Universitas Negeri Medan will propose the opening of 5 new Study Programs as follows; (1) Mechanical Engineering, (2) Material Engineering, (3) Metallurgical Engineering, (4) Chemical Engineering, and (5) Material Engineering. Along with the proposal of the new Study Program, as well as referring based on the need to implement the KKN curriculum by referring to the establishment of lecturers KDBK in each Department and Study Program, the JPTM FT Universitas Negeri Medan will also develop Laboratories and Workshops as presented in table 1 below:
Table 1. Development of JPTM Laboratories and Workshops

<table>
<thead>
<tr>
<th>No</th>
<th>Original</th>
<th>Becomes</th>
</tr>
</thead>
</table>

As a consequence of the opening and development of the new Study Program and Lab/WS, FT Unimed for the past three decades, patchwork has been added and is limited to learning space and office facilities. For the lecturer and workshop room the addition is still minimal. Another more crucial challenge is the age of buildings and their equipment, especially power lines and other utilities in order to meet the standards of adequacy, safety and efficiency. Considering the limited funds available, the demands of stakeholders and the demands of the development of learning technology, integrated planning is needed between funds, target spending and travel time. To support the opening of new study programs and lab/WS development as well as to strengthen the implementation of the IQF, it is necessary to make efficient use of the existing space and look for opportunities to optimize learning facilities in JPTM FT Universitas Negeri Medan to be used as lecturing facilities ahead of the construction of the new FT building in 2020.

Therefore, it is necessary to solve the problems of infrastructure related to the adequacy of limited conditions, namely: (1) how much efficiency and prediction index of calculation of JPTM FT Universitas Negeri Medan education infrastructure. (2) how much is the need and lack of educational infrastructure to support the implementation and development of study programs in JPTM FT Universitas Negeri Medan. (3) how are the priorities and efforts to provide educational infrastructure related to the limited funds available.

3.2 College Facilities Efficiency

Lecture facility efficiency is presented in table 2 below:

Table 2. College Facilities Efficiency

<table>
<thead>
<tr>
<th>No</th>
<th>Room Name</th>
<th>Room Kode</th>
<th>Used (min/week)</th>
<th>Available (min/week)</th>
<th>empty minutes/week</th>
<th>Efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lecture Room</td>
<td>89.3.01</td>
<td>2220</td>
<td>2700</td>
<td>480</td>
<td>82.22</td>
</tr>
<tr>
<td>2</td>
<td>Lecture Room</td>
<td>08.1.06</td>
<td>2190</td>
<td>2700</td>
<td>510</td>
<td>81.11</td>
</tr>
<tr>
<td>3</td>
<td>Lecture Room</td>
<td>08.1.07</td>
<td>2360</td>
<td>2700</td>
<td>340</td>
<td>87.41</td>
</tr>
<tr>
<td>4</td>
<td>Lecture Room</td>
<td>08.2.01</td>
<td>1600</td>
<td>2700</td>
<td>1100</td>
<td>59.26</td>
</tr>
<tr>
<td>5</td>
<td>Lecture Room</td>
<td>08.2.02</td>
<td>2010</td>
<td>2700</td>
<td>690</td>
<td>74.44</td>
</tr>
<tr>
<td>6</td>
<td>Lecture Room</td>
<td>08.1.05</td>
<td>1900</td>
<td>2700</td>
<td>800</td>
<td>70.37</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td></td>
<td>12280</td>
<td>16200</td>
<td>3920</td>
<td>75.80</td>
</tr>
<tr>
<td>7</td>
<td>Lab CAD</td>
<td>07.1.11</td>
<td>1380</td>
<td>2700</td>
<td>1320</td>
<td>51.11</td>
</tr>
<tr>
<td>8</td>
<td>Lab. CNC</td>
<td>79.1.03</td>
<td>300</td>
<td>2700</td>
<td>2400</td>
<td>11.11</td>
</tr>
<tr>
<td>9</td>
<td>Lab. Mechatronics</td>
<td>89.1.01</td>
<td>1420</td>
<td>2700</td>
<td>1280</td>
<td>52.59</td>
</tr>
<tr>
<td>10</td>
<td>Lab. Production</td>
<td>79.1.01</td>
<td>760</td>
<td>2700</td>
<td>1940</td>
<td>28.15</td>
</tr>
<tr>
<td>No</td>
<td>Room Name</td>
<td>Room Kode</td>
<td>Used (min/week)</td>
<td>Available (min/week)</td>
<td>empty minutes/week</td>
<td>Efficiency (%)</td>
</tr>
<tr>
<td>----</td>
<td>----------------------------</td>
<td>-----------</td>
<td>-----------------</td>
<td>----------------------</td>
<td>--------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>11</td>
<td>Lab. Automotive</td>
<td>118.1.01</td>
<td>960</td>
<td>2700</td>
<td>1740</td>
<td>35,56</td>
</tr>
<tr>
<td>12</td>
<td>Image Studio</td>
<td>08.2.03</td>
<td>150</td>
<td>2700</td>
<td>2550</td>
<td>5,56</td>
</tr>
<tr>
<td>13</td>
<td>Manufacturing Workshop</td>
<td>97.1.01</td>
<td>980</td>
<td>2700</td>
<td>1720</td>
<td>36,30</td>
</tr>
<tr>
<td>14</td>
<td>Production Workshop</td>
<td>97.1.01</td>
<td>880</td>
<td>2700</td>
<td>1820</td>
<td>32,59</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td></td>
<td>6830</td>
<td>21600</td>
<td>14770</td>
<td>31,62</td>
</tr>
</tbody>
</table>

Based on the efficient use of lecture rooms in the even semester of 2016/2017, there will be an opportunity for the availability of lecture facilities to obtain an average classroom use efficiency of 75, 80%, while the efficient use of learning spaces in laboratories and workshops is 31.62%.

3.3 Analysis of Availability of Classrooms for New Study Programs

Opportunities for availability of lecture facilities for 5 new study programs in 2020 based on the efficient use of lecture rooms. Assumption: All old study programs are assumed not to add classes. All new study programs will only open 1 class, the number of courses in the even semester = odd semester Total semester credits 22 credits = 2200 minutes / week. Needs of hours to be provided = 2200 min / week x 5 study rooms = 11,000 min / week, number of hours available 3,920 minutes / week, 3,920 minutes / week <11,000 minutes / week, or can only provide for 1 class of 2,200 hours / week. Conclusion the need for lecture rooms for 5 new study programs in 2018 has not been fulfilled, the remaining lecture hours remaining 1,720 minutes / week.

Opportunities for availability of lecture facilities for 4 new study programs in 2020 based on the mapping of existing infrastructure. The lecture infrastructure that can be converted into lecture rooms is as follows; (1) Automotive Workshop B can be converted into 2 lecture halls, (2) Ex Lab CNC Room (2 rooms). So the need for lecture rooms for 5 new study programs can be met.

4. Conclusions

The need for lecture rooms for 5 new study programs in 2020 has not been fulfilled, the remaining lecture room hours remaining 1,720 minutes / week, so it is recommended that the lecture halls can be affected by the Automotive B workshop can be converted into 2 study rooms.

With the current development of Blended Learning, it is expected that lecturers who have applied it in lectures, the study program should arrange an integrated lecture schedule and recovery program.

5. References


Language Maintenance In New Millenium: A Case Of Javanese-Batak Toba Families

Vivi Novalia siti njak1, Anna Tambunan2, Nurlaidy Simamora3, Pahotan Sinaga4
{0112128701@methodist.ac.id1, annztambunan@unimed.ac.id2, 0107108204@methodist.ac.id3, 0103016904@methodist.ac.id4}
1,3,4 Universitas Methodist Indonesia, Medan, Indonesia
2 Universitas Negeri Medan, Medan, Indonesia

Abstract: Medan is the biggest city in North Sumatera. In Medan, there are so many vernacular languages. Vernacular language is a symbol of ethnic identity. Maintaining vernacular language means maintaining identity. This study focuses on the dominant factor and the ways in vernacular language maintenance in Javanese-Batak families in Medan, Indonesia. There are four couples as subjects. This study applies qualitative research, especially case study. Data are taken from interview and observation. The technique of data analysis uses Miles and Huberman model which is divided into four steps; data collection, data reduction, data display, and conclusion drawing and verification. The findings of the data are 1) Attitude and parents' role at home are the dominant factor from three factors which influence the vernacular language maintenance in Javanese-Batak families. 2) Language maintenance can be done through three ways, they are: language choice at home, bringing children to ethnic church, and hearing traditional songs.

Keywords: Language, Maintenance, Javanese-Batak, Families.

1 Introduction

Language as a mean of communication. it is done by people by arranging words to be sentences in order to construct meaning and make others people understand what speakers talk. The existence of language represents the temple of speakers’ soul which relates to the interaction among tribes, ethnic groups, and religions [1].

Language is one of ethnic identity symbols. It will be lost without maintenance. It is a must to maintain the language [1]. Language maintenance is an effort to keep the consistence of the language by using the language continually [2] [3]. So many vernacular languages in Indonesia, it causes the competition among languages. As a fact, Lengilu language in East Borneo is only spoken by 4 people. The competition among languages effects language shift. Language shift is the change of language in use dominantly. It works to language loss [4].

Maintaining vernacular language in inter-ethnic families is questioned. Communication between people from different ethnics sends and receives the message across language and culture. Verification of ethnic diversity as the identity from its ethnic is the objective of interethnic communication [5]. The problem occurs because of the misconception of patriarch.
Father as head of household has power in the family and it causes father’s language must be maintained in family domain by shelving mother’s language.

The aims of this study attempted to observe the dominant factor of vernacular language maintenance in Javanese-Batak Toba families in Medan and to investigate the process of language maintenance in Javanese-Batak Toba families in Medan.

2 Method Of Research

This study was done by applying qualitative research especially case study. The instrument of data collection was mobile phone which was used to record the observation and the interview. The data were the recording of the observation and in-depth interview. The Data from observation and interview were transcribed. The subjects were 4 families who live in Medan, are able to speak their own vernacular languages, are Christian. The data analysis was done by applying Miles and Huberman technique which consisted of data collection, data reduction, data display, and conclusion drawing and verification [6].

3 Result

3.1 Factor of Language Maintenance

There are some factors influence Language maintenance: Attitude, parents’ role at home, and religion factor. Attitude factors is internal factor, it comes from speakers’ soul. It interactively influences to language maintenance, it improves speakers’ motivation to maintain their vernacular language. Parents’ role at home comes from parents’ attitude to their vernacular language. Religion factor is as the result of speakers’ motivation in order to maintain their vernacular languages.

3.1.1 Attitude

All parents have attitude toward their vernacular languages, especially Batak. Batak people have positive attitude to keep their symbol of identity alive. Batak People give surname for Javanese people who want to marry to Batak people. Javanese people who have surname attach to social ethnic groups and speak Batak Toba language when they meet Batak Toba People.

Data 1
Interviewer: Biasanya pakai bahasa apa di rumah? (What kind of language do you speak at home?)
Parent: Bahasa Batak sama bahasa Indonesia (Batak language and Indonesian)
Interviewer: Kenapa pakai bahasa batak? (why do you speak Batak language?)
Parent: Namanya orang Batak, ya pakai bahasa batak lah. (Batak people speak Batak language)

The data 1 shows that Attitude motives the speakers to speak Batak Toba language as seen in “Namanya orang Batak ya pakai bahasa Batak (Batak people speak Batak).” Giving surname improve their prestige to be Batak. Being Batak is not only about culture but also language. Surname as the identity force them to speak Batak Language.
Parents’ role at home

Parents’ role is one of language maintenance factors applied by all parents. In Batak tribe, Father as a head of household has an important role to choose the language used in family domain. There are two languages used; Indonesian and Batak Toba. Parents do code-mixing in doing communication to their children.

Data 2
Interviewer: Kenapa pakai bahasa batak? (why do you speak Batak?)
Parent: Namanya orang Batak, ya pakai bahasa batak lah. (Batak people speak Batak language)
Interviewer: Maksudny? (What do you mean?)
Parent: Yah, dikasih marga, sudah bagian dari batak, pakai bahasa batak lah kadang-kadang sama mereka, di sini juga rata-rata orang batak. (Yeah, I have been given surname, already being part of Batak Toba tribe, sometimes, I speak Batak Toba to them, Most of people here are Batak).

The data indicates that Parents’ role at home influences children acquisition. Children are forced to adopt Batak Toba language as stated “Pakai bahasa Batak lah kadang-kadang sama mereka” (Sometimes, I speak Batak Toba to them).” Father has a positive attitude to maintain Batak language even he is not Batak naturally. It is also as the impact of Father’s surname.

Religion

Bringing children to ethnic church is done by two parents to keep their children attitude to Batak Toba language alive. Reading holy bible in Batak Toba language and singing songs in Batak Toba language force children to understand Batak Toba language.

Data 3
Interviewer: Maksudny? (What do you mean?)
Parent: Yah, dikasih marga, sudah bagian dari batak, pakai bahasa batak lah kadang-kadang sama mereka, di sini juga rata-rata orang batak. (Yeah, I have been given surname, already being part of Batak Toba tribe, sometimes, I speak Batak Toba to them, Most of people here are Batak).
Interviewer: selain itu ada hal lain? (is there any other factor?)
Parent: apa ya, gereja kali ya, kan di sana pakai bahasa batak. (what, maybe church, we speak Batak Toba language there.)

This data is contradicted to two parents as display by data 4, Parents do not bring their children to ethnic church fellowship.

Data 4
Interviewer: Apakah Bapak dan ibu beribadah di gereja suku? (Do you join ethnic church fellowship?)
Parents: Ga (No)

Bringing children to ethnic church forces children to be familiar to Batak Toba language. Parents who bring their children to ethnic church Force their children to be at Batak Toba Language environment.

It concludes that from four families, there are two families influenced by religion factor to maintain Batak Toba language.
Figure 1 represents Religion factors contributed less than others subjects in language maintenance. Surprisingly, attitude and parents’ role are similar in percentage. It means that attitude and parents’ role have a big contribution in order to maintain the vernacular language at home domain. There are 4 couples in this study, All of them have attitude to their vernacular languages. Even though, Batak Toba people have a positive attitude to their vernacular language, and it motivates others people to speak their vernacular language. As the impact of positive attitude, All Parents play their role at home. They are not only as parents, but also as teacher. They teach their vernacular language at home. Two Parents from 4 families bring their children continually to ethnic church to do their fellowship.

3.2 The Ways in Maintaining Vernacular Language

There are three ways in maintaining vernacular language: language choice at home, bringing children to ethnic church and hearing traditional songs. Language choice at home is parents’ authority. Parents have power to choose language to be used at home domain. They also have authority to bring their children to ethnic church fellowship to make them familiar to their vernacular language. Hearing Traditional Batak Toba songs makes children familiar to vernacular language. Hearing Batak Toba songs also forces and motivates them to know and understand their vernacular language.

3.2.1 Language Choice at Home

Language choice at home influences children’s language. Children learn to speak and read in Batak Toba language at least at family domain. All parents speak Batak Toba language to their children at home by applying code-mixing between Indonesian and Batak Toba language. It makes children adopt Batak Toba language and they are able to speak Batak Toba language fluently.

Data 1
Interviewer: Biasanya pakai bahasa apa di rumah? (What kind of language do you speak at home?)
Parent: Bahasa Batak sama bahasa Indonesia (Batak language and Indonesian)

From the data above, it can be seen that parents choose Batak language and Indonesian as “Bahasa Batak sama bahasa Indonesia (Batak language and Indonesian)”.
3.2.2 Bringing Children to Ethnic Church

Learning a language is done by parents through religion; joining ethnic church, reading holy bible in Batak Toba language, and singing songs in Batak Toba language. It is done by two families.

Data 2

Interviewer: selain itu ada hal lain? (is there any factor?)
Parent: apa ya, gereja kali ya, kan di sana pakai bahasa batak. (what, maybe church, we speak Batak Toba language there).

Parents bring their children to ethnic church fellowship to introduce Batak Toba language as “apa ya, gereja kali ya, kan di sana pakai bahasa batak. (what, maybe church, we speak Batak Toba language there).”

3.2.3 Hearing Traditional Songs

Parents play Batak Toba songs at home and bring their children to Café or restaurant playing Batak Toba Songs. By hearing Batak’s songs, children motivate to understand and know Batak Toba language.

Figure 2: The ways in maintaining vernacular language in inter-ethnic families.

Figure 2 represents language choice at home gave a big contribution in maintaining vernacular language than bringing children to ethnic church and hearing traditional songs. All parents have their own authorities to choose their language to be used at home domain. Language choice at home is done by all parents. Bringing children to ethnic church service is done by two families. Parents bring them to ethnic church fellowship to introduce and motivate them to know and understand vernacular language. It is also done by hearing traditional songs. All of them are dominated by Batak Toba.

4 Discussion

Inter-ethnic families maintain at least one vernacular language. Language is maintained if the generation of the speakers are able to speak their language. In this study, families maintain Batak Toba language in Medan. Medan is dominated by Malay tribe. In fact, Batak language
dominates in Medan. It means the future generations from Javanese and Batak Toba families are able to speak Batak Toba language and it is supported by people in their region.

In this study, there are three factors influencing vernacular language maintenance in inter-ethnic families: Attitude, Parents’ role at home and religion. The dominant factors are parent’s role at home and Attitude. Preserving heritage language is important in this globalization era. It will keep the heritage language alive and save the ethnic’s identity [1]. In inter-ethnic families; at least 2 languages at home, preserving is necessary. Practicing native language is embedded with family communication. Parents’ positive attitude motivates their children to speak vernacular language [7]. Attitude motivates not only speakers to speak Batak Toba language to their children but also Children to others people. Parents as the leader in the family have power to choose Batak Toba language to be used at home. While, integrative motivation, view of importance of learning the language, and belief about parental attitudes toward learning the ancestral language influenced vernacular language maintenance in bilingual group and the most dominant factor is integrative motivation. This motivation contributed to others factors [8]. Family’s effort stimulates and provides children to build a balanced bilingualism [9]. Speakers who have highly value to their language maintain their language as a symbol of ethnic identity [1]. Their positive attitudes improve their value to the language to see their vernacular language as the symbol of their ethnic identity.

There are three ways to maintain vernacular language in inter-ethnic families; language choice at home, bringing children to ethnic church, and hearing traditional songs. Language choice at home forces family members to speak the Batak Toba language. Speaking Batak Toba language continually at home domain encourage the speakers to be able to speak Batak Toba language fluently. To support language choice, parents bring their children to ethnic church where the whole services are done in Batak Toba language. Joining ethnic church forces children to be able to speak Batak language [7]. Listening to Batak Toba’s stimulates speakers’ motivations to know, understand and speak Batak Toba language. Language maintenance can be done through promotion, encouraging speakers’ awareness and establishing speakers’ belief [10].

It is seen that inter-ethnic families; Javanese- Batak Toba are dominated by Batak Toba language. it is caused by Batak Toba culture. A man who gets married to Batak Toba woman is given one of Batak Toba surnames, automatically he becomes part of Batak Toba. This surname forces him to understand Batak Toba culture and be able to speak Batak Toba language. Father’s positive attitude maintains his wife’s language [7]. Batak people are “Raja (King)” without knowing their economic and social status. As a king, Batak people colonized others by using language and culture. In Batak culture, Men who get married to Batak women, will be given surname as a symbol of their identity as a prove of their prestige to Batak Toba. People who cannot speak Batak Toba are called by Batak Dalle (Batak people who stray). It is a must for Batak Toba people to be able to speak Batak Toba language.

5 Conclusions

The conclusions are 1) attitude and parents’ role at home are the dominant factor in language maintenance and they are followed by religion. Attitude and parents’ role at home force children to acquire and speak Batak Toba language automatically and continually. While Religion factor does not force children to speak Batak Toba continually. 2) Language choice at home, bringing children to ethnic church and hearing traditional songs are the ways
to maintain Batak Toba language. Choosing Batak Toba language at home keeps the language alive by speaking Batak Toba language in communication with family members. Then, bringing children to ethnic church introduces Batak Toba language to children. The last but not least, hearing traditional songs especially Batak Toba songs to children improve children’s interest in Batak Toba language. This study suggests that vernacular language can be planned to be an extra subject in its region, to support local television used vernacular language and to promote and to preserve traditional culture from every tribe.

Acknowledgements

First and foremost, praises and thanks to Jesus Christ for His blessing throughout in completing this manuscript. We would like to show our gratitude to the WMA Medan for comments that greatly improved this manuscript although any errors are our own.

References

Development of Web-Based Learning Media in The Research Methodology Course in The Department of Electrical Engineering Medan State University

Abdul Muin Sibuea1, Mohammad Amin2, and Joni Syafirin Rambey3

Fakultas Teknik, Universitas Negeri Medan1,2,3

Abstract. This research aims to determine the development of web-based media in the Research Methodology course in the Department of Electrical Engineering Education, Faculty of Engineering, Medan State University. The type of research was research and development (R&D) refers to Borg and Gall, and combines with learning development model of Dick and Carey. The subjects in this study were 47 students of the Department of Electrical Engineering Education class of 2017. The instrument used was in the form of a questionnaire and consisted of 4 instruments, namely validation instruments for media experts, validation instruments for design experts, validation instruments for material experts, and product trial instruments for students. The validation instrument for media experts contains 27 indicators that are classified into 5 aspects of assessment namely Guidelines and Information, Web Operations, Media Systematics, Media Aesthetics, and Principles of Web Form Variety. The validation instrument for design experts contains 18 indicators that are classified into 5 aspects of assessment, namely Appropriateness of Design, Attractiveness of Physical Appearance, Format Suitability, Presentation with Target Characteristics, and Clarity of Material Exposure. The validation instrument for material experts contains 20 indicators that are classified into 2 aspects namely Content Feasibility and Presentation Feasibility. The product trial instrument for students contains 33 indicators that are classified into 5 aspects, namely Guidelines and Information, Media Materials, Evaluations, Design and Facilities of Media and Pedagogical Effects. Research data obtained from questionnaires that have been filled out by media experts, design experts, material experts and students are formulated into scores, which are then interpreted into assessment criteria consisting of Bad, Poor, Doubtful, Good, and Very Good.

Keywords: Media Learning, Web Learning, Web-Based

1. Introduction

The impact of advances in information and communication technology has now changed the way people look and act in spending time working and overcoming their problems. The forms of developments and changes in information technology basically change people's activities in the real world into cyberspace activities. Many other forms of change occur in the joints of people's lives brought about by the development and advancement of technology and information (IT), not least in the world of education. The impact of advances in information and communication
technology (ICT) in the world of education is extraordinary. Various learning models using computers such as: e-learning (electronic learning), Computer Assisted Instruction (CAI), Computer Based Instruction (CBI), and e-teaching (electronic teaching) are very possible to facilitate the development of the world of education. This learning model allows educators and students to find their learning materials directly from sites on the internet through computers as learning tools.

The world of education is among those who have benefited greatly from the progress of ICT because it has gained tremendous benefits both in terms of learning models and the use of learning media. The use of computer-based learning media is considered to be more optimal to be used in supporting education today because with learning media students can learn and analyze teaching materials themselves whenever and wherever they are without having to wait for the presence of educators to explain these teaching materials.

Academic is often directed as the completeness in the completion of a study program at a tertiary institution, so the initial motivation is more to the practical needs of study programs at tertiary institutions than the needs of students in developing or discovering something new. The results are certainly very little that can be used as a contribution to the development of science. However, it cannot be denied that academic research has given students the basics of experience in the direction of developing research capabilities.

According to Sugiyono [1] through research, students can use the results to understand, solve and anticipate problems. Understanding means clarifying an unknown problem or information and then knowing, solving means minimizing or eliminating the problem, and anticipating means trying to prevent the problem from happening.

To provide students with an adequate understanding of the importance of research work, one of the courses they undertake at the Faculty of Engineering, Medan State University is Research Methodology. Besides because academic research (thesis) is one of the obligations of students in completing their studies in tertiary institutions, it is also hoped that it can be used as a basis for research experience.

Research Methodology courses provide a large provision for students to be able to think and move carefully, precisely, correctly, using a common and clear systematics. In addition, the content presented from research cannot be subjective, emotional, revealing conjecture, prejudice and without facts. According to previous research conducted by the scientific method is based on scientific features that are rational, empirical and systematic. Some problems that arise in the Research Methodology course are the lack of interest and attention of students in the course, so we need a method or a creative media that is expected to increase student interest and motivation to study in the research methodology course. In fact, learning of Research Methodology courses conducted by lecturers is still in the form of conventional learning. As a result, students’ learning outcomes are not in line with expectations. This is evidenced by the data obtained from the students’ even semester grades for the academic year 2017/2018, the average final grade for the Research Methodology course is still quite sufficient and has not shown a good category (Archive of the final semester scores for the academic year 2017/2018, Department of PTE, UNIMED).

The main problem in learning Research Methodology is the use of learning methods or models in conveying subject matter appropriately, which fulfills the contents of the order of values, so that it can be internalized within students and implements the nature of value education in daily life that does not meet expectations as desired. This relates to the community's criticism of the
Research Methodology learning material that is not loaded with practical values but is merely theoretical or rote for the sake of obtaining high grades or GPA. Learning methods in teaching and learning (PBM) seem very rigid, less flexible, less democratic, and lecturers tend to be more dominant in one-way method.

To deal with community criticism above, there is an effective and efficient learning media as an alternative, namely by using the web as a learning medium. It cannot be denied that the existence of computer-based learning media has become an important part in the world of education today. Computer-based media in the development of instructional media is often referred to as learning multimedia because the ability of computer media to convey messages through visual media, audio media, text in the form of recording or broadcast media. This technology is expected to be able to help the education process in general and specifically so that what you want to achieve through the education process can be obtained properly.

This discussion emphasizes the validation of instruments used in collecting data, namely expert validation including validation of material experts, media experts, and design experts as well as product trials to students.

2. Methods

The research method used in this research is research and development or research and development (R&D). According to Borg and Gall [2] research development is a research method used to develop or validate products used in education and learning. Development research aims to create a product to be used in the learning process. The product produced in this research is in the form of website-based e-learning learning media. The research and development model used in this study refers to the research model developed by Borg & Gall [2] by carrying out the research and development steps as in Figure 1.

![Figure 1. Development Research Step](image_url)
Systematic research in developing web-based learning media in Research Methodology courses is shown in Figure 2.

3. Results and Discussion

This study uses a research and development approach (Research and Development) using three
stages, namely (1) a preliminary study, (2) planning and preparation of web-based learning media and (3) field testing of instructional media developed. Following are the results obtained from each of the stages.

1. Description of Preliminary Study Results

The process of implementing web-based learning media development is carried out in stages. In the initial stages of research and development is to determine the courses to be developed. The next step is to conduct preliminary research in accordance with the syllabus. This study aims to obtain the data needs needed by lecturers and students in the lecture process.

The preliminary study aims to determine the need for developing web-based learning media in the Research Methodology course. The activity carried out at this stage was to collect data about the learning process that had been carried out by observation to the university where the research was conducted.

2. Description of Test Result Data

The trial was carried out in 4 stages, namely: (1) evaluation of material experts, media experts, and design experts, (2) individual trials, (3) small group trials, and (4) field trials.

a. Expert Validation Results

Product validation aims to find out the opinions of experts namely material experts, media experts, and learning design experts about the accuracy of the design, aspects of learning and the truth of the contents as well as the learning design.

i) Material Expert Validation Results

Material expert validation on the development of web-based learning media was conducted by two material expert lecturers namely: (1) Dr. Arif Rahman, M.Pd and (2) Drs. Dadang Mulyana, M.Pd. The assessment is carried out to obtain information that is used to improve the quality of web-based learning media in the Research Methodology course. The results of validation in the form of an assessment score of the learning media components of this research methodology on the quality of learning material can be seen in Table 1.

<table>
<thead>
<tr>
<th>No</th>
<th>Aspect</th>
<th>Reviewer 1</th>
<th>Reviewer 2</th>
<th>Average</th>
<th>Percentage (%)</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Content Feasibility</td>
<td>51</td>
<td>48</td>
<td>99</td>
<td>8,9</td>
<td>99</td>
</tr>
<tr>
<td></td>
<td>Presentation Feasibility</td>
<td>45</td>
<td>44</td>
<td>89</td>
<td>9,8</td>
<td>89</td>
</tr>
<tr>
<td></td>
<td>Average Total Score</td>
<td></td>
<td></td>
<td>9,4</td>
<td>94</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

Based on expert assessment of web-based learning media material on Research Methodology courses worth 9,4 that fits the criteria very well (94%) that means "fit for use". From the results of the material expert validation above we can see the quality of the contents and the quality of the presentation in this criterion is very good.
Media Expert Validation Results

The validation of learning media experts was carried out by two instructors of instructional media experts namely: (1) Dr. Agus Junaidi, ST., MT. and (2) Uli Basa Sidabutar, S.Kom., M.Pd. Learning media experts validate the product aspects of instructional media including on the start page, media layout, use of letters, typography of letters, and picture illustrations. Validation results in the form of scores on the assessment of web-based learning media components in the Research Methodology course on the quality of instructional media can be seen in Table 2.

Table 2. Media Expert Ratings

<table>
<thead>
<tr>
<th>No</th>
<th>Aspect</th>
<th>Reviewer 1</th>
<th>Reviewer 2</th>
<th>Total Score</th>
<th>Average</th>
<th>Percentage (%)</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Information Guide</td>
<td>13</td>
<td>14</td>
<td>27</td>
<td>9,0</td>
<td>89,9</td>
<td>Very Good</td>
</tr>
<tr>
<td>2</td>
<td>Web Operational</td>
<td>49</td>
<td>40</td>
<td>84</td>
<td>8,9</td>
<td>89,0</td>
<td>Very Good</td>
</tr>
<tr>
<td>3</td>
<td>Systematics of Media</td>
<td>14</td>
<td>13</td>
<td>27</td>
<td>9,0</td>
<td>89,9</td>
<td>Very Good</td>
</tr>
<tr>
<td>4</td>
<td>Media Aesthetics</td>
<td>20</td>
<td>15</td>
<td>35</td>
<td>8,8</td>
<td>87,5</td>
<td>Very Good</td>
</tr>
<tr>
<td>5</td>
<td>Principles of Web Design Conformity</td>
<td>34</td>
<td>28</td>
<td>62</td>
<td>8,8</td>
<td>88,5</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

Average Total Score 8,9 88,96 Sangat Baik

According to learning media experts, the quality of web-based learning media from aspects of information guidance, web operations, media systematics, media aesthetics, and web design principles is 8.9 within the range of the "feasible testing" criteria. The percentage of total scores from learning media experts was 88.96% that was included in the "very good" category.
1) Design Expert Validation Results

The validation of learning design experts was carried out by two instructors of learning design experts. Learning design experts validate the product aspects of learning design including aspects of the attractiveness of physical appearance consisting of the attractiveness of colors on the media, proportional (layout of text and images), aspects of the accuracy of the use of design consisting of the accuracy of topic selection, compatibility of material with indicators, aspects format suitability, aspects of the presentation with target characteristics consisting of clarity of material description in the media, clarity of the examples given in the learning media, use of new information, aspects of clarity of media instructions consisting of the use of instructions on instructional media, explanation of the terms in the media, use of texts, the ease of learning media, the clarity of the material exposure aspect consisting of the material presented, the relevant material, and the suitability aspect of the evaluation with the material consisting of the material presented, the relevant material, and the evaluation aspect of the suitability of the material consisting of exercises and questions. The results of the validation take the form of a score assessment of web-based learning media components in the Research Methodology course. According to the instructional design expert the quality of the developed learning media is good and worth testing, the assessment score can be seen in Table 3.

<table>
<thead>
<tr>
<th>No</th>
<th>Aspect</th>
<th>Reviewer</th>
<th>Total Score</th>
<th>Average</th>
<th>Percentage (%)</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Appropriate Usage of Design</td>
<td>30</td>
<td>24</td>
<td>54</td>
<td>9</td>
<td>90</td>
</tr>
<tr>
<td>2</td>
<td>Physical Appearance</td>
<td>25</td>
<td>20</td>
<td>45</td>
<td>9</td>
<td>90</td>
</tr>
<tr>
<td>3</td>
<td>Format suitability</td>
<td>5</td>
<td>4</td>
<td>9</td>
<td>9</td>
<td>90</td>
</tr>
<tr>
<td>4</td>
<td>Dishes with Target Characteristics</td>
<td>15</td>
<td>12</td>
<td>27</td>
<td>9</td>
<td>90</td>
</tr>
<tr>
<td>5</td>
<td>Clarity of Material Exposure</td>
<td>15</td>
<td>12</td>
<td>27</td>
<td>9</td>
<td>90</td>
</tr>
</tbody>
</table>

Average Total Score 9 90  Very Good
According to learning design experts that the quality of web-based learning media in the Research Methodology course is worth 9 which is within the range of very good criteria. The percentage of total scores from learning design experts is 90% that is included in the "very good" category. The result of the validation of the learning design expert is feasible to use without any revisions.

![Validation of Design Experts](image)

**Figure 5. Diagram of Average Score Results**

### a. Phase I Trial Results (Individual Trial)

Individual trials were conducted at the Department of Electrical Engineering Education, Faculty of Engineering, Medan State University with 3 students consisting of 1 student having high achievement, 1 student having moderate achievement, and 1 student having low achievement. The purpose of this individual trial is carried out to identify deficiencies in learning products after being reviewed by experts. This trial evaluation and input is about guidance and information, media material, evaluation, design and media facilities and pedagogical effects. The results of individual phase I trials can be seen in Table 4.

<table>
<thead>
<tr>
<th>No</th>
<th>Aspect</th>
<th>Student</th>
<th>Total Score</th>
<th>Average</th>
<th>Percentage (%)</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Information Guide</td>
<td>T: 20</td>
<td>S: 17</td>
<td>R: 15</td>
<td>52</td>
<td>4.3</td>
</tr>
<tr>
<td>2</td>
<td>Media Material</td>
<td>T: 60</td>
<td>S: 57</td>
<td>R: 51</td>
<td>168</td>
<td>4.7</td>
</tr>
<tr>
<td>3</td>
<td>Evaluation</td>
<td>T: 25</td>
<td>S: 24</td>
<td>R: 20</td>
<td>69</td>
<td>4.6</td>
</tr>
<tr>
<td>4</td>
<td>Design Dan Facility</td>
<td>T: 35</td>
<td>S: 33</td>
<td>R: 27</td>
<td>95</td>
<td>4.5</td>
</tr>
<tr>
<td>5</td>
<td>Pedagogical Effect</td>
<td>T: 25</td>
<td>S: 24</td>
<td>R: 22</td>
<td>71</td>
<td>4.7</td>
</tr>
</tbody>
</table>

**Average Total Score**

5  

91  

Very Good

Table 4. Results of the Phase I Individual Trial Questionnaire
Student responses to individual trials at the Department of Electrical Engineering Education, Medan State University are shown in table 5.4 explained that the learning of web-based learning media from the aspects of information guidance, media material, evaluation, design and facilities and pedagogical effects were assessed overall, each including the criteria of "Very Good" ie with an average score of 91%.

b. Phase II Trial Results (Small Group Trials)

A small group trial where web-based learning media was implemented to 9 students in the Department of Electrical Engineering Education, Medan State University, namely 3 high-achieving students, 3 moderate-achieving students, and 3 low-achieving students. This small group trial data is used as initial experience before the product is tested on a large field. Data on the results of small group trials can be seen in the following Table 5.

Table 5. Small Group Trial Results Questionnaire Data

<table>
<thead>
<tr>
<th>No</th>
<th>Aspect</th>
<th>T</th>
<th>S</th>
<th>R</th>
<th>Total Score</th>
<th>Average (%)</th>
<th>Percentage Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Information Guide</td>
<td>57</td>
<td>52</td>
<td>51</td>
<td>160</td>
<td>4.5</td>
<td>80</td>
</tr>
<tr>
<td>2</td>
<td>Media Material</td>
<td>171</td>
<td>168</td>
<td>155</td>
<td>494</td>
<td>4.6</td>
<td>80</td>
</tr>
<tr>
<td>3</td>
<td>Evaluation</td>
<td>71</td>
<td>73</td>
<td>64</td>
<td>208</td>
<td>4.6</td>
<td>80</td>
</tr>
<tr>
<td>4</td>
<td>Design dan Facility</td>
<td>102</td>
<td>101</td>
<td>90</td>
<td>293</td>
<td>4.7</td>
<td>80</td>
</tr>
<tr>
<td>5</td>
<td>Pedagogical Effect</td>
<td>70</td>
<td>70</td>
<td>67</td>
<td>207</td>
<td>4.6</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Average Total Score</td>
<td></td>
<td></td>
<td></td>
<td>4.6</td>
<td>80</td>
<td></td>
</tr>
</tbody>
</table>
In table 5.5 above can be seen trials conducted in the Department of Electrical Engineering Education, UNIMED conducted by 9 students visible from the percentage total score percentage is "80%" so that it can be said web-based learning media from the aspects of information guidance, media material, evaluation, design and facilities, and pedagogical effects are included in the "very good" criteria.

c. Phase III Trial Results (Field Trials)

Field trials are carried out after the implementation of individual trials and small group trials. The field trial was conducted at the Department of Electrical Engineering Education, Medan State University in the 2017 class of 47 students. Field trials produce data that will later measure the feasibility of the product being developed, and to find out the benefits of the product for its use. Field trial evaluation results can be seen in table 4.6.

<table>
<thead>
<tr>
<th>No</th>
<th>Aspect</th>
<th>Total Score</th>
<th>Average</th>
<th>Percentage (%)</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Information Guide</td>
<td>846</td>
<td>4.5</td>
<td>90</td>
<td>Very Good</td>
</tr>
<tr>
<td>2</td>
<td>Media Material</td>
<td>2585</td>
<td>4.6</td>
<td>92</td>
<td>Very Good</td>
</tr>
<tr>
<td>3</td>
<td>Evaluation</td>
<td>940</td>
<td>4.0</td>
<td>80</td>
<td>Very Good</td>
</tr>
<tr>
<td>4</td>
<td>Design dan Facility</td>
<td>1410</td>
<td>4.3</td>
<td>85</td>
<td>Very Good</td>
</tr>
<tr>
<td>5</td>
<td>Pedagogical Effect</td>
<td>1081</td>
<td>4.6</td>
<td>92</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

Average Total Score 4.4 88 Very Good
Student learning outcomes in field trials in the Department of Electrical Engineering Education, Medan State University class of 2017 explained that web-based learning media from aspects of information guidance, media material, evaluation, design and facilities, and pedagogical effects were assessed as a whole each included in the "Very Good" category. Table 4.6 it can be seen that the total score percentage of all aspects is 88% so if it is included in the percentage category according to Sugiyono [1] then the validation of web-based learning media is categorized as "Very Good".

In the field trials conducted on 47 students in the Department of Electrical Engineering Education UNIMED in general students stated that web-based learning media was very amenable to use and there were no problems that had to be fixed, thus no revisions were made to the field trials. The results of an assessment of web-based learning media in the field trial of 47 students of the Department of Electrical Engineering Education, Medan State University in 2017 showed that the products developed were very good and suitable for use.

4. Conclusion

Based on the results and discussion of research and development of web-based learning media conducted, it can be concluded as follows: Web-based learning media for courses Research Methodology is feasible to use for the percentage of material expert validation 94% falls into the excellent category, media expert validation is 88.96 % is in the very good category, and design expert validation is 90% in the very good category. For the first phase trial resulted in a percentage of 91% included in the excellent category, for the second phase trial resulted in a percentage of 80% included in the excellent category and for field trials to all students the percentage of 88% included in the excellent category.
Suggestion

Based on the results of research and development of web-based learning media conducted, the following suggestions can be given:

1. It is recommended for lecturers to use web-based learning media to improve students’ learning outcomes in the Research Methodology course.
2. Web-based learning media can be used as an example for lecturers in developing learning media.

5. References

Abstract. The form of learning strategies that are considered appropriate is creative-productive (CP). This learning strategy challenges students to produce creative product that comes from their understanding of the concepts being studied. Learning steps include: orientation, exploration, interpretation, and re-creation. In connection with this reality, the researchers felt the need to conduct research and development that focused on efforts to obtain alternative structured patterns by developing digital learning media for "entrepreneurship" subject using CP learning strategies in determining business opportunities in the field of mechanical engineering. The development of digital learning materials uses a research and development (R&D) approach, a process used to develop and validate products. Data collection techniques in validating learning material products are carried out by distributing questionnaires. This study was designed in three stages: (1) Research in the form of planning and formulation of learning objectives, (2) Development in the form of making entrepreneurial learning materials using CP learning strategies, (3) Formative evaluation and revision by material experts, media experts and instructional design experts and evaluators one to one, small group, field trial. With these three stages of research and development, it is expected that the teaching material produced is feasible to be implemented and can improve student competence in determining business opportunities.

Keywords: Learning Strategies, Digital Media, Learning, Creative Productive Learning

1. Introduction

Higher education should emphasize increasing the competence and creativity of graduates with the hope that after graduating students can meet the needs of the workforce or become an entrepreneur. This is in line with the opinion of Sallis who revealed that the quality standards of tertiary graduates were measured by criteria in accordance with the needs of the workforce, customer or user satisfaction [1]. Joyce and Weil revealed that learning development is a plan or pattern that can be used for the curriculum (long learning material), designing learning materials, and for delivering learning inside and outside the classroom [2]. Miarso states the development of learning
materials in the area of educational technology requires a systematic and systemic approach, which is carried out coherently and comprehensively or comprehensively [3]. Along with the development of information and communication technology, today's technological devices have spread widely regardless of economic, social, educational, and so on. In line with the study of learning technology, the penetration of the use of technology media to support learning activities is increasingly open. Good learning can be supported by conducive learning’s atmosphere and communication relationships between lecturers and students can run well. The learning process will be effective when utilizing the various facilities and infrastructure available including utilizing digital learning media.

The development of digital learning media in this research is a systematic way of identifying, developing, and evaluating a set of materials and strategies aimed at achieving certain learning goals. At first the creative-productive (CP) learning strategy was called the strata strategy, then with various modifications and development of this strategy it was called the CP learning strategies. The CP learning strategy is a strategy developed by referring to various learning approaches that are assumed to be able to improve the quality of teaching and learning process both in primary and secondary education, as well as in higher education. These approaches include creative active learning (CBSA), also known as inquiry strategies, constructive learning strategies, and collaborative and cooperative learning strategies. This learning strategy is expected to be able to challenge students to produce something creative as a re-creation or reflection of their understanding of the intended problem / topic [4].

The CP learning strategy is expected to be able to develop the quality of learning especially at the tertiary level of education, further stated that this learning strategy challenges students to produce something creative that stems from their understanding of the concepts being studied. The characteristic of creative-productive learning is to actively involve students both intellectually and emotionally through. Learning steps include: orientation, exploration, interpretation, and recreation. "Entrepreneurship" learning activities can be developed using CP learning strategies.

General competencies possessed after studying the digital learning materials of entrepreneurship subject that will be developed are: students are expected to have broad insights, deep appreciation and skills in analyzing values and processes in developing an entrepreneurial spirit in the business world and determining the best choice to be developed as an opportunity business in mechanical engineering.

Well-designed learning that takes into account conditions and selects appropriate learning strategies will improve the quality of learning and naturally will improve students’ learning outcomes. This means that improvements in learning outcomes must start from improving the quality of learning designs. Learning strategies by promoting creativity and productivity are expected to help improve student learning outcomes and skills that take "entrepreneurship" subject. In connection with this fact, the researchers felt the need to conduct research and development of digital media learning "entrepreneurship" using CP learning strategies.

Based on the description above, the research problem formulation is as follows: (1) how is the development of digital learning media on entrepreneurship subject using CP learning strategies? (2) How is the feasibility of digital learning media on entrepreneurship subject using CP learning strategies? (3) How is the effectiveness of digital learning media on entrepreneurship subject using CP learning strategies?
Based on the problems that have been raised, the purpose of this research and development is to: (1) Develop digital learning media on entrepreneurship subject using CP learning strategies; (2) Knowing the feasibility of digital learning media on entrepreneurship subject using CP learning strategies; and (3) Knowing the effectiveness of digital learning media on entrepreneurship subject using CP learning strategies.

In general, this research and development is expected to produce digital learning media that can improve student competency and creativity in entrepreneurship subject, especially in determining business opportunities in the field of mechanical engineering, so as to increase student interest in becoming entrepreneurs. Specifically the results of this research and development can provide benefits: (1) As a reference to optimize the learning process of entrepreneurship subject, especially in determining business opportunities in the field of mechanical engineering; (2) Adding knowledge in the field of entrepreneurship, especially in determining business opportunities in the field of mechanical engineering; and (3) As a reference for the development of learning materials in other subjects with different learning models and strategies.

**Development of Digital Learning Media**

The development of instructional media in this study is guided by the development of learning models. According to Gustafson (2013: 18) there are several learning development models that can be used in developing learning models: (a) Classroom-Oriented Models, Classroom-Oriented Models are models related to the learning process that takes place in the classroom both educators and students. This is closely related to teaching materials, planning learning strategies, choosing learning media, delivery and evaluation systems; (b) Product-Oriented Models, Characteristics of Product-Oriented Models have four assumptions, namely: (1) learning products needed (2) necessary and important development of existing products (3) emphasis on testing and revision (4) products must be used; (c) System-Oriented Models, These System-Oriented Models can be characterized by their characteristics, namely: (1) it is carried out by a large number of teams and their expertise, (2) is developed linearly with step accuracy and (3) is oriented towards problem solving.

Development of learning materials must be carried out in stages and thoroughly with the aim of increasing student competency or learning outcomes. Sugiono states, it is necessary to do a research in the form of a needs analysis so that the product can be useful for the user community [5].

Basically, digital learning media is an electronic version of text that can be read on a desktop or laptop screen, PDA or other portable device. Digital learning media can use a variety of file formats and can combine other features, such as annotations, audio and video, and hyperlinks. In addition, digital learning media can also include comments and communication tools (chat) that allow interaction between readers, and allow readers to add links to outside sources. Some digital learning media products are tied to software to read them, and some are providing digital media in formats, such as HTML.

Furthermore, the understanding of digital books according to Jones and Brown explains that: "digital books can be as simple as a scanned version of a printed publication, inherent in digital books is the ability to make available a number of features to the reader which includes multimedia, hyperlinks and other interactive components, search features, and customizability to change text size or convert text to audio so as to meet the special needs of readers." Books digital offers several benefits for readers, among others by utilizing the features of audio, video, and simulations that
facilitate understanding of material subjects were more inside. In addition, it provides an opportunity for students to improve understanding of subject matter instead of just reading the text.

Students in tertiary institutions are adults, so they are considered to have the awareness in developing their potential to become intellectuals, scientists, practitioners, and / or professionals. Accordingly, changes in the learning process become important and will create an academic climate that will improve student competencies both hard skills and soft skills. This is in accordance with the aim of Higher Education in Law No. 12 of 2012 that is to become a man of faith and piety to God Almighty and to have noble, healthy, knowledgeable, capable, creative, independent, skilled, competent, and cultured for the interests of the nation. To realize this goal, all students must attend general basic learning subject known as MKDU. In order to improve learning outcomes, the MKDU is added with English, Entrepreneurship, and subject that encourage the development of other characters, both integrated and individual.

Entrepreneurship subject are lessons that shape the character of entrepreneurship or at least students can increase knowledge about the ins and outs of business both in terms of soft skills and hard skills so that students are able to take advantage of opportunities around them in creating their own businesses after graduation or while still in college. Entrepreneurial learning material used as a reference in the Department of Mechanical Engineering, State University of Medan (Unimed) so far is still entrepreneurial in general. The description and case studies still refer to businesses outside the field of mechanical engineering. Learning materials to be developed are oriented towards developing business in the field of mechanical engineering, for example, in the field of welding production, metal plating, automotive modification and other mechanical engineering businesses. The learning objectives to be achieved are that students will be able to understand, apply, and make entrepreneurial lifestyles with the ability to communicate, lead, and apply business management in managing their business properly, especially in the field of mechanical engineering.

Creative productive Learning (CP)

Learning strategy is a plan or a pattern that is used as a guide in planning learning in class or learning in tutorials and to determine learning tools including books, films, computers, curriculum and others. Joyce in [6] also states that each learning strategy directs us into designing learning to help students in such a way that learning objectives are achieved.

1. Understanding of Creative-Productive Learning Strategies.

Made Wena states that the approaches referenced in the creative-productive learning strategy include; active and creative learning (Active Student Learning Methods) which is also known as inquiry strategy, constructivism learning strategy, and collaborative and cooperative learning strategies [4]. With these approaches the creative-productive learning strategy is expected to challenge students to construct their own concepts or materials and produce something creative as a re-creation or reflection of students' understanding of the problem / topic being studied.
Characteristics of Creative-Productive Learning Strategies.

Creative productive learning has several characteristics that distinguish it from other learning models [4]. Characteristics of creative-productive learning strategies include the following: (a) Intellectual and emotional student involvement in learning, (b) Students are encouraged to discover / construct their own concepts that are being studied through interpretation conducted in various ways such as observation, discussion or experiment, (c) Give students the opportunity to take responsibility for completing joint assignments, and (d) To be creative, one must work hard, be highly dedicated, enthusiastic and confident.

The creative productive learning strategy is assumed to be able to motivate students in carrying out various activities so that they feel challenged to complete their tasks creatively. Made Wena [4] describes the stages as follows: (a) Orientation, learning activities begin with an orientation to communicate and agree on the tasks and steps of learning; (b) Exploration, can be done in various ways, such as reading, observation, interview, watch a show, do experiments, browsing through the internet, and so on; (c) Interpretation, the results of exploration are interpreted through analysis, discussion, question and answer, or even in the form of a retry, if that is indeed necessary. Interpretation should be carried out during face-to-face hours, preparations have been made by students outside of face-to-face hours; (d) Re-creation, students are assigned to produce something that reflects the results of their interpretation of the concepts / topics / problems that are studied according to their respective creations; (e) Evaluation and evaluation are carried out during the learning process and at the end of the learning process.

2. Research Methods

This research was conducted at the Department of Mechanical Engineering at the Faculty of Engineering, State University of Medan. The study was conducted for 1 (one) semester. The development of learning material that is used as the basis for this research and development is the development model of Dick and Carey, considering the steps of developing the Dick and Carey model are more complete and specific.

This research uses a research and development (R & D) approach. That is a process used to develop and validate educational products, such as textbooks, learning films, and others. Educational research and development includes several stages in which a product is developed, tested, and revised according to the results of field tests.

The data in this study were analyzed qualitatively, and the data collection instruments developed in this study were related to data collection techniques carried out at each stage of the study, namely: (a) questionnaire in the form of a questionnaire, used to ask questions and observations in stages expert development and validation, as well as learning outcomes tests in the form of objective tests and action tests used to measure student competency improvement.
3. Results and Outcomes Achieved

3.1. Results
This research was started from the data collection conducted at the lecturers of entrepreneurship subject and fifth semester students of Mechanical Engineering Study Program, Faculty of Engineering, State University of Medan.

Preliminary Research Results
To find out the learning process of entrepreneurship subject in the FT.Unimed mechanical engineering study program, data collection was carried out in preliminary research, there were seven indicators proposed, the same indicators were applied to the questions raised by lecturers and students. Of the 30 students who were the subjects of the study came from 16 Public High Schools (SMU) and 14 from the Vocational High School (SMK).

The results of the preliminary research questionnaire can be described as follows:

a. Indicators Explain Learning Outcomes
This indicator is described in 3 questions and the results can be seen in the following table:

<table>
<thead>
<tr>
<th>No</th>
<th>Question</th>
<th>Yes</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Did the lecturer explain the learning achievements and competencies to</td>
<td>27 people</td>
<td>3 people</td>
</tr>
<tr>
<td></td>
<td>be achieved in learning?</td>
<td>(90%)</td>
<td>(10%)</td>
</tr>
<tr>
<td>2</td>
<td>What are learning outcomes and eye competencies college according to</td>
<td>14 people</td>
<td>16 people</td>
</tr>
<tr>
<td></td>
<td>student needs?</td>
<td>(46,7%)</td>
<td>(53,3%)</td>
</tr>
<tr>
<td>3</td>
<td>Do Entrepreneurship subject need development?</td>
<td>29 people</td>
<td>1 people</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(96,7%)</td>
<td>(3,3%)</td>
</tr>
</tbody>
</table>

b. Indicators Provide Motivation Stimulus and Feedback.
This indicator is described in 5 questions and the results can be seen in the following table:

<table>
<thead>
<tr>
<th>No</th>
<th>Question</th>
<th>Yes</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Does the lecturer provide motivation to students to study hard?</td>
<td>27 people</td>
<td>3 people</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(90%)</td>
<td>(10%)</td>
</tr>
<tr>
<td>2</td>
<td>Is an Entrepreneurship subject interesting and not boring?</td>
<td>10 people</td>
<td>20 people</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(33,3%)</td>
<td>(66,7%)</td>
</tr>
<tr>
<td>3</td>
<td>Do lecturers assess student performance fairly and according to the</td>
<td>25 people</td>
<td>5 people</td>
</tr>
<tr>
<td></td>
<td>competencies achieved by each student?</td>
<td>(83,3%)</td>
<td>(16,7%)</td>
</tr>
<tr>
<td>4</td>
<td>Does the lecturer assign tasks to be done at home individually or in</td>
<td>27 people</td>
<td>3 people</td>
</tr>
<tr>
<td></td>
<td>groups?</td>
<td>(90%)</td>
<td>(10%)</td>
</tr>
<tr>
<td>5</td>
<td>After completing checking student assignments, does the lecturer explain</td>
<td>14 people</td>
<td>16 people</td>
</tr>
<tr>
<td></td>
<td>the correct answer to students?</td>
<td>(46,7%)</td>
<td>(53,3%)</td>
</tr>
</tbody>
</table>

Table 1. Preliminary Research Results Indicators Explain Learning Outcomes

Table 2. Preliminary Research Results Indicators Provide Motivation Stimulus and Feedback.
c. Indicators arrange teaching materials to be provided.

This indicator is described in 4 questions and the results can be seen in the following table:

<table>
<thead>
<tr>
<th>No</th>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Did the Lecturer explain GBPP and SAP Entrepreneurship subject for one semester?</td>
<td>Yes: 26 people, Not: 4 people (86.7%, 13.3%)</td>
</tr>
<tr>
<td>2</td>
<td>Does the lecturer explain the summary of the subject matter of Entrepreneurship subject at each meeting?</td>
<td>Yes: 14 people, Not: 16 people (46.7%, 53.3%)</td>
</tr>
<tr>
<td>3</td>
<td>Do Lecturer conduct tests early the ability of students to establish boundaries early material eye study Entrepreneurship at the beginning of the semester?</td>
<td>Yes: 7 people, Not: 23 people (23.3%, 76.7%)</td>
</tr>
<tr>
<td>4</td>
<td>Is the material resource that is used notified to the students so that students can learn it independently?</td>
<td>Yes: 14 people, Not: 16 people (46.7%, 53.3%)</td>
</tr>
</tbody>
</table>

d. Indicators use various methods and media in the delivery of learning.

This indicator is described in 2 questions and the results can be seen in the following table:

<table>
<thead>
<tr>
<th>No</th>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Do lecturers use varied learning media in Entrepreneurship subject?</td>
<td>Yes: 6 people, Not: 24 people (20%, 80%)</td>
</tr>
<tr>
<td>2</td>
<td>Do lecturers use varied methods in the learning process of Entrepreneurship subject?</td>
<td>Yes: 29 people, Not: 1 people (96.7%, 3.3%)</td>
</tr>
</tbody>
</table>

e. Focus Group Discussion (FGD)

Participants FGD consists of vocational school teachers the fields of entrepreneurship, can be in grab conclusion of discussions results were described as follows: (1) Materials that are relevant to the learning objectives, Entrepreneurship subject material must start from basic knowledge about Entrepreneurship, which is then followed by tips on becoming an entrepreneur, identifying various business opportunities, ending with how to implement business in technical fields that are complemented with examples of the calculation of production costs in engineering business; (2) Presentation methods that are relevant for achieving learning outcomes, It is proposed to use several methods of presenting learning in accordance with the characteristics of students. In order to make learning more interesting and the competencies and learning objectives can be achieved, the learning presentation method is varied, namely: if participatory lectures, interactive question and answer, group discussions and presentations of each group and project final project consultations; (3) Relevant Learning Strategies; For achieve the learning objectives based KKNI needed an innovative learning strategy that is able to engage students actively and critically to produce learning to stimulate students to be more creative capture business opportunities. Creative productive learning strategy is a learning strategy that requires students to be able to produce a final product of learning
to dig as much information as possible from various sources to be discussed and consult later developed products entrepreneurship form of new entrepreneurs. Learning strategies with creative productive approaches are relevant to desired learning outcomes; and (4) Evaluation of learning, FGD participants suggest that evaluations be made in the form of written tests individually or in groups. At the beginning of the learning entrepreneurship be evaluated with the work on the problems of pre-test and end of the study done by working on the evaluation of the post-test. Evaluation is also during the ongoing learning process, with independent assignments done individually, journal review. Review books and case studies that are discussed in groups.

The results of the preliminary study concluded that it is necessary the development of materials learning subject entrepreneurship which emphasizes the opportunities and challenges in accordance with the needs of the students. Next step is the identification and analysis of learning objectives. Identification and analysis of learning objectives will be formulated after considering all forms of data and information as well as suggestions obtained from the needs analysis and FGD in preliminary research.

The results of the analysis of the learning objectives then it can be concluded material from entrepreneurship subject that are expected to increase opportunities and interest in entrepreneurship are as follows: Chapter 1 Introduction, Chapter 2 Entrepreneurship Nature, Chapter 3 Becoming an Entrepreneur, Chapter 4 Business Opportunities, Chapter 5 Opportunities Engineering Business.

Next Stage Plan

Phase subsequent book media instructional print developed into a medium of learning Entrepreneurship shaped digital. After completing the digital learning media product, the next stage of research will be carried out, namely: (a) Material Expert Validation; Material expert assessment consists of 3 (three) aspects, namely the preparation of learning materials, presentation of learning materials and assessment tools. An assessment of the question items is given in the scaling score 1 - 5, and comments / input for improvement / revision. For the aspects of the preparation of teaching materials, visits of learning objectives, student characteristics, student involvement and examples provided are in accordance with the designation. The material has also been compiled from various sources that enrich students' insights; (b) Learning Media Expert Validation; Evaluation of media experts in this case instructional media experts consists of 3 (three) aspects namely setting and lay out, book cover, and visual illustrations. An evaluation of the question / statement items is given in the scaling score 1 - 5, and comments / input for improvement / revision; (c) Validation of Learning Design Expert; Inputs and suggestions from learning design experts are divided into 4 (four) indicators namely learning objectives, learning strategies, material preparation and evaluation tools. An assessment of the question items is given in the scaling score 1 - 5, and comments / input for improvement / revision; (d) One to one evaluation; Evaluation of one to one is done with 3 (three) students in an individual. The three students come from students who have high, medium, and low abilities. Students are asked to read the learning material and discuss it. In this evaluation interviews were conducted. After a one-to-one evaluation of revised learning materials, direct improvements were made to parts that were considered difficult for students to understand, difficult to read, or cause misunderstandings; (e) Small Group Evaluation; Learning materials were re-evaluated to Small Groups consisting of 12 students and did not include three students who were involved in the one to one evaluation; and (f) Field Trial; The Field Trial involved 30 students. Field Trial is most
similar to the state of the real as is done in environments that resemble the environment are real. In this field trial a post-test was conducted to determine the effectiveness of learning materials and creative productive strategies developed. This research and development concludes with the final product reporting and socialization stage among the Unimed Mechanical Engineering Study Program.

4. Conclusion and Suggestions

Based on the formulation of objectives and exposure to the results obtained in research and development of entrepreneurial learning materials, it can be concluded as follows: (1) Preliminary research results show that, entrepreneurship learning needs to be developed, especially in determining opportunities for engineering. This print entrepreneurship learning media is only the first step, digital entrepreneurship learning media will be developed; and (2) Research and development has been carried out 70%.

Based on the conclusions of the research results that have been presented, then in the following description put forward some relevant suggestions, namely: (1) This print and digital entrepreneurship learning media is only the first step, other subject digital learning media will be developed; and (2) The development of this learning media can collaborate with expert teams / development teams so that educators can arouse their motivation by preparing learning resources that have an appeal.

5. References


The Development of Learning Media Based On Visual Using Snake and Ladder Board Games to the Learning Outcomes of Early Age Children in TK Karya Darma Medan

Andrew Ryan Hasudungan Siallagan1, Julaga Situmorang2, Harun Sitompul3
{andrewsiallagan054@gmail.com1}

Postgraduate Programe Universitas Negeri Medan, Indonesia1,
Jurusan Pendidikan Teknik Mesin Universitas Negeri Medan, Indonesia2,
Jurusan Pendidikan Teknik Bangunan Universitas Negeri Medan, Indonesia3

Abstract. This study aims to: produce visual based learning media product that are feasible to use, easily learned by students and can be used for early of childhood. This type of research is developing the Borg and Gall product development model of Dick and Carey’s learning design model. The result of the study showed: (1) the expert test was very good qualification (93,13%), (2) the learning design expert qualifications were very good (93,13%), (3) the test media learning expert qualifications were very good (93,75%), (4) individual qualification trials are very good (95,16%), (5) small group trials of very good qualifications (96,01%), (6) field trials are limited to very good qualifications (96,12%), and is suitable for use in the process of learning early of childhood. The result of hypothesis testing prove that there are significant differences between student learning outcomes learned by using media products with student learning outcomes learned without using media product. This is indicated by the results of data processing obtained by t-count = 4,782 > t table = 1,679, with dk = 9 at the significance level α = 0.05. It was concluded that the group learning outcomes of students who were taught using visual based learning media product using snake and ladder board games were 82,3% higher than the group of students who were taught without learning media product of 80,0.

Keywords: Games Learning, Visual Learning Media, Games Education

1. Introduction

Early childhood brain development is greater at 0 to 8 years in the future and the remaining 20% is determined for the remainder of his life after childhood, and of course the form of stimulation provided must be in an appropriate manner in accordance with the level of early childhood development. Observing the development that occurs in children is a fun activity where at that time the child's development is very fast. These developments include physical, cognitive and social emotional development.

The meaning of play which is a fun activity carried out for the benefit of the activity itself. Playing is an activity that helps children to achieve complete development both physically, mentally and emotionally [1]. In carrying out children's play activities require play equipment.
Based on the results of researchers' interviews with the teacher's board at TK Karya Darma, that, their children's cognitive abilities are still lacking especially in terms of mentioning numbers 1-10, children are still stammering and need help from teachers to mention numbers 1-10. The snakes and ladders game tool already exists but its use is just a toy played by children not to be used as a method in cognitive learning.

Based on the results of researchers' survey in TK Karya Darma, it is known that the problem is that teachers lack a maximum role in developing the cognitive aspects of children through the play process. The learning process is set up with classical learning patterns, where the teacher stands in front of explaining the material and students (students) are asked to sit listening and the learning patterns as above are very monotonous because the interaction only takes place in one direction, namely from teacher to students, less interactive between teachers and students, or between students with other students. Ideally, the teacher in giving lessons should be interspersed with various games. Because learning while playing will be an important vehicle for children to develop all their potential including cognitive aspects.

Based on observations carried out, the researchers will conduct research on the development of an integrated snake ladder media in TK Karya Darma. Researchers chose the snake ladder game media because TK Karya Darma did not use the media, but only used printed books. This game is an interesting medium for students so that they can motivate students to learn. In addition, the snake ladder game media has never been used as a learning medium.

This study aims to develop visual-based ladder snake game media for early childhood that is feasible and effective. This is intended so that students can understand the concept of learning material through the media contained in the snake and ladder game. Snakes and ladders game media will be developed in an integrated manner so that it is attractive to students.

Snakes and ladders game is interactive, educational and entertaining, simple and practical. This makes the snakes and ladders game favored by children, because of its simple and interesting nature. This is expected to arouse children's interest in traditional games and develop interesting and innovative media as play media and as a learning tool.

2. Research Method

The method used in this research is Borg and Gall development research. The subject in this study was the material “Lingkunganku” contained in the RPPM (Weekly Learning Program Plan). The object in this study is TK Karya Darma Medan students who are studying “Lingkunganku” learning material. Data obtained by giving questionnaires and objective tests of learning outcomes. The data obtained were then tested for normality and homogeneity. The hypothesis of this study will be tested using the analysis of the T-test (t-test).

3. Results and Discussion

The data obtained in this study are the results of assessments by material experts, instructional design experts and instructional media experts and early childhood learning outcomes of TK Karya Darma. Based on the results of the assessment of learning material experts assess that visual-based learning media using the snake ladder game in learning “Lingkunganku” developed environment has had feasibility on three aspects of assessment which include aspects of content worthiness with a percentage score of 94.27% and the feasibility
aspect of the presentation of 91.67%. This indicates that the interactive learning media developed can meet the demands of learning needs. The percentage of assessment scores from the two material experts on visual-based learning media using the snakes and ladders game in “Lingkunganku” learning is shown in Table 1.

**Table 1. Percentage of Results of Expert Material Assessment of Visual Based Learning Media Using Snakes and Ladders Games**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Rating Percentage</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content Worthiness Aspect</td>
<td>94.27</td>
<td>Very feasible</td>
</tr>
<tr>
<td>Aspect of Presentation</td>
<td>91.67</td>
<td>Very feasible</td>
</tr>
<tr>
<td>Eligibility</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>93.13</strong></td>
<td>Very feasible</td>
</tr>
</tbody>
</table>

Furthermore, the results of the design expert’s assessment of the visual-based learning media using the snake and ladder game in “Lingkunganku” learning are shown in Table 2.

**Table 2. Percentage of Results of Design Expert Assessment of Visual Based Learning Media Using Snakes and Ladders Games**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Rating Percentage</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspect of Appropriate Design Format</td>
<td>93.75</td>
<td>Very feasible</td>
</tr>
<tr>
<td>Aspects of Conformity of Learning</td>
<td>93.75</td>
<td>Very feasible</td>
</tr>
<tr>
<td>Activity Order</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspects of Conformity of Methods and Media in Learning Activities</td>
<td>93.75</td>
<td>Very feasible</td>
</tr>
<tr>
<td>Aspect of Appropriateness of Time Allocation</td>
<td>87.5</td>
<td>Very feasible</td>
</tr>
<tr>
<td>Design Physical Attractiveness Design</td>
<td>92.5</td>
<td>Very feasible</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>93.13</strong></td>
<td>Very feasible</td>
</tr>
</tbody>
</table>

Furthermore, according to learning media experts, the development of visual-based learning media uses the snake ladder game in learning “Lingkunganku” has the feasibility of two aspects of assessment in terms of media construction which includes aspects of media design with a percentage score of 94.44% and aspects of media content design with a percentage score of 93.42%. This indicates that the interactive learning media developed can meet the demands of learning needs. The percentage of assessment scores from the two design experts on visual-based learning media using the snakes and ladders game in “Lingkunganku” learning is shown in Table 3.

**Table 3. Percentage of results of Media Expert Assessment of Visual Based Learning Media Using Ladder Snake Games**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Rating Percentage</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media Design Aspects</td>
<td>94.44</td>
<td>Very feasible</td>
</tr>
<tr>
<td>Design Aspects of Media Content</td>
<td>93.42</td>
<td>Very feasible</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>93.75</strong></td>
<td>Very feasible</td>
</tr>
</tbody>
</table>

Furthermore, the data obtained in this study are the results of early childhood learning in TK Karya Darma Medan with “Lingkunganku” material. Based on the results of the study it can
be seen that the minimum, maximum, mean and standard learning outcomes of early childhood in the media development group at TK Karya Darma Medan can be seen in Table 4.

Table 4. Minimum Learning Results, Maximum, Mean and Standard Deviation in Early Childhood in the Intervention Group at TK Karya Darma Medan

<table>
<thead>
<tr>
<th>Learning Outcomes</th>
<th>Min.</th>
<th>Max.</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre Media Development</td>
<td>60</td>
<td>90</td>
<td>77.5</td>
<td>4.553</td>
</tr>
<tr>
<td>Post Media Development</td>
<td>77.5</td>
<td>100</td>
<td>88.75</td>
<td>2.714</td>
</tr>
</tbody>
</table>

Based on Table 4, it can be seen that the learning outcomes in early childhood TK Karya Darma Medan in the intervention group minimum learning outcomes after given the development of learning media has increased from 60 to 77.5, the maximum learning outcomes after the intervention in the development of learning media has increased from 90 to 100 and the mean (average) of learning outcomes after being given the development of instructional media has increased from 77.5 to 88.75 after the experiment.

The learning outcomes data are then subjected to an analysis prerequisite test which includes a normality test and a homogeneity test. Normality test conducted on learning outcomes data in this study is the Liliefors test. Normality of data is significant if the test results \( l \) > 0.05. The results of the normality of pretest and posttest data can be seen in Table 5.

Table 5. Data Normality Test for Experiment Class and Control Class

<table>
<thead>
<tr>
<th>Data</th>
<th>Class</th>
<th>( l )-count</th>
<th>( l )-table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>Experiment</td>
<td>0.197</td>
<td>1.796</td>
</tr>
<tr>
<td>Posttest</td>
<td>Experiment</td>
<td>0.126</td>
<td>1.833</td>
</tr>
<tr>
<td>Pretest</td>
<td>Control</td>
<td>0.137</td>
<td>1.833</td>
</tr>
<tr>
<td>Posttest</td>
<td>Control</td>
<td>0.137</td>
<td>1.833</td>
</tr>
</tbody>
</table>

Based on the results of normality testing in the experimental class and the control class in Table 5, it is known that the pretest and posttest data in both classes produce a normality test value \( l \) > 0.05. Thus, it can be concluded that learning outcomes data in the experimental class and the control class are normally distributed. Homogeneity test conducted in this study uses the Lavene Equality of Error Variances Test. Homogeneity of data is fulfilled if the significance test results obtained > 0.05. Homogeneity test results of pretest and posttest data can be seen in Table 6.

Table 6. Test Homogeneity of Pretest and Posttest Data

<table>
<thead>
<tr>
<th>Data</th>
<th>Class</th>
<th>p-value</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>experiment</td>
<td>3.034</td>
<td>1.685</td>
</tr>
<tr>
<td></td>
<td>control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>experiment</td>
<td>0.025</td>
<td>1.685</td>
</tr>
<tr>
<td></td>
<td>control</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on the results of homogeneity testing in the experimental and control classes in Table 6, the results of the pretest and posttest significance obtained > 0.05. Thus, it can be
concluded that the pretest and posttest learning outcome data in the experimental class and the control class are homogeneous.

After the analysis prerequisite tests are met then the learning outcomes data are analyzed to test the research hypotheses. Hypothesis testing is done by the t test formula. Based on the calculation results obtained by t-count < t-table = 1.679. Based on these results, then Ho and ha are accepted or in other words there are significant differences between learning outcomes in the experimental class and the control class at the 5% significance level. Thus, the results of “Lingkunganku” learning taught by the development of visual media based on the use of snakes and ladders have differences with the results of learning being tested.

To test the development of visual based learning media using the ladder snake game it is found that the results of the statistical test T-test obtained the value of t-count (4.782) > t-table (1.679), meaning Ho is rejected, meaning that the development of visual based learning media using the ladder snake game is effective to improve learning outcomes early childhood in TK Karya Darma Medan.

4.1. Discussion of Product Development Results

Development of visual based learning media using ladder snake game based on the stages as contained in the procedure. The results of the subsequent development are carried out due diligence or validation by experts who have been determined. Based on the results of the validation carried out, the product in the form of a visual snake ladder game in learning “Lingkunganku” was declared very feasible to be continued in field trials. The learning media developed have met the standards based on the design of learning media development standards and learning material standards.

The product development research conducted was directed to produce a product in the form of visual-based learning media using the snakes and ladders game in learning “Lingkunganku” in early childhood TK Karya Darma which is used to improve early childhood learning outcomes. Aspects that are revised and refined based on data analysis and tested and input from material experts, learning design experts, learning media experts. It aims to explore some aspects that are common in the process of developing a product.

The results of the assessment presented by the material experts on the development of visual based learning media using the snake ladder game in learning “Lingkunganku” gives an average percentage of 93.13%, thus the learning media are included in the category of “very feasible” so that it can be accepted and suitable for use in learning process. The results of the assessment of learning design experts in the development of visual-based learning media using the ladder snake game gives an average percentage score of 93.13% and meet learning design standards. Meanwhile, instructional media experts on learning media were phased in the development of visual based learning media using the snakes and ladders game, giving an average percentage of 93.75%, thus the development of visual based learning media using the snakes and ladders game in learning “Lingkunganku” is included in the category of “very feasible” so that it can be accepted and is suitable for use because it contains material and delivery criteria that meet the delivery requirements of the message.

From the discussion above it can be concluded that the development of visual based learning media using the snake ladder game in learning “Lingkunganku” is appropriate for learning as learning media in TK Karya Darma Medan.

4.2. Discussion of Research Results of Product Effectiveness Test
Based on statistical tests that have been done, the results of hypothesis test analysis are obtained, namely $t_{\text{count}} = 4.782$ and $t_{\text{table}} = 1.679$ which is $t_{\text{count}} > t_{\text{table}}$, this means the use of visual based learning media using the snakes and ladders game can improve early learning outcomes on the subject of Lingkunganku in TK Karya Darma Medan, with an influence on improving learning outcomes by 50.97%.

Snakes and ladders game can improve early learning outcomes because in this game early childhood are required to be quick and alert in answering questions when getting question cards and practice cards. Groups will compete to quickly answer the questions obtained and collect as many point cards as possible to be a winner. One of the essential characteristics of an individual is that he always wants to win in various ways [2]. Each individual will make various efforts so that he can be superior to others. His efforts can be in the form of positive and negative things.

The use of snakes and ladders game media can improve student achievement on the subject of hydrocarbons in TK Gracia Kids classrooms and the effect of increased use of snakes and ladders playing media on student achievement by 16.84% [3].

5. Conclusions

Based on the results of research that has been done and the results of data analysis obtained can be concluded as follows. Based on statistical tests that have been done, the results of hypothesis test analysis are obtained, namely $t_{\text{count}} = 4.782$ and $t_{\text{table}} = 1.679$ which is $t_{\text{count}} > t_{\text{table}}$, this means the use of visual based learning media using the snakes and ladders game can improve early learning outcomes on the subject of Lingkunganku in TK Karya Darma Medan, with an influence on improving learning outcomes by 50.97%.

The results showed that the development of snakes and ladders game media had a positive effect in creating an active and enjoyable learning process. The development of visual snake ladder game media is proven to make students more enthusiastic and responsible for more active learning, which in turn has an impact on student learning outcomes better than without using media. Therefore, the development of a visual-based ladder snake game can be recommended for use in the early childhood learning process. Suggestions that can be given to teachers, to be able to implement this snake ladder game by planning learning better, so that the results obtained are more maximum and efficient.

6. References


The Development of Interactive Computer-Based Learning Models to Improve Student Learning Outcomes in Integrated Social Studies Education at SMP Negeri 4 Tarutung

Wesli H Situmeang¹, Sahat Siagian², Efendi Napitupulu³
{wesli.h.situmeang@gmail.com}¹
Universitas Negeri Medan, Medan, Indonesia¹,²,³

Abstract. This study aims to: produce visual based learning media products that are appropriate to use, easy to learn by students and can be used for early childhood. This type of research develops the ADDIE model from the Dick and Carey learning design model. The results showed: (1) the expert test material qualifications were very good (89%), (2) the learning design expert qualifications were very good (97%), (3) the instructor learning media qualification test was very good (89%), (4) individual qualification trials are very good (95.16%), (5) small group trials with very good qualifications (96.01%), (6) field trials are limited to very good qualifications (96.12%), and suitable for use in the learning process early on. Hypothesis testing results prove that there are significant differences between student learning outcomes that are learned using media products with student learning outcomes that are learned without using media products. This is indicated by the results of data processing obtained by $t$-count = 3.678 > $t$ table = 1.79, with $df = 2$ at the significance level $\alpha = 0.05$. It was concluded that the learning outcomes of students taught using interactive computer-based "Wesli" learning models was 83% higher than the group of students taught without 81 learning media products.

Keywords: Computer Based Learning, Social Studies, ADDIE Model

1. Introduction

With the development of technology at this time where students are able to follow technology in daily life, where learning models are required to evolve according to technological developments, the low student learning outcomes in Integrated Social Studies learning and learning methods that are still teacher-centered and the opportunities for information technology development and communication in learning it is necessary to innovate student-oriented learning and facilitate learning needs that are challenging, Active, Creative, Effective and Enjoyable (PAIKEM) to prepare students to face future challenges with the development of information technology and global competition, one of which is by developing models learning and integrating the learning process with interactive computer-based learning.

Researchers are interested in developing the WESLI learning model (Weakness, Explicit Instruction, SAVI, LAPS Heuristics, and Introspection). Based on computers using Microsoft Power Point application for presentations and designed for interactive activities using the
Ispring Suite program so that it is expected to have a two-way relationship between computers (software / applications / products) with students, components of the WESLI learning model:

Weakness: giving questions or problems (a case relating to learning material) to students so that we know where lies the weaknesses of each student from the way he answered the case. Explicit Instruction that is the results of student answers that may be less satisfactory, the teacher demonstrates pictures and videos using the Microsoft Power Point learning application so that students understand the material

SAVI (Somatic, Auditory, Visual and Intellectual) by demonstrating learning using the Microsoft Power Point application, students make use of all student senses so that the material can be digested LAPS Heuristics (Logan Avenue Problem Solving) in a series of questions that are demands that provide cases and provide instructions on how to answer questions using the Microsoft Power Point application, with the questions students look for answers and be able to answer questions and master the subject matter.

Introspection, in this case the teacher evaluates the results of the answers that have been submitted by students and gives an assessment to students. The use of learning models by using computers with interactive power point applications allows students to adjust the speed in mastering the lesson. A student who has a higher learning speed will more quickly complete his learning activities while students who have a slow learning speed will complete their activities in accordance with their respective abilities so that the student is able to follow. In contrast to the direct learning method which is generally the speed of understanding learning is determined by the teacher. It is apparent that learning media is very influential in the effectiveness and efficiency of learning.

2. Research Methods

The method used in this research is ADDIE development research. The subject in this research is the material "Social Interaction" contained in the RPP (Learning Program Plan). This research is conducted to SMPN 4 Tarutung students who are studying "Social Interaction" learning material. Data obtained by giving questionnaires and objective tests of learning outcomes. The data obtained were then tested for normality and homogeneity. This research hypothesis will be tested using T-test analysis (t-test).

3. Results and Discussion

Data obtained Based on the results of the assessment of learning material experts that the learning model using interactive computers in the material Social interaction has the feasibility of three aspects of assessment which includes aspects of the feasibility of the material with a percentage score of 89%, the feasibility aspects of learning design 97%. The feasibility aspect of software engineering is 87.5%. It shows that the learning model using an interactive computer that is developed can meet the demands of learning needs.

| Table 1. Average Percentage of Assessment Results by Material Experts |
|-----------------|-----------------|-----------------|
| Indicator       | Rating Percentage | Criteria        |
| Content eligibility    | 88              | Very feasible   |
| Presentation       | 90              | Very feasible   |
Furthermore, the data obtained in this study are the results of early childhood learning in SMPN 4 Tarutung with the material "Social Interaction". Based on the results of the study it can be seen that the learning outcomes of the minimum, maximum, average and early childhood standards in the Learning Model development group using Interactive computers.

Table 4. Minimum Learning Outcomes, Maximum and Standard Deviation in SMP N 4 Tarutung

<table>
<thead>
<tr>
<th>Learning Outcomes</th>
<th>Min.</th>
<th>Max.</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre Media Development</td>
<td>44</td>
<td>75</td>
<td>78.5</td>
<td>4.663</td>
</tr>
<tr>
<td>Post Media Development</td>
<td>47</td>
<td>100</td>
<td>78.22</td>
<td>16.84</td>
</tr>
</tbody>
</table>

Based on Table 4, it can be seen that the learning outcomes in SMP 4 Tarutung in the intervention group minimum learning outcomes after given the development of learning models increased from 40 to 47, the maximum learning outcomes after the intervention in the development of learning media has increased from 60 to 100 and on average (average) learning outcomes after being given the development of interactive computer-based learning models have increased from 70 to 83 after the experiment.

Learning outcomes data are then subjected to analysis prerequisite tests which include tests of normality and homogeneity tests. Normality test conducted on learning outcome data in this study is the Liliefors test. The normality of data is significant if the test results l > 0.05. The results of the normality of the pretest and posttest data can be seen in Table 5

Table 5. Data Normality Test for Experiment Class and Control Class

<table>
<thead>
<tr>
<th></th>
<th>Class</th>
<th>l-count</th>
<th>l-table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>Experiment</td>
<td>0.1566</td>
<td>1.796</td>
</tr>
<tr>
<td>Posttest</td>
<td>Experiment</td>
<td>0.1566</td>
<td>1.833</td>
</tr>
<tr>
<td>Pretest</td>
<td>Control</td>
<td>0.1366</td>
<td>1.833</td>
</tr>
</tbody>
</table>
Based on the results of normality testing in the experimental class and the control class in Table 5, it is known that the pretest and posttest data in both classes produce a normality test value \( (l) > 0.05 \). Thus, it can be concluded that learning outcomes data in the experimental class and the control class are normally distributed. Homogeneity test conducted in this study uses the Lavene Equality of Error Variances Test. Homogeneity of data is fulfilled if the significance test results obtained \( > 0.05 \). Homogeneity test results of pretest and posttest data can be seen in Table 6.

### Table 6. Test Homogeneity of Pretest and Posttest Data

<table>
<thead>
<tr>
<th>Data</th>
<th>Class</th>
<th>p-value</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>experiment</td>
<td>1.56</td>
<td>1.79</td>
</tr>
<tr>
<td></td>
<td>control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>experiment</td>
<td>1.79</td>
<td>1.79</td>
</tr>
<tr>
<td></td>
<td>control</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on the results of homogeneity testing in the experimental and control classes in Table 6, the results of the pretest and posttest significance were obtained \( > 0.05 \). Thus, it can be concluded that the pretest and posttest learning outcome data in the experimental class and the control class are homogeneous.

After the analysis prerequisite tests are fulfilled, the learning outcomes data are analyzed to test the research hypotheses. Hypothesis testing is done by the \( t \) test formula. Based on the calculation results obtained \( t_{\text{count}} < t_{\text{table}} = 1.79 \). Based on these results, \( H_0 \) and \( H_a \) are accepted or in other words there is a significant difference between learning outcomes in the experimental class and the control class at the 5% significance level. Thus, learning outcomes "Social interaction" taught by the development of computer-based learning models are different from the learning outcomes tested.

The test of development of interactive computer-based learning models it was found that the results of the T-test statistic obtained \( t_{\text{count}} (3.678) > t_{\text{table}} (1.79) \), meaning that \( H_0 \) was rejected, meaning that the development of interactive computer-based learning models was effective for improving student learning outcomes at SMP N 4 Tarutung.

### Discussion of Product Development Results

Development of interactive computer-based learning models based on the stages as stated in the procedure. The results of further development are carried out due to due diligence or validation by predetermined experts. Based on the results of the validation, the product in the interactive computer-based learning model "Social Interaction" was declared very feasible to be continued in the field trials. The learning media developed have met the standards based on the design standards of instructional media development and learning material standards.

The product development research carried out is directed to produce products in the form of computer-based interactive learning models in the material "Social Interaction" at SMP N 4 Tarutung which are used to improve student learning outcomes. Aspects are revised and refined based on data analysis and tested and input from material experts, learning design experts, instructional media experts. It aims to explore some aspects that are common in the process of developing a product.
The results of the assessment presented by material experts about the development of a computer-based interactive learning model "Social Interaction" gave an average percentage of 93.13%, so that the learning media included in the "very feasible" category so that it could be accepted and suitable for use in the learning process. The results of the assessment of learning design experts in the development of computer-based learning development models with an average percentage score of 93.13% and meet learning design standards. Meanwhile, learning media experts in learning media gradually developed a computer-based interactive learning model, giving an average percentage of 93.75%, so that the development of visual-based learning media using a computer-based interactive learning model Social Interaction "included in the" very feasible "category so it is acceptable and suitable for use because it contains materials and shipping criteria that meet the message delivery requirements.

From the discussion above it can be concluded that the development of a computer-based interactive learning model "Social Interaction" is feasible for learning as a learning in SMPN 4 Tarutung

Discussion of Research Results of Product Effectiveness Test

Based on statistical tests that have been done, the results of hypothesis test analysis are obtained, namely t-count = 3.678 and t-table = 1.79 which is t-count> t-table, this means the use of interactive computer-based learning model media can improve initial learning outcomes at Tarutung Middle School 4 subjects, with an influence on improving learning outcomes by 41.17%. Interactive computer-based learning models improve learning outcomes because students actively use all five senses to solve the problems made in computers so that students can follow learning according to their abilities so that students can master the material perfectly.

4. Conclusions

Based on the results of research that has been done and the results of data analysis obtained can be concluded as follows. Based on statistical tests that have been done, the results of hypothesis test analysis are obtained, namely t-count = 3.978 and t-table = 1.79 which is t-count> t-table, this means the use of interactive computer-based learning model media can improve initial learning outcomes at Tarutung Middle School 4 subjects, with an influence on improving learning outcomes by 41.17%.

The results showed that the development of computer based "Wesli" learning models had a positive effect in creating an active and enjoyable learning process. The development of visual snake game media has proven to make students more enthusiastic and responsible for more active learning, which in turn has an impact on student learning outcomes better than without using media. Therefore, the development of interactive computer-based learning models can be recommended for use in the student learning process. Suggestions that can be given to teachers, so that they can implement interactive computer-based learning models by planning better learning, so that the results obtained are more optimal and efficient.

5. References

and Bacon (2005).


doi:10.1088/1757-899X/434/1/012267

Applying Video Learning of Media Tutorials and Actual Media Objects to Increase Student Interest and Learning Outcomes on the Clutch System Material

Henry Iskandar¹, Dwiki Muda Yulanto², Sapitri Januariyansah³, Siti Ulgari⁴, Ahmad A. Sandi⁵

Universitas Negeri Medan, Indonesia¹,²,³,⁴,⁵
SMK Negeri 2 Bener Meriah, Indonesia²
henryiskandar@unimed.ac.id

Abstract: This research was conducted on students of Level XI Vocational High School (SMK) of Automotive Vehicle Engineering Program. The problem faced is not found in the appropriate learning media on the material clutch system. This study aims to determine the appropriate learning media on the material clutch system to accelerate learning participation and learning outcomes. Quasy research method 2 x 2 factorial design experiment with samples obtained through random cluster sampling. Test analysis used descriptive statistics and two-way ANOVA analysis requirements test. The results of this study show that; (1) there are distinctions in student learning outcomes taught by using video tutorial of media learning and actual learning media, (2) there is a high impact of learning interest and low learning interest on the learning outcomes of the clutch system (3) there is an interaction between the use of teaching media and student interest in persuading the learning outcomes of the clutch system material.

Keywords: Media of Tutorial Video, Actual Media, Studying enthusiasm, Studying Outcomes, Clutch Systems.

1. Introduction

An educational institution's vocational school founded by the Indonesian government, namely vocational high school (SMK). The purpose of the vocational school in general to increase intelligence, knowledge, personality noble, attitude and skills to live independently and follow further education in accordance with the field of his expertise [1]. The system material clutch is one of the material lab work, which discusses powertrain/spin of a car engine, output learning which are how a knowing manner function and all that stuff components clutch, improve and care for him. The statement need device actual media and media visual packed simple in the process of learning.

The role of technology and information on learning triggers changes in the world of education [2]. The use of instructional media in the learning process in Vocational High School clutch system material has a role to improve learning outcomes cognitive and psychomotor aspects in accordance with their fields of expertise and can foster attitudes and behavior through student interest in learning.
Using video tutorials, the teacher's role can be replaced so that the teacher can simultaneously evaluate students during the learning process [3]. Video tutorials on the learning process can be shown step by step can easily be played back and back so that the material can be more easily understood by students [4,5]. Evaluation of learning can be done when the practice learning process takes place, in the learning process of the clutch system material, namely the clutch system work process, repairing and maintenance need to need to learn over and over again practically so that it can help students correct their mistakes when doing practical learning, so that the use media of tutorial video very needed.

Vocational High Schools, laboratory facilities are a necessity as a special support for the practical learning process. Media object learning is actually also a tool that must be found in the laboratory. Because the results will know and use actual object media in the learning process aimed at being able to see and use practical tools directly students are expected to gain psychomotor when using practical tools and can form habits and increase accuracy and speed [6,7].

Interest is a tendency or a great interest in something. Interest plays an important role in student life which has a major impact on attitudes and behavior. Students who are interested in creating a pleasant learning atmosphere can be supported by the use of appropriate learning media [2]. In addition to the selection of instructional media to improve learning outcomes of knowledge and skills, the most important learning process is the evidence of students' attitudes and behavior in the process [8]. Therefore the intended learning interest is asking for the learning of the teaching material of the clutch system. Learning outcomes to increase knowledge and skills, namely by learning media video tutorials and learning objects of actual objects.

The next previous research conducted showed that the instructional media for video tutorials can show increasing learning outcomes effectively [9]. To get the results of learning, cognitive and psychomotor aspects can be done by using these two media, namely video tutorial media and the actual object media in the learning process [4,10]. While the interest in learning can be grown with the use of learning media simultaneously while learning theory and practicum.

2. Research Method

This research was conducted on students of the XI light vehicle engineering expertise program. Determination of the characteristics of students is not grouped in the ranking or classification of superior classes, but is done random only taken a few groups of students. The sampling technique in this study was purposive random sampling. This technique was chosen because what adds to the population is the number of classes rather than the number of students in the population. The sample taken consisted of two groups, namely one class group did learning using video tutorial learning media, and another class did learning using actual object learning media.

The research method used is Quase Experiment 2 x 2 factorial design. The data analysis technique uses descriptive and inferential statistics by using the two-way analysis of variance analysis (ANOVA) test requirements. and the statistical test used is the F test with $\alpha = 0.005$. 
Table 1. Research Design

<table>
<thead>
<tr>
<th>Variable Instructional Media</th>
<th>Video tutorial media</th>
<th>Media of actual objects</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Learning Interest (X1.1)</td>
<td>X2.1</td>
<td>X2.2</td>
</tr>
<tr>
<td>Low Learning Interest (X1.2)</td>
<td>X2.1</td>
<td>X2.2</td>
</tr>
</tbody>
</table>

3. Results and Discussion

Table 2. Summary of Calculation Result of Descriptive Analysis

<table>
<thead>
<tr>
<th>Summary Data</th>
<th>Use Media Learning</th>
<th>Statistic</th>
<th>Video Tutorials</th>
<th>Actual Objects</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Interest to Learn</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>17</td>
<td>14</td>
<td>31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΣX</td>
<td>380</td>
<td>299</td>
<td>679</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΣX2</td>
<td>8099</td>
<td>6477</td>
<td>14576</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>22.35</td>
<td>21.36</td>
<td>43.71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2</td>
<td>11.35</td>
<td>10.9</td>
<td>22.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Interest to Learn</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>13</td>
<td>16</td>
<td>29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΣX</td>
<td>243</td>
<td>280</td>
<td>523</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΣX2</td>
<td>4597</td>
<td>4942</td>
<td>9539</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>18.69</td>
<td>17.5</td>
<td>36.19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2</td>
<td>9.45</td>
<td>9.05</td>
<td>18.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>30</td>
<td>30</td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΣX</td>
<td>623</td>
<td>623</td>
<td>1202</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΣX2</td>
<td>12696</td>
<td>12696</td>
<td>11419</td>
<td>24115</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>41.04</td>
<td>41.04</td>
<td>38.86</td>
<td>79.9</td>
<td></td>
</tr>
<tr>
<td>S2</td>
<td>20.8</td>
<td>20.8</td>
<td>19.95</td>
<td>40.75</td>
<td></td>
</tr>
</tbody>
</table>

Based on the descriptive analysis calculations from Table 2 above, ANOVA was calculated with a 2 x 2 factorial design and a summary of the results of the ANOVA 2 x 2 factorial design was used to test the research hypotheses in Table 3 below:

Table 3. Summary Calculation of Factorial ANOVA 2 x 2

<table>
<thead>
<tr>
<th>Source Varians</th>
<th>dk</th>
<th>JK</th>
<th>RJK</th>
<th>F count</th>
<th>F table 0.05</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of media</td>
<td>1</td>
<td>405.6</td>
<td>405.6</td>
<td>102.17</td>
<td>4.01</td>
<td>Significant</td>
</tr>
<tr>
<td>Use video learning of media tutorials</td>
<td>1</td>
<td>383.58</td>
<td>383.58</td>
<td>96.62</td>
<td>4.01</td>
<td>Significant</td>
</tr>
<tr>
<td>Use media of actual objects</td>
<td>1</td>
<td>22.02</td>
<td>22.02</td>
<td>5.55</td>
<td>4.01</td>
<td>Significant</td>
</tr>
<tr>
<td>Use of Interest to learn</td>
<td>1</td>
<td>32.26</td>
<td>32.26</td>
<td>8.33</td>
<td>4.01</td>
<td>Significant</td>
</tr>
<tr>
<td>Interaction (AB)</td>
<td>1</td>
<td>166.22</td>
<td>166.22</td>
<td>41.87</td>
<td>4.01</td>
<td>Significant</td>
</tr>
<tr>
<td>Error</td>
<td>50</td>
<td>207.12</td>
<td>3.69</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>53</td>
<td>1216.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Based on Table 3 above the summary of the 2x2 factorial design ANOVA calculation can be concluded the results of the study, that the use of video tutorial media learning and actual object learning media with learning interests that affect the learning outcomes of the clutch system material is provided by comparing the value $F_{\text{count}} > F_{\text{table}}$ with a significant level $\alpha 0.05$.

The results of the study stated that there were differences in student learning outcomes using instructional media video tutorial media and using object learning media actually there were differences in learning outcomes, learning outcomes using video tutorial media were higher than those taught with actual learning media evidenced by seen in Figure 1 below this:

![Fig 1. Graph of the average difference in learning outcomes of video tutorial media and actual media objects](image)

The results of the research hypothesis test based on Figure 1 above can be proven that the learning outcomes using video tutorial media are higher than the actual object learning media by comparing the average score of video tutorial videos 20.7 > 19.03 media objects are actually tested for truth.

The results of the study there is the influence of high learning interest and low learning interest on the learning outcomes of the clutch system material taught using video tutorial media and actual object learning media, evidenced by a comparison of average scores seen in Figure 2 below:

![Fig 2. Graph of the average value of learning outcomes of video tutorial media and actual object media with high learning interest and low learning interest](image)
The results of the research hypothesis test based on Figure 2 and Table 2 above can be proven that the effect of high learning interest and low learning interest on the learning outcomes of the clutch system material is taught using video tutorial media and object learning media the value \( F_{\text{count}} > F_{\text{table}} \) 8.33 > 4.01 with a significant level \( \alpha \) 0.05. Then the conclusion there is a significant influence between high learning interests on the learning outcomes of the clutch system material by using truth-tested learning media.

(3) The results of the study there are interactions between the use of learning media and student interest in influencing learning outcomes of the clutch system material. The proven results of the research hypothesis test based on Table 2 above that there is an interaction between the use of instructional media and student interest in influencing the learning outcomes of the clutch system material expressed in the comparison results the value \( F_{\text{count}} > F_{\text{table}} \) that is 41.87 > 4.01 with a significant level \( \alpha \) 0.05. Proven comparison of the average score seen in Figure 3 below:

![Figure 3](image)

**Fig 3.** Line Pattern graphs of interaction using instructional media (video tutorials and actual objects) and student learning interest in learning outcomes of the clutch system material

Then the conclusion this gives an indication that the treatment of groups of students who have High Learning Interests are different from groups of students who have Low Learning Interests, meaning that one of the two groups will produce better learning outcomes when taught with Video Tutorials and other learning media would be better taught by using the Actual Objects of Learning Media.

Implementation of the use of video tutorial media learning and actual objects together will directly improve student learning outcomes on the material clutch system that has a high interest in learning. In addition, students will also be active so that they will stimulate students to move continuously to follow the steps in learning the material clutch system practicum before and when learning takes place.
4. Conclusion

Based on the results of the research and discussion described earlier, it can be concluded that; (1) there is a difference in the learning outcomes of students taught using video tutorial media learning higher than using actual objects of learning media, (2) there is a high influence of learning interests and low learning interest on the learning outcomes of the clutch system taught by video learning media tutorials and actual object learning media, (3) there is an interaction between the use of instructional media video tutorials, actual object learning media and student learning interest in influencing the learning outcomes of the clutch system material.

5. References


The Effect of Tourist Facilities on Visitor Satisfaction in Tourist Attractions in Pamutusan Island, Bungus West Sumatera

Yuzia Eka Putri¹, Fatma Tresno Ingtiyas²

Universitas Negeri Medan, Indonesia¹²
e.yuzia@yahoo.com¹

Abstract. This research is motivated by the price of the package complained about being quite high because it is not in accordance with the facilities and tourist attractions on the island of Pamutusan. Bad condition tourist attraction facilities, such as open wells and the beach area look dirty because of the scattered garbage. This article aims to reveal the factual effect of tourist facilities on visitor satisfaction in the tourist attraction of the island of Pamutusan West Sumatra. This type of research is causal associative. The population in this study is visitors to Pamutusan Island with 100 respondents. Data analysis techniques using in this study is analysis of the level of respondents' achievement, the test of classical assumptions and hypothesis testing. The results showed the TCR for the facility variable obtained a TCR of 77.20% with a sufficient category. It would be better if the addition of facilities that do not yet exist and the improvement of facilities that are in poor condition. While the visitor satisfaction variable gets TCR 80% in the good category. Regression test results showed the value of the analysis results known t count = -3.031 with sig = 0.003 <0.05. This means that there is an influence between facilities on visitor satisfaction in tourist attractions on the island of Pamutusan.

Keywords: facilities, and visitor satisfaction

1. Introduction

Indonesia is an archipelago that has more than 13,466 islands. This condition causes Indonesia to become one of the destinations of local and different tourists because of the beautiful and unique tourist attractions and culture, where each island has a different beauty from the island that includes small islands in the region of West Sumatra.

West Sumatra with a city center structure that is spread along the coast and has islands scattered around it so that it provides potential as an area for tourist areas. Island tourism is currently an alternative to meeting the needs for recreation and tourism. Previously the island's only known tour was Sikuai Island, but the fishermen in the area tried to search the islands around the Bungus area and found Pagang and Pamutusan Island, that has more beautiful views than Sikuai Island. The beauty of the island is like soft white sand beach and blue water and surrounded by coconut trees around the beach and verdant mangrove. From the surface of the beach fish that are swimming can be seen. On the mainland coast there is a plateau in the form of a small hill. Visitors can enjoy the beauty of the beach from the top of the hill.
At present the existence of small islands is beginning to be known because fishermen have sought the introduction of the island among the most prominent communities to the students. Since 2012 until now there has been an increase in visitors continuously until travel agents are on the rise doing promotions by offering a variety of packages to these islands. This attempt was done because of seeing tourists' interest in island tourism is very high, especially among teenagers and With the potential beauty of the students, Pamutusan Island can be famous if the government intervenes in completing tourism facilities and promoting tourism.

Visitors who travel to Pamutusan Island can snorkel while taking pictures in the water. This activity is one of the tourist attractions in Pamutusan. The travel agent also helped provide snorkeling equipment and cameras used for diving. The following is a list of the levels of visits in Pamutusan Island in the past year:

<table>
<thead>
<tr>
<th>Table. 1 List of visits in Pamutusan Island in 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Month</td>
</tr>
<tr>
<td>------------</td>
</tr>
<tr>
<td>January</td>
</tr>
<tr>
<td>February</td>
</tr>
<tr>
<td>Marc</td>
</tr>
<tr>
<td>April</td>
</tr>
<tr>
<td>Mei</td>
</tr>
<tr>
<td>June</td>
</tr>
<tr>
<td>July</td>
</tr>
<tr>
<td>August</td>
</tr>
<tr>
<td>September</td>
</tr>
<tr>
<td>October</td>
</tr>
<tr>
<td>November</td>
</tr>
<tr>
<td>December</td>
</tr>
</tbody>
</table>

Based on the table the number of visitors to Pamutusan Island from observations shows that the number of visitors is almost a lot every month, reaching 590 people and also with the use of attractions such as snorkeling facilities, underwater photos, and boats. The graph of visitor growth can be described as follows:

![Graph showing visitor growth](image)

**Fig 1.** The number of visitors to the tourist attraction in the island of Pamutusan 2015

The graph above shows the movement of the number of visitors each month. Surge in visitors there in the holiday season, namely June. Drastic decline in visitors was found in
August. This is due in August Muslims entered the fasting month. Looking at the number of visit data that is quite a lot, it is unfortunate if the condition of the island is not equipped with tourist support facilities.

Ideally, visitors who come want a clean tourist environment. But in reality, based on preliminary observations of the current condition of the islands, the scattered areas are not properly considered by the management. There is a little rubbish. The waste is also left scattered around the coastal environment, so that the beauty of the beach is reduced. Like the picture 2 below:

![Fig 2. Dirty beach conditions with plastic waste and coconut waste](image)

The picture above shows the beach environment that looks dirty. Besides that the facilities available are also far from good category. The toilet is provided in an open state. There is only well in an open state, sometimes surrounded by tarpaulin. So that when visitors want to clean the body of visitors is not comfortable with existing conditions.

![Fig 3. Condition of well to rinse](image)

The picture above illustrates the condition of one of the facilities on the island of Pamutusan. Furthermore, some snorkeling equipment is also in poor condition. As Figure 4 below:
Figure 4 above shows a number of snorkeling equipment, some of which are in poor condition. The color is worn and rubber equipment that is damaged is only replaced using ordinary rubber. This snorkeling equipment is rented by a travel agent if there are visitors who use tour packages to visit Pamutusan Snorkeling equipment provided by travel agents is not proportional to the number of visitors there. As a result the use of snorkeling equipment must be used interchangeably. This is not in accordance with the expectations of visitors, even though visitors have incurred a large enough cost to be able to travel to the island. Problems such as those described above are very hindering for the development of tourist attractions as stated by Suwantoro [1]: "The main elements that must receive attention in order to support the development of tourism in tourist destinations, include: (1) Tourism Objects and Attractions (ODTW), (2) Tourism Infrastructure, (3) Tourism Facilities, (4) Governance (services, security, and comfort) (5) Community / Environment ".

Facilities obtained by visitors are felt inappropriate, in the end visitors complained about the high price spent to get to the island's attractions. One of the tourists who had visited Pamutusan Island stated that they were satisfied with the view of the coast of Pamutusan Island, and felt disappointed with the environment that was not preserved.

In terms of access to the island visitors feel quite difficult. To achieve this, visitors are offered two options, namely to use island tour packages sold by travel agents or using the services of fishermen. If you use the service of visitors only costs approximately Rp. 100,000. At that price, visitors get around trip transportation, swimming equipment, and island entrance tickets. But visitors must gather a minimum of 15 members and security is not available. The vehicle used is the fishing boat. If visitors to the island use the services of a travel agent, visitors must spend a significant amount each person for a day trip with transportation facilities to the island, lunch, and swimming equipment. The following is a list of prices given by travel agents:
Table 2. List price of Pamutusan Island Tour through Travel Agent

<table>
<thead>
<tr>
<th>Agent Name</th>
<th>Price (Rp)</th>
<th>Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duta Wisata Pesona</td>
<td>280,000</td>
<td>1. boat transportation, lunch (rice box / wrap) + mineral water,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. banana boat, snorkeling, underwater photos, island entrance tickets</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Coffee break</td>
</tr>
<tr>
<td>Sartika Dewi</td>
<td>270,000</td>
<td>1. boat transportation, lunch (rice box / wrap) + mineral water.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. banana boat, snorkeling, underwater photos, island entrance tickets</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Coffee break (kopi / teh panas)</td>
</tr>
<tr>
<td>Raminang Tour</td>
<td>350,000</td>
<td>1. Ac ship and round trip</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Entrance ticket to the island</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. The life jacket</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Lunch (rice wrap / box) + mineral water</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Coffee break (hot tea / hot coffee)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Free banana boat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7. Snorkeling + underwater photos</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8. Safety first aid</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9. Travel Insurance</td>
</tr>
</tbody>
</table>

From the city of Padang visitors must first go to Sungai Pisang, then can use a boat to islands. The struggle to get to the Banana River is not easy. Visitors must pass through a very steep and punchy road. If visitors choose a package offered by the travel agent, they use a motorboat to access transportation to the islands, of course, using a higher cost than using the services of fishermen. Complaints of high prices felt by visitors when using the services of this travel agent. They complained about tourist facilities that did not match the price they paid.

Based on preliminary observations of various visitors to the island's tourist attractions, the problems related to prices and facilities mentioned above caused visitors to feel less satisfied. Visitors compare the costs incurred with the acquisition of facilities at tourist attractions. This is in line with Tjiptono [2] that states that satisfaction is the consumer's response to the perceived evaluation between previous expectations and the actual performance of the product that is felt after its use. The relationship between facilities and satisfaction has been proven by research conducted by Martianawati, Widitomo, Wijaya, where the results of the study are that facilities have an influence on satisfaction.

2. Research Method

This research uses quantitative methods. The data collection technique is in the form of a questionnaire that is arranged using a Likert scale. The research respondents numbered 100 people who visited the tourist attraction Pamutusuan. The data analysis technique consisted of the level of respondents' achievement, the classical assumption test, and the hypothesis test. Presentation of quantitative data is in the form of tables and narratives.
3. Results and Discussion

The results showed the average tourist facilities variable assessment given by 100 respondents as a whole was 3.86 with 77.2% of respondents' achievement level. The level of achievement of these respondents can be classified with enough categories. Then for the visitor satisfaction variable obtained an average rating given by 100 respondents as a whole is 3.99 with an 80% achievement rate of respondents. The level of achievement of these respondents can be classified in either category. Multiple regression analysis shows there is an influence of package prices and tourist facilities on the satisfaction of visitors to the tourist attraction. The contribution amount given by the variable price of packages and facilities to visitor satisfaction is 9.21% while the rest is explained by other factors outside the variable prices of packages and facilities. Significant positive correlation between tourist facilities on satisfaction 0.096 means that the more complete the facility, the higher the level of visitor satisfaction in tourist attractions on the island of Pamutusan.

Based on the results of hypothesis testing found that there is a significant influence of facility (X2) on visitor satisfaction (Y). Multiple regression analysis showed that t arithmetic = -3.031 with sig = 0.003 < 0.05, indicating that the facility had a positive and significant effect on the satisfaction of visitors of tourist attractions. This means that facility factors can increase the satisfaction of visitors to tourist attractions.

4. Conclusions and Suggestions

Based on the results of research and discussion conducted through data analysis, it can be concluded:

1) The facilities available on Pamutusan Island are considered sufficient by 100 data respondents with an average score of 3.86 with a TCR of 77.20%, like the rinse and toilet.

2) The satisfaction of visitors to the tourist attraction of the island of Pamutusan in the value enough by the visitors of the attractions seen from the average score of 3.99.

Based on the conclusions that have been put forward, then below are some suggestions that are expected to increase visitor satisfaction. The suggestions given for the island manager are as follows:

1) Maintain the price of the package, do additional tourist attractions on the island of Pamutusan such as flying boards, rolling donuts, flying fish, sea walkers, walker boarding so that visitors come back to the island of Pamutusan.

2) Add additional facilities, such as toilets, condition the number with visitors, repair rinse rooms, restaurants, trash bins, place of worship, beach umbrella etc.

3) Visitors are satisfied now to enjoy the beauty of the beach on the island of Pamutusan. This must be anticipated by the improvement of facilities and the addition of attractions so that visitors can come back to travel on the island of Pamutusan, with the acquisition of TCR 79%. Package and facility prices affect visitor satisfaction.
5. References


The Relationship of Innovative Working Activity with The Self-Development of Productive Teachers Automotive Engineering Programs

Dwiki Muda Yulanto¹, Sapitri Januariyansah², Henry Iskandar³, Siti Ulgari⁴, Didik Rohmantoro⁵

Universitas Negeri Medan¹,²,³,⁴, Universitas PGRI Yogyakarta⁵
dwikimudayulanto@unimed.ac.id

Abstract. Productive teachers are required to develop their competence. Innovative working activity and self-development are part of the development of productive teacher competencies. The research was aimed to analyze the effect of innovative working activity on the self-development of productive teachers in the Automotive Engineering Expertise Program. The type of this research was correlational research with a quantitative approach. A questionnaire was used as the data collection method. Data analysis techniques were used for inferential statistics. The results showed that 1) the correlation value (R) was 0.679, 2) the significance value was 0.00, 3) the determination value was 46%, and 4) the regression value Y=11.160+0.200X. The conclusions of this study were innovative working activity strongly influences on productive teacher self-development. The innovative working activity can be an alternative solution for productive teachers in developing themselves.

Keywords: competency, innovative work, productive teachers, self development.

1. Introduction

Industrial Revolution 4.0 brought influence in the world of education, especially vocational education. Vocational High Schools must be able to train and guide their students to deal with the changing characteristics of the world of work. Learners must easily adapt to changes that occur so quickly. Currently, Vocational High Schools are not only required to produce superior graduates but must be able to produce human resources who have competencies according to the needs of the workforce. The 21st century is synonymous with the development of technology that is increasingly fast. Many jobs that apply technology in the work process. This affects the competencies students must have. Students must have the knowledge, skills in mastering the field of technology, skills in processing information, the ability to innovate in all fields, and life and career skills [1].

In the 21st century, teachers must be able to create students who have superior personalities, resilient, and have high competitiveness. Productive teachers must be able to guide students in the mastery of knowledge, skills, attitudes, and values needed by the world of work. Therefore, productive teachers must have qualified knowledge and skills. Productive teachers are

ACEIVE 2019, November 16, Medan, Indonesia
Copyright © 2020 EAI
DOI 10.4108/eai.16-11-2019.2293283
encouraged to always improve their quality following their functions and roles. The government through the Ministry of Education and Culture instructs vocational teachers to always develop their competence [2]. Vocational teachers must have a higher awareness to improve their quality, improve their competence and profession.

Self-development is an effort to improve self-professionalism so that it has competencies that are following the laws and regulations or national education policies and the development of science, technology, and / or art [3]. The development of productive teacher skills can be done in several ways, namely: independent learning (reading literature, conducting independent training using school learning facilities such as libraries, laboratories and the internet); work or group discussions with colleagues in the same field (through the MGMP / KKG forum); attend training from school and outside school; teaching supervision; and continuing education to a higher level [4]. Personal development activities can be carried out through functional training and/ or teacher collective activities to improve teacher competency and/ or professionalism [5]. Education and training activities will provide benefits for teacher professional development and teacher competence [6]. Training makes teachers able to work effectively to create quality education [7]. Training can increase teacher confidence in classroom teaching [8]. Discussions with fellow teacher communities can improve teacher professionalism, specifically in the application of their pedagogical and professional competencies. Community-based training/ teacher forums can increase teacher motivation to actively participate in ongoing learning efforts by forming a strong teacher network and can work collaboratively [9]. Workshops can improve the performance of teachers and improve their teaching competencies. Teaching competence provides an important role in improving teacher skills, knowledge, and performance to be more effective [10].

Innovative works are works that are development, modification or discoveries as a form of teacher's contribution to improving the quality of the learning process in schools and the development of education, science/ technology, and art [11]. Innovative work activities can be done in several ways, namely: finding appropriate technology, making/ modifying practical tools/ lessons, following the development of standards, guidelines, questions, and the like. Appropriate Technology Work is a work of design/ development/ experiment in the field of science and/ or technology that is used for education or the community so that education is helped by its smoothness or the life-assisted community [12].

At present the relationship of innovative work activities with productive teacher self-development is unknown. Therefore, this research focuses on innovative work activities and self-development. The results of this study can show how much the relationship between innovative work activities and self-development carried out by productive automotive engineering teachers in the city of Surakarta so that it can be a material consideration for productive automotive engineering teachers related to personal development and innovative crafts.

2. Research Method

This type of research is correlational research with a quantitative approach. The population in this study amounted to 76 productive teachers. The number is all productive teachers of the Automotive Engineering Expertise Program in Surakarta City. The sample in this study is the total of all populations or using sampling techniques using saturated sampling. This research was conducted in 10 Vocational High Schools (SMK) in Surakarta that has Automotive Engineering Skills Programs. The data collection tool used was a questionnaire. Instrument validity test to test the content validity of the questionnaire in this study uses the opinions of
experts (expert judgment) and the instrument reliability test uses the internal consistency method with Cronbach's Alpha. Data analysis techniques using inferential statistics. Before a regression analysis is performed first, the prerequisite analysis tests are (1) normality test with the Shapiro-Wilk test, (2) linearity test by conducting a Test For Linearity.

3. Results and Discussion

The purpose of this study is to analyze the effect of innovative work activities on the self-development of productive teachers in the Automotive Engineering Skills Program. Before conducting a regression analysis, a prerequisite analysis consists of tests of normality and linearity. The results of the test are as follows:

<table>
<thead>
<tr>
<th>Variabel</th>
<th>Sig.</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovative Work</td>
<td>0.304</td>
<td>Normal</td>
</tr>
<tr>
<td>Self Development</td>
<td>0.155</td>
<td>Normal</td>
</tr>
</tbody>
</table>

Based on the results of the normality test with Shapiro-Wilk shows all data are normally distributed because of the value of Sig. greater than 0.05.

Based on the results of the linearity test using SPSS, the Sig. Deviation from Linearity is 0.374 because the Sig value is greater than 0.05, it can be concluded that there is a linear relationship between the variable of innovative work and the variable of self-development. After the data is tested for normality and linearity, then the data are analyzed using simple regression analysis with the help of the SPSS program.

<table>
<thead>
<tr>
<th>Variabel</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation coefficient (R)</td>
<td>0.679</td>
</tr>
<tr>
<td>Coefficient of Determination (R Square)</td>
<td>0.460</td>
</tr>
<tr>
<td>Significance level</td>
<td>0.000</td>
</tr>
<tr>
<td>Regression Equation Model</td>
<td>$Y=11.160 + 0.200X$</td>
</tr>
</tbody>
</table>

The results of the analysis obtained a correlation value of 0.679 which means the relationship between innovative work and self-development in the strong category. The coefficient of determination is 0.460 which means that innovative work activities have a contribution of 46% towards self-development. The significance level value is 0.000 which means the value is smaller than 0.05, then it can be concluded that the results are significant. Based on the calculation, the regression equation model is obtained as follows:

$Y=11.160+0.200X$

4. Conclusion

The results of this study are innovative work activities that have a strong and significant influence on self-development. The activity of innovative work can be an alternative solution for productive teachers in the Automotive Engineering Expertise Program in their self-
development. As a suggestion, research is needed to analyze the factors that influence the self-development of productive teachers in the Automotive Engineering Skills Program.

5. References


Prediction System of Police Officer Admissions Number using Analysis of Variance Method

TTA Putri1, HD Hutahaean2, RD Sari3, R Rahmadani4
PTIK-FT, Universitas Negeri Medan, Indonesia1,2,3,4
tansatrisna@unimed.ac.id

Abstract: Police officer admission attracts people to be able to contribute for their country. There could be many youths who want to participate on it. Based on that number, we believe that a prediction system about the admission of police officer is important to notice a decent candidate. This research generated a prediction system to find out how many police officers are received at each year. The object of this research is the North Sumatra Police Chief. This study used the ANOVA method, that is a two-way ANOVA procedure which is classified using statistical product and service solutions (SPSS) version 16 to determine the admission of prospective police officers from year to year. Supporting factors in the recruitment of prospective police officers is the ability of intelligence candidates to be seen from year to year.

Keyword: police officer admissions, prediction system

1. Introduction

Becoming a police officer is a very noble job because it serves as a servant of the state, maintaining national security, regulating the rules and regulations. Becoming a police officer is not easy because besides having to have a healthy and healthy body. The police must also be smart and agile, because they must be prepared in all conditions even as a threatening emergency.

Prediction is a process of estimating systematically about something that is most likely to occur in the future based on past and present information that is owned, so that errors (the difference between something that happens with the estimated results) can be minimized. Prediction does not have to provide a definite answer to events that will occur, but rather try to find answers as close as possible to happen. In predicting a problem, especially the number of admissions by police officers is quite difficult where the amount of revenue will certainly be difficult to determine.

The increasing interest of the people of Indonesia in wanting to become a police officer, it is very difficult to determine the number of police personnel received each year, because the number of police personnel every year has decreased and has also increased. In determining the number of reception of members of the Police there are several factors that are very influential in the reception of members of the Police for each year, namely, the criminal factor the higher the number of crimes that occur in North Sumatra, the number of reception of members of the Police that will be needed is also higher but if the number of criminals in North Sumatra is low, the number of admissions required by police is not large. As for other factors that affect the
recruitment of the police officer, such as the retirement factor of the police and regional expansion factors.

Therefore, the writer wants to predict the number of police officers received to find out how many people are needed to become a police officer that will be received every year. To predict the amount of acceptance, the writer uses a computer and software as the most efficient tool to examine the prediction system.

Analysis of Variance (ANOVA) is a method for breaking down total diversity of data into components that measure various sources of diversity. ANOVA is used if there are more than two variables. In Indonesian literature this method is known by various other names, such as analysis of variance, variance, and Analysis of Variance. Anova is one of the statistical analyzes that is often used to check the difference in mean values of two or more data groups. In general there are two applications of ANOVA, namely hypothesis testing and estimation [2].

In this ANOVA analysis a Two Way ANOVA procedure is often used which is called the design of a factor that is one of the Two Way ANOVA analysis tools. Anova is a method of testing hypotheses and predictions whose results can be interpreted. By using ANOVA, whether there is a significant difference between the predicted value and observational data.

Prediction

Prediction is a process of estimating systematically about something that is most likely to occur in the future based on past and present information that is owned, so that the error (the difference between something that happens with the estimated results) can be minimized. Predictions do not have to provide answers with certainty of events that will occur, but rather try to find answers as close as possible to happen. Many parties use the test for predictive purposes in order to screen and select candidates who have the potential to succeed in education and other jobs. [1]

Prediction Technique

Based on the technique used to predict the prediction can be divided into two parts, namely qualitative prediction and quantitative prediction.

Qualitative Prediction

Qualitative predictions are based on qualitative data from the past. Qualitative methods are used if past data from the variable to be predicted is absent, insufficient or less reliable. The results of predictions made are very dependent on the individuals who compose them. This is important because the prediction results are determined based on judgmental thoughts or opinions, knowledge and experiences of the constituents. Therefore this qualitative method is also called judgmental, subjective, and intuitive.

Quantitative Prediction

Quantitative predictions are based on quantitative data from the past. The results of predictions made depend on the method used in the prediction. With different methods different predictions will be obtained. The thing to note from the use of these methods is whether or not the method used and is determined by the deviation between the predicted results with the reality that occurs. A good method is a method that gives the values of differences or possible deviations. Quantitative prediction can only be used if there are three conditions as follows:
1. There is information about other circumstances.
2. The information can be quantified in the form of data.
3. It can be assumed that past patterns will be sustainable in the future.
ANOVA Method

Analysis Of Variance (ANOVA) is a method for breaking down total diversity of data into components that measure various sources of diversity. ANOVA is used if there are more than two variables. In Indonesian literature this method is known by various other names, such as analysis of variance, variance, and Analysis Of Variance. Anova is one of the statistical analyzes that is often used to check the difference in mean values of two or more data groups. In general there are two applications of ANOVA, namely hypothesis testing and estimation.[2][5]

Two Ways ANOVA

The concept of variance analysis is based on the concept of the F distribution and can usually be applied to various types of cases as well as in the analysis of the relationships between the various observed variables. In statistical calculations, analysis of variance is greatly influenced by the assumptions used such as the normality of the distribution, the homogeneity of variance and freedom from error.[3]

The normality assumption of distribution provides an explanation of the data characteristics of each group. The assumption of homogeneity of variance explains that the variance in each group is considered the same. While the free assumptions explain that each variance to the average in each group is mutually independent. If the t test is used for testing two samples, then the F test or ANOVA Hoyt is used for testing more than two samples.[4]

The assumptions used in the Anova Hoyt test are:
1. The populations to be tested are normally distributed.
2. The variance of these populations is the same.
3. Samples are not related to each other.

The steps for completing Two Way ANOVA are:
1. Hypothesis
   a. \( H_0 \): All treatments (columns, rows, interactions) that have the same average value.
   b. \( H_1 \): There are treatments (columns, rows, interactions) that have averages that are not of equal value (different).
2. Determine the significant level of \( \alpha \)
3. Two Way Anova Table
# Table 1 Two Way ANOVA

<table>
<thead>
<tr>
<th>Source of Uniformity (SK)</th>
<th>Sum of Squares (JK)</th>
<th>Free Degrees (db)</th>
<th>Middle Squared (KT)</th>
<th>f count</th>
<th>f Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Row Average</td>
<td>JKB</td>
<td>db numer1=</td>
<td>S²B = KTB=</td>
<td>f count = ( \frac{KTB}{KTG} )</td>
<td>db numer1=</td>
</tr>
<tr>
<td></td>
<td></td>
<td>r – 1</td>
<td>JKB ( \frac{r}{r-1} )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Column Average</td>
<td>JKK</td>
<td>db numer2=</td>
<td>S²K= KTK=</td>
<td>f count = ( \frac{KTK}{KTG} )</td>
<td>db numer2=</td>
</tr>
<tr>
<td></td>
<td></td>
<td>k – 1</td>
<td>JKK ( \frac{r}{r-1} )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>JKG</td>
<td>db denum=</td>
<td>S²G= KTG=</td>
<td>JKG ( \frac{1}{(r-1)(k-1)} )</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>JKT</td>
<td>r.k -1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Thomas Yunigunarto, Uji Anova, 2009

4. Settlement of JKT, JKK, JKB, JKG
   a) Sum of total squares
   \[
   JKT = \sum_{i=1}^{r} \sum_{j=1}^{k} x_{ij}^2 - \frac{T_{**}^2}{rk}
   \]
   b) Number of Column Squares
   \[
   JKK = \sum_{i=1}^{r} \frac{T_{i**}^2}{r} - \frac{T_{**}^2}{rk}
   \]
   c) Number of Row Squares
   \[
   JKB = \sum_{i=1}^{r} \frac{T_{i**}^2}{k} - \frac{T_{**}^2}{rk}
   \]
   d) Number of Error Square
   \[
   JKG = JKT - JKB - JKK
   \]

Where:
- k: The number of columns
- r: Many lines
- xij: Data in the i-th row, j-th column
- Q * h: Total (number) of the jth column
- r: Number of lines / blocks
- Ti *: Total (number) i-th row
- Q **: Total (number) of all observations

5. Determine the testing criteria by comparing Fcount with Ftable
   a. H₀ is accepted when Fcount ≤ Ftable
   b. H₁ is accepted when Fcount > Ftable

6. Decision
The decision is the final result of a study obtained from H₀ and H₁.
2. Analysis, Results and Discussion

Becoming a police officer is a very noble job because it serves as a servant of the state, maintaining national security, regulating the rules and regulations. Becoming a police officer is not easy because besides having to have a healthy and healthy body. The police must also be smart and agile, because they must be prepared in all conditions even as a threatening emergency. A prospective police officer, before being accepted must undergo a series of tests. In official terms, the entire selection process to become a member of the Police from the local level to the central level is free of charge.

Prediction is a process of estimating systematically about something that is most likely to occur in the future based on past and present information that is owned, so that the error (the difference between something that occurs with the estimated results) can be minimized. Prediction does not have to provide a definite answer to events that will occur, but rather try to find answers as close as possible to happen.

The number of police officers received from year to year could not be ascertained how many. Sometimes it has increased and sometimes it has decreased. This makes someone who wants to register, pessimistic about the opportunity to be accepted as a member of the police force so that predictions need to be made to find out the amount needed by the Regional Police in the coming year.

With the help of SPSS software version 16, it is hoped that it can help the public, especially for those who want to try the selection of Police acceptance, so that they can predict the number of police officers based on data from year to year.

In general, the total number of police force admissions is influenced by various factors that shape it. Some of these factors are factors that affect the number of recruits from the police force, increasing or decreasing. These factors include:

a) Factors of Crime
b) The factor of criminality can affect the number of recruits from the police force. The lack of security personnel from the police to combat the increasing and rampant crime, becomes a factor that requires the Regional Police to add new police officers so that new police officers can help other police tasks to deal with criminal actions that are often happens in Indonesia, especially in the area of North Sumatra.
c) Factors of Police Retirement
d) The total number of recruitment of police officers so far has also aimed to replace personnel who will retire. Therefore the regional police need a new police officer to replace the retired police personnel.
e) Regional expansion

Because of the vast territory of an area so it is difficult to develop an area, in order to achieve a civilized and organized society that requires a new security, such as the addition of police personnel so that the area is safe and secure. That is why the Regional Police open receipts every year.

Completion Analysis with the Analysis of Variance (ANOVA) Method

Analysis Of Variance (ANOVA) is a method for breaking down total diversity of data into components that measure various sources of diversity. ANOVA is used if there are more than two variables. In Indonesian literature this method is known by various other names, such as analysis of variance, variance, and Analysis Of Variance. ANOVA is a development of the Behrens-Fisher problem, so the F-test is also used in making decision. Analysis Variance was
first introduced by Sir Ronald Fisher, the father of modern statistics. In practice, analysis of variance can be a hypothesis test (more often used) or estimation (estimation, especially in the field of applied genetics). In general, analysis of variance tests two variances (or variances) based on the null hypothesis that the two variances are the same. The first variance is the variance between samples and the second variance is the variance within each sample (within samples). With this kind of idea, ANOVA with two samples will give the same results with the t-test for two mean (mean).

ANOVA is relatively easy to modify and can be developed for a variety of more complex forms of experiments. If you take the step of testing the average difference one by one (with t test) will take time, a lot of effort. In addition, there is a great risk of being wrong. For that, it has been found a way of analysis that contains smaller errors and can save time and energy, namely by ANOVA (Analysis Of Variances) basically the sample patterns can be grouped into:

a) All samples, both those in the first group to those in other groups, come from the same population. For this condition the null hypothesis is limited to no treatment effect.

b) The samples in Group One come from different populations from the sample populations in other groups. For this condition the null hypothesis can be read: there is no treatment effect between groups.

Table 2. Statistics on the number of police officers every year has increased and decreased.

<table>
<thead>
<tr>
<th>Academic Year</th>
<th>Male</th>
<th>Female</th>
<th>Number of Admission</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011/2012</td>
<td>64</td>
<td>6</td>
<td>70</td>
</tr>
<tr>
<td>2012/2013</td>
<td>241</td>
<td>0</td>
<td>241</td>
</tr>
<tr>
<td>2013/2014</td>
<td>879</td>
<td>16</td>
<td>895</td>
</tr>
<tr>
<td>2014/2015</td>
<td>517</td>
<td>278</td>
<td>795</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1701</td>
<td>300</td>
<td>2001</td>
</tr>
</tbody>
</table>

Implementation of the Anova Method

1) Anova = Test difference > 2 mean
2) It is not recommended to use alpha t inflation test
3) 1 - (1-a)
4) Recommended test f

Settlement of received amount:

1) Hypothesis
   a. $H_0$ = four academic years have the same level of difficulty.
   b. $H_1$ = At least one is not the same.
2) $\alpha = 0.05$
3) The Two Way Anova table
4) Settlement of JKT, JKB, JKK and JKG:

a) Sum of total squares

$$JKT = \sum_{i=1}^{r} \sum_{j=1}^{k} \chi_{ij}^2 - \frac{T_z^2}{rk}$$

$$= (64^2 + 241^2 + 879^2 + 517^2 + 6^2 + 0^2 + 16^2 + 278^2) - \frac{2001^2}{8}$$

$$= 1179683 - 500500.125 = 679182.875$$
b) Number of Column Squares

\[ JKB = \frac{1}{r} \sum_{i=1}^{r} \frac{T_{i}^2}{r} - \frac{T_{k}^2}{r} \]

\[ = \frac{70^2 + 241^2 + 895^2 + 795^2}{4} - \frac{2001^2}{4} = \frac{1496031}{4} - \frac{4004001}{4} \]

\[ = 374007.75 - 500500.13 = -126492.38 \]

c) Number of Row Squares

\[ JKK = \frac{k}{r} \sum_{i=1}^{k} \frac{T_{i}^2}{k} - \frac{T_{k}^2}{k} \]

\[ = \frac{1701^2 + 300^2}{2} - \frac{2001^2}{2} = \frac{2983401}{2} - \frac{4004001}{2} \]

\[ = 1491700.5 - 500500.125 = 991200.375 \]

d) Number of Error Square

\[ JKG = JKT - JKB - JKK \]

\[ = 679182.875 - (-126493.13) - 991200.375 \]

\[ = -185524.37 \]

<table>
<thead>
<tr>
<th>Source of Uniformity (SK)</th>
<th>Sum of Squares (JK)</th>
<th>Free Degrees (db)</th>
<th>Middle Squared (KT)</th>
<th>f count</th>
<th>f table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Row Average</td>
<td>JKB = -126493.13</td>
<td>db numer1=r-1=4-1=3</td>
<td>$\sigma^2 = KT_B = JKB$</td>
<td>$t = -42164.377$</td>
<td>$f = 0.8818141$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$t = JKB$ r-1</td>
<td>$t = -126493.13$</td>
<td>$JKB = -126493.13$</td>
</tr>
<tr>
<td>Column Average</td>
<td>JKK = 991200.375</td>
<td>db numer2=k-1=2-1=1</td>
<td>$\sigma^2 = KT_K = JKK$</td>
<td>$t = 991200.375$</td>
<td>$t = 0.6818141$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$t = JKK$ k-1</td>
<td>$t = 991200.375$</td>
<td>$JKK = 991200.375$</td>
</tr>
<tr>
<td>Error</td>
<td>JKG = -185524.37</td>
<td>db numer (r-1)(k-1) 3.1=3</td>
<td>$\sigma^2 = KT_G = JKG$</td>
<td>$t = -61841.457$</td>
<td>$t = -16.028091$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$t = JKG$ (r-1)(k-1)</td>
<td>$t = -61841.457$</td>
<td>$JKG = -185524.37$</td>
</tr>
<tr>
<td>Total</td>
<td>JKT = 679182.875</td>
<td>r.k-1=4.2-1=7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Conclusion of Analysis**

a. Reject $H_0'$, and conclude that the amount of revenue each year experiences unequal difficulties.

b. Receive $H_0''$, and conclude that the four school years have an unequal number of members of the Police force.

To make it easier to analyze the process, flowcharts are used on the running system. The flowchart used can be seen in Figure 1 below:
3. Conclusion

Based on the previous description, the author can provide the following conclusions:
1. Crime is the most dominant factor in determining the number of admissions of police officers in addition to the police retirement period
2. The implementation of the ANOVA method in predicting the number of police personnel every year tends to increase.
3. Two way ANOVA procedure can help to compare the amount of revenue from year to year.

4. References

Implementation of User Centered Design Method in E-Commerce Book Sales Application

R Rahmadani¹, Mendoza, M. D. ², RD Sari³, and TTA Putri⁴
{renirahmadani@unimed.ac.id¹, aenaen@unimed.ac.id², ressy@unimed.ac.id³, tansatrisna@unimed.ac.id⁴}

PTIK - Universitas Negeri Medan, Indonesia¹,²,³,⁴

Abstract. Placement of the end user as a center in the system development process is a philosophy of UCD (User Centered Design). UCD method can help end users to overcome the difficulty of reading and translating the documents that exist in every development. The UCD approach has been supported by a variety of techniques, tools, methods, procedures and processes to help design interactive systems to be more user-centered. In the UCD method the user is at the highest level on all graphical interfaces that are used in conjunction with the entire admin content of the information. The user interaction with the information admin must have the same comfort as his experience using other systems. This writing aims to design an e-commerce application with the UCD method of selling books and providing information relating to books. The methods used for collecting data are interviews and observation of end users, and literature studies. The expected outcome of this design is to be able to provide better services, especially in providing books desired by the buyer.

Keywords: Book Sales, User Centered Design, E-Commerce.

1. Introduction

Human needs for information is currently increasing, this is in line with the rapid development of technology both in the development of software and hardware. The internet is a form of technological development that can be used to access news, observe business developments, sell and buy transactions, interact with other people through social networks, chat or just browse. Sellers and buyers of goods and services do not have to be in the same place to do the buying and selling process. Internet tools can be used to connect sellers and buyers with a system called e-commerce.

Amazon.com won the Reader's Choice Award in the best e-Commerce web design category in 2009. However, many e-commerce sites do not have a design structure like Amazon.com. Most of the e-commerce sites today have lost their main goal as e-commerce websites and have decreased the usability rate. Many users who are ordinary people who have difficulty understanding and using their site. It needs to be observed before building a web site so that the site design can be based on the user (user-centered-design) and in accordance with the original purpose of why the site was built.

E-Commerce (Electronic Commerce) is a current popular topic that has a major impact on economic and retail services. Many initiatives have arisen in a short time due to e-commerce, such as smart card innovations that facilitate e-commerce, remote payments, and electronic commerce.
checking[1]. The capacity of the internet to access, organize and communicate information in a more efficient way brings a new formula to the relationship between users and entrepreneurs. It also raises new economic and business agents. E-commerce development offers good opportunities for producers and retailers, but this also poses challenges for organizations, with demands for knowing sales strategies and knowledge of buyers in more depth [2].

By using information technology, e-Commerce can be used as a solution to assist producers in the face of competition. The high sales competition that emerged requires that producers can provide a good response. The use of e-commerce can increase the cost efficiency and productivity of producers, so as to increase the ability of producers to compete.

E-Commerce

E-commerce is an innovation process whose approach looks at the difference between fixed and virtual stores. The benefits of e-commerce can be seen from how activities and tasks are carried out at each store, and how to transfer ownership, costs, and efficiency. The evaluation process carried out shows the benefits of using the internet in increasing business efficiency[3].

According to the Information System Success Model DeLone & McLean there are 6 dimensions of success that can be applied in an e-commerce environment[4]:

1) System quality, used to measure e-commerce characteristics are adaptability, availability, usability, reliability, and response time. This is an example of the quality desired by e-commerce system users.

2) Information quality related to content in e-commerce. Content on the web must be as desired, complete, relevant, easy to understand, and safe for buyers and sellers who will carry out transactions through the internet on an ongoing basis.

3) Service quality, all support provided by service providers is applied whenever the service is provided by an information systems department or organizational unit or even an internet service provider. This dimension is the most important dimension in e-commerce because now users are customers and not employees. Therefore poor service will cause loss of customers and sales.

4) Usage measures everything from website visits, instructions on the web, information returns and transaction execution.

5) User satisfaction is the most important thing in measuring customer opinion on e-commerce systems and must cover the entire customer experience from information gathering through transactions, payments, receipts, and services.

6) Net benefits are used to measure the degree of success, because it captures the balance of positive and negative impacts of e-commerce on customers, providers, employees, marketing organizations, industry, economy, and society as a whole.

UCD (User Centered Design)

User-centered design can be categorized as a problem-solving stage that requires designers to analyze and predict how users use interfaces and test the validity of their opinions regarding user habits in the use of interfaces in real life. In designing a web or a system, UCD must provide the best service for users and online shop owners[5]. The quality of the user interface and the quality of information provided by e-commerce services have a direct impact on increasing customer satisfaction and loyalty in the e-commerce market[6]. Therefore it is very important to know the user before starting the design[5].

Usability is a term that has a different definition in every field. In the field of industrial engineering, product research and development, computer systems, and science library usability
are associated with lessons about interaction between humans and machines and commitment to users. Dumas and Reddish said that Usability means that people who use products can complete their tasks quickly and easily[7].

User-centered design incorporates the principle of usability into product design and places a focus on the user during project development. According to Gould and Lewis, there are three UCD principles: an initial focus on tasks and users, empirical measures on product use, and interactive design to get user input on design and modification[7][8].

Software development using UCD, users are involved at all stages. This includes analysis, design, development stage, ordering process, customer support and advertising. Instead of being technology driven, user centered design is user driven. User requirements and user interface design are not only accidental or additional aspects that occur during the process, but must be a driver of technical processes[9][10].

During the analysis phase, UCD uses many interview techniques to know the user. In the context of knowing the work of user, techniques that are often used in individuals is a face-to-face setting. This technique observes the user as long as they complete tasks on work that involve 'thinking aloud' or 'talk right after.' Another interview investigates user information related to the task and involves several types of card sorting. Human Computer Interaction researchers conclude that traditional sales techniques that focus on groups and are less useful because the techniques are carried out in the context of the actual task[10].

3. Analysis, Results and Discussion

In general, the method is a comprehensive plan of a series of activity processes that are in accordance with the program designed. The following are the aspects that need to be considered for a successful system.

a) Online Book Shops Script

<table>
<thead>
<tr>
<th>Sript Name</th>
<th>Component</th>
<th>Specific Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Website Maintenance</td>
<td>Login</td>
<td>- Input username and password</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Log in administrator web page.</td>
</tr>
<tr>
<td></td>
<td>Manage books reservations</td>
<td>- Checking book availability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Checking payment confirmation/ Book order</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Approving / rejecting payment confirmation or books reservation.</td>
</tr>
<tr>
<td></td>
<td>News update</td>
<td>- Fill in news date</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Fill in news title</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Fill in news detail</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. News Saving</td>
</tr>
<tr>
<td></td>
<td>Books updating</td>
<td>- Get in to Books Menu</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Fill in book’s name</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Fill in book’s description</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Books Categorize</td>
</tr>
<tr>
<td>Script Name</td>
<td>Component</td>
<td>Specific Action</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------</td>
<td>---------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Website</td>
<td>Login</td>
<td>- Input username and password&lt;br&gt;- Log in administrator web page.</td>
</tr>
<tr>
<td>Maintenance</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Respond to</td>
<td>- Fill in username and password&lt;br&gt;- Get in to forum page</td>
</tr>
<tr>
<td>Member Forum</td>
<td>Login</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Search new message</td>
<td>- Get in to forum page&lt;br&gt;- Enter the search period&lt;br&gt;- Select the latest messages that are displayed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Respond to Messages&lt;br&gt;5. Message storage</td>
</tr>
</tbody>
</table>

### Table 2: Script for Customers

<table>
<thead>
<tr>
<th>Script Name</th>
<th>Component</th>
<th>Specific Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access exhibition information</td>
<td>Reading News</td>
<td>- Look into the news column&lt;br&gt;- Choose the news title&lt;br&gt;- Read news details</td>
</tr>
<tr>
<td></td>
<td>Looking for books data</td>
<td>- Enter the book search menu&lt;br&gt;- Choose item categories&lt;br&gt;- Enter the book key you are looking for&lt;br&gt;- See book listings of search results</td>
</tr>
<tr>
<td></td>
<td>Ordering books</td>
<td>- Enter the book search menu&lt;br&gt;- Choose a book category&lt;br&gt;- Enter the book key you are looking for&lt;br&gt;- Fill in the order data (name, telephone number, shipping address)&lt;br&gt;- Sending order data&lt;br&gt;- Waiting for payment confirmation max 2 x 24 hours</td>
</tr>
<tr>
<td></td>
<td>Filling Guest Book</td>
<td>- Enter the guest book column&lt;br&gt;- Fill in visitor data (name, email)&lt;br&gt;- Fill out messages / questions / suggestions&lt;br&gt;- Save message</td>
</tr>
</tbody>
</table>
b) Customizing
   a. The facility to customize the website is given to the user and admin with consideration of the needs and interests of each party.
   b. Customization facilities for users: language selection (Indonesian and English)
   c. Customization facilities for administrators aim to make administrators easily maintain and adjust the appearance and content of the website as needed

c) Customization facilities provided to website administrators
   a. Customizing website content
   b. Customizing banner and header images
   c. Polling customization
   d. SMS Customization
   e. Customizing guest book
   f. Add, delete, edit menu
   g. Selection of menu classification, which consists of: main content, potential and links.
   h. Add, delete edit sub menu
   i. Ordering menu display
   j. Fill in the news details on each menu

4. Conclusion

In this paper we have examine that e-commerce is a sales system that is dynamic, web-based, and can be integrated with social media to increase promotion. The company needs to design its e-commerce page using user centered design to maintain closeness between customers and companies and make these customers comfortable by knowing customer desires, making promos, and bonuses, so the company has gained intangible benefits. This advantage is seen from the increase in customers and customer loyalty.

5 References


Mixed Heuristic Algorithm As String Matching For Search Document

RD Sari¹, R Rahmadani², TTA Putri³
{ressy@unimed.ac.id¹, renirahmadani@unimed.ac.id², tansatrisna@unimed.ac.id³}

¹,²,³ PTIK-FT, Universitas Negeri Medan, Indonesia

Abstract. The computer provides document search based on the document file title. So this makes it difficult for users to find documents, if the user forgets the file title of the document. String matching algorithm is the basic component for data searching. Search engine requires an algorithm that can work quickly and can sort the documents according to the level of compatibility. One of the algorithms that match is the Mixed Heuristic. These algorithms perform a search pattern or query not just against a word, but can be a sentence of more than one word. In addition, these algorithms also perform ranking of relevant documents. This paper shows the analysis of the level of accuracy using precision and recall of the results given by search engines by using the Mixed Heuristic algorithms for string matching, and the analysis of documents from the results given by search engines.

Keywords: search engine, string matching, mixed heuristic

1. Introduction

It is very often for people to use computers to store documents. The computer provides document search based on the document file title. So this makes it difficult for users to find documents, if the user forgets the file title of the document. For this reason, a search engine is needed that can search documents quickly and be sorted according to the level of compatibility. Mixed Heuristic Algorithm is an algorithm that adopts the well-known Heuristic algorithm, which is Brute Force. Mixed Heuristic Algorithm does a search pattern or query not only for 1 word, but can be a sentence that is more than 1 word. A string matching pattern shifts the pattern by 1 word, if a match has not been found.

The implementation of Mixed Heuristic algorithm as string matching in document search will perform the calculation and analysis of the accuracy with the precision and recall parameters based on the number of datasets. And also analyzed the results of ranking given by the system. Mixed Heuristic Algorithm is part of the system searching phase. The results given will be tested on several users of the system so that the value obtained is the average value of the test results. Analysis of ranking results is also carried out testing of several users.

Algoritma Mixed Heuristic

According to Atif Agha Hassan, the Mixed Heuristic algorithm is the result of the adoption of an algorithm using the Heuristic technique, the Brute Force. Mixed Heuristic Algorithm does a search pattern or query not only for 1 word, but can be a sentence that is more than 1 word. A string matching pattern shifts the pattern by 1 word, if a match has not been found. This
algorithm first works by utilizing exact String Matching and if a solution is not found to be exact or 100%, then this algorithm will estimate the matching string by calculating the probability of success and the most feasible solution. The match percentage is saved for use when ranking [1].

**Implementation Mixed Heuristic Algorithm.**

In doing string matching, the Mixed Heuristic algorithm has a pattern. For the first pattern, the Mixed Heuristic algorithm relies on matching strings exactly as given keywords. And if an exact solution is not found, then the subsequent matching uses a matching estimate string to calculate the probability of success and get the most feasible solution [1]. Using this estimated string is due to user behavior that changes the search keyword if a match is not found with the keyword used before, such as minimizing the search string again and again or multiple times adding a string to the keyword [1].

If a new user uses a search engine and doesn’t know the search strategy, it will be difficult to find results that are suitable for the user. For example can not find what is needed or can not find the right results. By using this Mixed Heuristic algorithm, it will be given matching patterns with keywords that come from the user. With this algorithm, users do not need to change keywords if a match is not found. Because this algorithm has provided combinations of keywords given by the user.

Given an example of a Mixed Heuristic algorithm pattern so that it can be seen the shape of the pattern given by the Mixed Heuristic algorithm.

Example: $n = 5$, $n$ is the number of words in the search string

```
  a b c d e  1 1 1 1 1
  b c d e a  1 1 1 1 1
  c d e a b  1 1 1 1 1
  d e a b c  1 1 1 1 1
  e a b c d  1 1 1 1 1
  a b c d   1 1 1 0 1
  a b c e   1 1 1 0 1
  a b d e   1 1 1 0 1
  a c d e   1 1 0 1 1
  b c d e   1 1 1 0 1
  a b c    1 1 1 0 0
  a b e    1 1 0 0 1
  a d e    1 0 0 1 1
  c d e    1 0 0 1 1
  b c d    1 1 1 0 0
  a b      1 1 0 0 0
  a e      1 0 0 0 1
  d e      0 0 0 1 1
  c d      0 0 0 1 1
  b c      0 0 0 1 1
  a       0 0 0 0 1
  e       0 0 0 0 1
  d       0 0 0 1 0
  c       0 0 1 0 0
  b       0 1 0 0 0
```
2. Research Method

The system built is a system that implements Mixed Heuristic algorithm in matching strings and is applied in searching indexes. The input from the system is an Indonesian language news document downloaded from www.kompas.com. This document was previously saved as *.txt. Figure 1 below is a picture of the stages of building a system.

![Fig 1. Stages of Development System](image)

The explanation of Figure 1 is as follows:

1) **Searching:** This process of searching a document by the user, starts with the user entering a query in the search engine. At this stage, the Indexing process is performed on queries entered by the user. The results of the indexing in the form of a collection of terms, will be matched with the query entered by the user [2].

2) **Pre-processing:** Processing is done in this stage to convert text into usable data [3]. In this process include:
   a. **Tokenizing:** the stage of cutting the input string based on each word that makes it up. All words in a document will be broken down according to the words of the compiler. At this stage a case folding process is also carried out, which changes all the letters in the document into lowercase letters. Only letters atau A-Z ', a-z ', and numbers' 0-9 'are accepted [4].
   b. **Stoplist:** Stoplist is the process of deleting words that are very often displayed in documents such as: and, or, not and so on [4].
   c. **Stemming:** This stage performs the process of returning various word formations into the same representation. Stem (root word) is the part of the word that remains after the affix is removed (prefix and suffix) [4].

3. System Design

In the system to be built, functional requirements that must be met are:

1. Input data is an Indonesian language news document with *.txt format done offline.
2. Doing the process of cutting the words that compose the sentence in the document into tokens (tokenizing stage), the process of removing common and unimportant words
(stoplist) and returning the words to their basic form (stemming stage). The stemming algorithm uses the Porter algorithm which is adapted to Indonesian [5].

3. Do the indexing process.
4. Perform the searching process using the Mixed Heuristic algorithm.
5. See the level of relevance of documents produced by Mixed Heuristic algorithm based on document ranking.
6. Seeing the searching performance of relevance values, namely precision and recall.

**Analysis System Test**

System testing uses the results given by the system, which then results will be given the value of precision, recall. Tests are carried out by 7 users to get the value of the number of relevant documents retrieved. The average value is the value used for the calculation of precision and recall [6].

\[
\text{precision} = \frac{\text{Number of relevant documents retrieved}}{\text{The number of documents retrieved}}
\]

\[
\text{recall} = \frac{\text{Number of relevant documents retrieved}}{\text{Total number of relevant documents}}
\]

3. Results and Discussion

3.1 Analysis of Testing Results on Number of Documents Viewed from Precision and Recall

After testing with a predetermined scenario, the results are obtained that the greater the document, the greater the chance for users to get relevant data. For more details, Figure 2 is a graph that shows the relationship of the number of documents and the value of precision, recall.

---

![Graph of Test Results for Document Number](image)

**Fig 2.** Graph of Test Results for Document Number

3.2 Analysis of Test Results for Term Amounts in Queries

The optimal results for this test will be achieved with the condition that all possible term combinations are retrieved by the system and the results are relevant according to the user,
because the system with the Mixed Heuristic algorithm works by matching strings for all query combinations. Can be seen from the graph, the optimal results achieved for examples 1 and 3.

---

**Fig 3.** Graph of the number of terms to the value of precision

**Fig 4.** Graph of the number of terms to the value of precision 20

**Fig 5.** Graph of the number of terms to the recall value

### 3.3 Analysis of Test Results of Term Effect with Stopword on Queries

The more the number of terms, the value of precision and recall tends to fall because the possibility of finding documents with sentences that match or equal to the query is increasingly difficult. The combination of terms given by the system more and more, the possibility of relevant documents is also less because the system provides documents that come from a combination of one or two query terms. This can be seen from the graph below.
Fig 6. Graph of precision values to terms with stopwords

Fig 7. Graph value of precision 20 to term with stopword

Fig 8. Graph of recall value of terms with stopword

3.4 Analysis of Test Results of Term Effects without Stopword on Queries

For the use of terms without a stopword in the query, the preprocessing process will not change the length of the query term. From the three graphs below, we can see that the values of
precision and recall tend to go down because the possibility of finding documents with the same sentence or the same as the query becomes more difficult.

![Figure 9. Value of precision term without stopword](image)

![Figure 10. The value of precision is 20 terms without stop word](image)

![Figure 11. The value of recall term without stop word](image)

### 5.5 Analysis of System Ranking Test Results

This test is done because the workings of the Mixed Heuristic algorithm not only provide relevant document results, but also provide value to the document. This value is used for ranking documents when the system gives results to the user. The following document ranking formula is used:

\[
\text{Ranking value formula} = \frac{\text{Incorrect number of documents retrieved}}{\text{The number of relevant documents retrieved}}
\]  

(3)
Following are the test results for ranking the system using 250 document numbers and the number of terms given in the following table:

**Table 1. System ranking results**

<table>
<thead>
<tr>
<th>Jumlah Term</th>
<th>Jumlah Dokumen</th>
<th>Jumlah Relevan ter-retrieve</th>
<th>Unsur Perangkingan yang Relevan (20 teratas)</th>
<th>Nilai persentase kesalahan (20 teratas)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25</td>
<td>21</td>
<td>1-20</td>
<td>0%</td>
</tr>
<tr>
<td>2</td>
<td>29</td>
<td>6</td>
<td>7, 12, 13, 16, 17, 19</td>
<td>0%</td>
</tr>
<tr>
<td>3</td>
<td>28</td>
<td>27</td>
<td>1-20</td>
<td>0%</td>
</tr>
<tr>
<td>4</td>
<td>36</td>
<td>4</td>
<td>1, 2, 3, 4</td>
<td>0%</td>
</tr>
<tr>
<td>5</td>
<td>48</td>
<td>15</td>
<td>1, 2, 3, 8, 17, 18</td>
<td>60%</td>
</tr>
</tbody>
</table>

From table 1, we can see the top 20 ranking has a low percentage for the error rate of the ranking retrieved by the system. With an average percentage of 12%.

4. Conclusion

1) Mixed Heuristic Algorithm can be applied for document search, marked with a recall value above 0.8 from a scale of 0-1 for the five tests.
2) Mixed Heuristic Algorithm can be used to search documents with large data. This can be seen from the test results, namely the value of precision and recall close to value 1.
3) The Mixed Heuristic algorithm provides accurate results if the search query only uses 2 terms.
4) Ranking using the Mixed Heuristic algorithm gives good results, with an average value of 12% for incorrect results from the top 20 retrieved documents.

5. References


The Influence of Pillar Form to Local Mechanism

Sarra Rahmadani¹, Syarvina²
{sarra_ft@unimed.ac.id¹, syarvina@gmail.com²}

Universitas Negeri Medan, Indonesia¹
Universitas Sumatera Utara, Indonesia²

Sarra-ft@unimed.ac.id

Abstract. Basically, rivers have a dynamic flow character that often causes changes in flow morphology. The pillar is one form of water that can affect changes in flow patterns, because its presence obstructs river flow. Changes in flow patterns that occur can result in scouring around the pillars. The purpose of this study to determine the effect of a pillar of the local scour potential that occur around the pillar with the discharge, \( Q = 1.0 \) liter/\( s \) and know the pattern and depth of scour around the pillar. The study was conducted on permanent uniform flow conditions with variations in the shape of the pillars. The pillar shape variations used are cylinder, rectangular and rectangular wide shape nose. The study was conducted at the Laboratory of civil engineering hydraulics, Universitas Sumatera Utara (USU), using a flume (length: 8 m, height: 0.3 m and width: 0.076 m). The material used in the form of sand, with model tested for 250 minutes for running. The observation results obtained the value of the maximum scour depth on the cylinder, rectangular and rectangular wide shape nose with discharge, \( Q = 1.0 \) liter/\( s \) respectively are 25 mm, 30 mm, and 39 mm.

Keywords: Discharge, Local Scour, Pillar.

1. Introduction

The process of scouring on rivers can occur due to the influence of the building of water around the river. The water building can be a pillar of a bridge. Because of the existence of pillar, causing the river flow is blocked. This can result in scouring/erosion and sediment/deposition deposits around the pillars. In addition, there is also a change in flow characteristics such as flow velocity and turbulence that causes changes in sediment transport.

The scouring that occurs around the pillar is the influence of the vortex system that arises due to an obstacle to flow by the pillar. When the flow approached the pillar, the pressure will decrease and stagnation causing downward flow (down flow) or a stream of high velocity into a low speed. This down flow reaches a maximum peak when it is at the bottom of the channel.

From various variations of pillar shapes such as cylinder, rectangular, rectangular with semicircular ends, rectangular wide shape nose, lenticular and ellipse front sides can have a different effect on flow patterns. Cylinder, rectangular and rectangular wide shape nose are forms of various variations of pillar shapes that are often used in bridge construction planning, because in terms of pillar shape itself it is quite easy in the manufacturing process and in theory ticks, scouring that occurs on rectangular pillars bigger than a pillar with a flat front side. The purpose of this study was to determine the influence of a pillar of the local scour...
around the pillar, obtain a picture of the development process and getting crushed against time to scour pattern around the pillars with a constant discharge \( Q = 1.0 \text{ liter/s} \).

This study has the following limitations:
- Variation of pillar models: cylinder, rectangular and rectangular wide shape nose
- Scour behavior reviewed around the pillar
- The material used in this study is sand
- The observed flow pattern is a three-dimensional contour pattern with measurements of the \( x, y \) and \( z \) direction depth.
- The flow used is flow without any sediment content (clear water scour).
- The effect of the flume boundary wall on the scour that occurs is not taken into account.
- Using a flume with a length: 8 m, height: 0.3 m and width: 0.076 m.

**Scouring**

The eruption can be divided into three sections according to Ettema and Raudkivi \([1][2]\) namely:

a) General scouring, scouring that occurs as a result of natural processes and not at all related to the presence or absence of river buildings.

b) Scouring is localized (constriction scour), scouring caused by narrowing of the river channel so that the flow becomes centralized.

c) Local scour is a direct result of the structure in the river channel.

Where local scouring according to Yulistiyanto \([3]\) is a scour that occurs around the bridge or pillar abutments, caused by a vortex system due to interference with the flow pattern due to obstacles. Pillar approach flow and stagnation pressure will decrease and cause a down flow that flows from the high speed becomes low. The strength of down flow will reach its maximum when it is right at the bottom of the channel.

According to Hanwar \([4]\), the scour mechanism around the bridge pillar is when the sediment particles covering the pillar start to move, then the scour process begins to form. These eroded particles will follow the flow pattern and bottom from near the pillar towards the bottom of the river. Furthermore, if these sediment particles are more eroded then the scouring will reach maximum depth. Factors influencing scour depths such as flow velocity in river basins, sediment gradation, pillar size and grain size of base material, river bed depth from water level, pillar position, and pillar shape.

**The scour equation for regular flow**

Depth of scour depends on several variables \([5]\), namely the characteristics of liquid, base material, flow in the channel and the shape of the bridge pillar written \( y_s = f(\rho, v, g, d, \rho_s, y_0, U, b) \). In clear water conditions for the depth of grinding can be calculated through the equations of Raudkivi \([1]\), as stated in equation (1) below:

\[
yse = 2.3 K_\sigma K_s K_\alpha K_{dt} K_d
\]

\( K_d \): fluid height factor
\( K_s \): pillar form factor
\( K_{dt} \): pillar size factor
\( K_\alpha \): pillar position factor
\( K_\sigma \): function of the geometric standard deviation of the particle size distribution
\( \alpha \): angle comes flow
In Melville and Sutherland (1988) explained, that the depth of scouring of local scour, \( y_s \), on the pillar can be written in equation (2):

\[
yse = K_I \sigma K_s K_\alpha K_d K_d
\]

- \( K_d \): flow height factor
- \( K_I \): flow intensity factor
- \( K_s \): pillar form factor
- \( K_\alpha \): pillar position factor \([0.78 \left( \frac{y_0}{b} \right) 0.225]\)
- \( K_d t \): pillar size factor
- \( K_\sigma \): function of the geometric standard deviation of the particle size distribution

Information:

\( K_I = 2.4 \left( \frac{U}{U_c} \right) \) if \( \frac{U}{U_c} < 1 \)
\( K_I = 2.4 \) if \( \frac{U}{U_c} > 1 \)

2. **Research Method**

The study was conducted at the Hydraulic Laboratory of the Department of Civil Engineering, Faculty of Engineering, University of North Sumatera (USU), using recirculating sediment flume (Figure 1), with position model of a pillar made of wood. The pillar model (Figure 2) is placed in the middle of the flume at a distance of 3.5 m from the upstream and then arranged with sand material that has been spread along the flume. This research was conducted by regulating discharge, \( Q = 1.0 \text{ liter/s} \).
Observation process scour depth is done by noting the depth of scouring of the early running for a specified time, that is 1-10 minutes recorded every interval of 1 minute, 10 - 40 minute interval is recorded every 5 minutes, 40 - 70 minutes are recorded each interval of 10 minutes, 70 - 250 minutes are recorded at 15-minute intervals. Observation of scour depth is recorded continuously during equilibrium time.

The contour data taken is scour contour data around the pillar. Where the data is measured after running has been completed. You do this by slowly reducing discharge so that scouring around the pillar is not disturbed by changes in the discharge. After that, three dimensional measurements were taken and the sand was leveled again. So, the process runs like that done in return again with the form of the next pillar.

3. Results and Discussion

Measurements on the development of local scour depth and contour data of scouring that occurs around the pillar performed through visual observation and measurement methods it uses the tool point gauge. Measurement contour data is then processed using a software, which is a surfer to get a surface contour display around the pillar.

3.1 The depth scour on cylinder pillar against time

Measurement of scour depth development of the time around the pillars of the cylinder is done at 8 observation point as shown in Figure 3 below:
The results of observations of the scour depth to time on the cylinder pillar with discharge, \( Q = 1.0 \text{ liter/s} \), are shown in Figure 4, which shows the relationship of scour depth to time.

In Figure 4 it is shown that point 1 is the point that experiences the greatest scour depth compared to other observation points, while point 5 is the point that experiences the smallest scour depth. This happens because of the location of the pillar.

### 3.2 The depth scour on rectangular pillar against time

Measurement of scour depth development of the time around the pillars rectangular performed at 8 observation point as shown in Figure 5 below:
The results of observed scour depth to time on a rectangular pillar with a discharge, \( Q = 1.0 \) liter/ s, are shown in Figure 6, which shows the relationship of scour depth to time.

![Fig 6. Development of scour depth with time on a rectangular pillar](image)

The greatest scour development occurred at the observation point 1 as shown in Figure 6. The point are the pillars of the front, while the development of scours the smallest pitch so at the observation point 5 which is the pillar of the back.

### 3.3. The depth scour on rectangular wide shape nose pillar against time

Measurement of the development of scour depth with respect to time around a rectangular wide shape nose pillar is performed at 8 points of observation as shown in Figure 7 below:

![Fig 7. Position of the observation point of a rectangular wide shape nose pillar](image)

The results of observed scour depth to time on a rectangular wide shape nose pillar at discharge, \( Q = 1.0 \) liter/ s, are shown in Figure 8, which shows the relationship of scour depth to time.
Fig 8. Development of scour depth with time on a rectangular wide shape nose pillar

At figure 8 shows that the largest scour development achieved at the point of observation 1 where in the position is almost the same as the third point is on the side of the front pillar. The smallest scouring development is achieved at observation point 6 located behind the pillar, resulting in the accumulation of sand material.

Of the three pillar shapes tested, there was a similarity regarding the position of the observation point where on the observation side the front of the pillar experienced the deepest scouring. It is caused by factors stream which initially directly on the front side pillars point and opposite on the back side of the pillar will occur accumulation of sand material because it does not impact directly streaming. From the sides of the jetting pillar it forms a proper pile up at the observation point behind the pillar.

The following Table 1 that shows the value of the depth of scour maximum each pillar shape with an 8 point observations.

<table>
<thead>
<tr>
<th>Shape</th>
<th>Depth of Scour Ds/ b Observation Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder</td>
<td>-0.516 -0.700 -0.766 -0.816 -0.833 -0.800 -0.766 -0.733</td>
</tr>
<tr>
<td>Rectangular</td>
<td>-0.988 -0.833 -0.895 -0.767 -0.584 -0.736 -0.777 -0.755</td>
</tr>
<tr>
<td>Rectangular wide shape nose</td>
<td>-1.3 -0.922 -1 -0.847 -0.833 -0.745 -0.8 -0.9</td>
</tr>
</tbody>
</table>

Source: Observation Results

From Table 1 it appears that the maximum scour depth value of the three pillar shapes occurs in the shape of a rectangular wide shape nose pillar, precisely at observation point 1 which is -1.3. The maximum scour depth that occurs in the cylinder pillar is 25 mm, the rectangular pillar is 30 mm, and for the rectangular wide shape nose pillar is 39 mm.
3.4 Scour pattern around the pillar cylinder

Contour measurement is done by point gauge and contour coordinate taking, namely for X perpendicular to the direction of flow (horizontal), Y in the direction of flow and Z perpendicular to the direction of flow (vertical). The scour depth (Z direction) is measured by the interval of the distance for the X direction of 1 cm and for the Y direction of 1 cm. Point reading gauge produce point of depth (Z direction) of each coordinate directions X and Y directions on the surface of the base material with different patterns of scouring in every variation pillar. Furthermore, the data and measurement results are processed to obtain a contour map using the *surfer* program. Figure 9 shows an illustration of the cylinder pillar seen above on the flume.

![Figure 9. Top view of cylinder pillar on flume (without scale)](image)

Figure 10 below shows the results of the contours of the scour formed around the cylinder pillars by the *surfer* program. With this Surfer program, it can also be seen as isometry of the scouring of the cylinder pillars as shown in Figure 11.

![Figure 10. Contour scour pattern cylinder pillar](image)  ![Figure 11. Isometry scour patterns cylinder pillar](image)

The isometric figure the scouring pattern of the cylinder pillar is clearly visible local scouring that occurs around the pillar, which displays the largest scour in the direction of flow.
3.5 Patterns of scouring around the rectangular pillar

Figure 12 is a sketch of an image showing the placement of a rectangular pillar on the flume.

![Figure 12: Top view of rectangular pillars on the flume (without scale)](image)

Generally, the scour pattern that occurs in this rectangular pillar is relatively the same as the cylinder pillar, which starts from the flow originating from the upstream which is blocked by the pillar, which can cause a vortex that occurs due to the velocity of the flow that hits the front pillar into a compressive force on the pillar surface. The vortex which diminishes from the front pillar and then grind the side pillar and local scour on the pillar. For contour patterns of scour and isometry pillars of rectangular can be seen in Figure 13 and Figure 14.

![Figure 13: Contour scour pattern rectangular pillar](image)

![Figure 14: Isometry scour patterns rectangular pillar](image)

In Figure 14, it can be seen clearly the accumulation of material behind the rectangular pillar, this is caused by the flow that flows obstructed by the pillar, the obstruction causes the material to not be carried towards the downstream (sediment) flow.

3.6 Patterns of scouring around the rectangular wide shape nose pillar

Sketch of the placement of a rectangular wide shape nose pillar of the flume can be seen in the following Figure 15:
Fig 15. Top view of the rectangular wide shape nose pillar of the flume (without scale)

Fig 16. Contour scour pattern rectangular wide shape nose pillar

Fig 17. Isometry scour patterns rectangular wide shape nose pillar

In general, the scour patterns that occur in the three pillar shapes are relatively the same. Starting from a stream originating from the upstream that is blocked by the presence of a pillar, can cause a vortex that occurs due to the velocity of the flow that hits the front pillar into a compressive force on the surface of the pillar. Vortex which eroded part front pillar and then grind the side pillar and local scour on the pillar.

3.7 Calculation local scour depth according to the equation Raudkivi (1991)

**Cylinder pillar**

\[
K_{\sigma} = 0.8; K_s = 1.0; K_\alpha = 1.0; K_{dt} = 0.95; K_d = 1.0
\]

\[
y_{se} = 2.3 \times K_{\sigma} K_s K_\alpha K_{dt} K_d
\]

\[
y_{se} = 2.3 \times 0.8 \times 1.0 \times 1.0 \times 0.95 \times 1.0 = 1.784
\]

**Rectangular pillar**

\[
K_{\sigma} = 0.8; K_s = 1.22; K_\alpha = 1.0; K_{dt} = 1.0; K_d = 0.55
\]

\[
y_{se} = 2.3 \times K_{\sigma} K_s K_\alpha K_{dt} K_d
\]

\[
y_{se} = 2.3 \times 0.8 \times 1.22 \times 1.0 \times 1.0 \times 0.55 = 1.235
\]
Rectangular wide shape nose pillar

\[ K_\sigma = 0.8; \quad K_s = 0.76; \quad K_\alpha = 1.0; \quad K_{dt} = 1.0; \quad K_d = 0.55 \]
\[ y_{se} = 2.3 \quad K_\sigma \quad K_s \quad K_\alpha \quad K_{dt} \quad K_d \]
\[ = 2.3 \times 0.8 \times 0.76 \times 1.0 \times 1.0 \times 0.55 = 0.769 \]

3.8 Depth scours according to the equation Melville and Sutherland (1998)

Cylinder pillar

Because the value \( U/ U_c = 0.447 \)
\( (U/ U_c) < 1 \) then the value of \( K_I = 2.4 \times (U/ U_c) \)
\[ K_I = 2.4 \times 0.447 = 1.0728 \]
\[ K_\sigma = 0.8; \quad K_s = 1.0; \quad K_\alpha = 1.0; \quad K_{dt} = 0.95; \quad K_d = 1.0 \]
\[ y_{se} = K_I \times K_\sigma \times K_s \times K_\alpha \times K_{dt} \times K_d \]
\[ = 1.0728 \times 0.8 \times 1.0 \times 1.0 \times 0.95 \times 1.0 = 0.815 \]

Rectangular pillar

Because the value \( U/ U_c = 0.43 \)
\( (U/ U_c) < 1 \) then the value of \( K_I = 2.4 \times (U/ U_c) \)
\[ K_I = 2.4 \times 0.43 = 1.032 \]
\[ K_\sigma = 0.8; \quad K_s = 1.22; \quad K_\alpha = 1.0; \quad K_{dt} = 1.0; \quad K_d = 0.55 \]
\[ y_{se} = K_I \times K_\sigma \times K_s \times K_\alpha \times K_{dt} \times K_d \]
\[ = 1.032 \times 0.8 \times 1.22 \times 1.0 \times 1.0 \times 0.55 = 0.554 \]

Rectangular wide shape nose pillar

Because the value \( U/ U_c = 0.43 \)
\( (U/ U_c) < 1 \) then the value of \( K_I = 2.4 \times (U/ U_c) \)
\[ K_I = 2.4 \times 0.43 = 1.032 \]
\[ K_\sigma = 0.8; \quad K_s = 0.76; \quad K_\alpha = 1.0; \quad K_{dt} = 1.0; \quad K_d = 0.55 \]
\[ y_{se} = K_I \times K_\sigma \times K_s \times K_\alpha \times K_{dt} \times K_d \]
\[ = 1.032 \times 0.8 \times 0.76 \times 1.0 \times 1.0 \times 0.55 = 0.345 \]

4. Conclusion

1. The results of running from the three pillar variations (cylinder, rectangular, rectangular wide shape nose pillar) show that the greatest scour depth occurs at the point of observation of the front side of the pillar.
2. The shape of the pillar is a factor that influences the depth of local scouring around the pillar. Rectangular wide shape nose are the pillars that form the greatest scour depth of the other two pillars (cylinder and rectangular).
3. The maximum scour depth values on cylinder, rectangular and rectangular wide shape nose at discharge of 1.0 liter/s are 25 mm, 30 mm, and 39 mm respectively.

4. From the scour depth and observation values on the effect of the pillar shape on the local scouring mechanism with three variations of the pillars show that the cylinder pillar has the lowest value for local scour depth, then the cylinder pillar shape is better than the other two shapes to be used as bridge pillar.

5. References


Investigating The Use of Smartphone Disorders in Learning by Students of Mechanical Engineering Expertise Program (MEEP)

Sapitri Januariyansah¹, Dwiki Muda Yulanto², Safri Gunawan³, Hanapi Hasan⁴, Henry Iskandar⁵
Universitas Negeri Medan, Indonesia¹²³⁴⁵
sapitrijanuariyansah@unimed.ac.id

Abstract. The use of smartphones by MEEP students is expected to help the learning process. However, whether the smartphone can really help the learning process or even give a negative impact? This study is to describe the use of smartphones by MEEP students in learning. The type of research is Sequential Explanatory Design with Mixed Method Approach. The result of this research is the level of disruption of smartphone usage by MEEP students in general learning into the high category (mean count (3.32) > mean ideal (2.5)). It means that the use of smartphones by MEEP students has a negative impact on learning. Negative impacts that happened (as a medium for playing mobile games and social media) were more dominant than positive impacts. The use of smartphones by MEEP students cannot be stopped. However, students can be directed to use smartphones in a healthy way.

Keywords: smartphone; MEEP students; learning process

1. Introduction

Smartphone is one of technological developments that occur in the present era. Smartphones become one of the smart technologies that are widely used by all circles because the selling price of smartphones is affordable. Actually, this smartphone is supported by internet technology and technology Operational System (OS) that allows the smartphone can work like a computer in a mini version. The Internet has been introduced worldwide globally since the 1990s [1]. The global use of the Internet allows each user to access information. While the OS which is the IOS OS and Android OS became the main choice since the 2000s. Therefore, in addition of the communication media such as telephone, short message service, and social media, smartphone can also access a lot of information and run other virtual media in a state connected to the internet or not. OS of a smartphone combined with quality hardware, also helps in optimizing the performance of smartphones. The features and ease of using the smartphone make it as one of the tools used in education, especially in the learning process.

The learning process is in desperate need of media as a means to make learning more interesting, effective, and efficient. The media used can be either conventional media or interactive media based on technology. However, in the present, the often-used learning media is interactive media with the help of technology. Learning media in the form of software can
improve the students’ learning outcomes which mean that there is a positive effect on learning by utilizing technology [2]. At present the technology that is popular to improve learning is mobile technology such as tablet/iPad and smartphone. It is because this technology is more practical and has a high mobility. The use of mobile technologies such as tablets/iPads and smartphones can increase students’ engagement in learning [3]. Smartphones can also inspire, motivate, provoke curiosity and invite a substantial reading that will enhance students’ complex reading skills [4].

Basically, the use of smartphone technology by students of Vocational High School of Mechanical Engineering Expertise Program is unavoidable. This happens because they are the Z generation that has the ability to use good technology including smartphones. The Z Generation has the characteristics that: (1) Convenient and highly dependent on technology, this is because Z Generation grows surrounded by technology; (2) Multitasking with various online products, advanced technology tools, respect for simplicity, and interactive design; (3) have a higher social responsibility for the amount of information obtained online; and (4) always connected to social networks [5]. Smartphones are not only used at home students but also it is used at school in the learning process. The use of smartphones in learning can also help the learning process of students such as teacher and student discussion media, sender and recipient of teaching materials, and as a media browser material and video education (tutorial). Based on the explanation above, it can be said that the smartphone has a positive impact for MEP students in learning. However, does the use of smartphones in learning really give just a positive impact and not have a negative impact? Is the smartphone’s positive impact greater than its negative impact, or the vice versa? And how to manage the smartphone usage positively in the Z generation that grows along with the development of technology since childhood?

Media-based learning technology is considered to help the learning process. The use of technology in learning has been widely used such as technology in education can improve teaching practice and student performance [6]. Technology is usually used as a learning media that become one of the focuses of the development in the world of education today. However, in the development of technology-based media in learning cannot be made arbitrarily, but required special designs that fit the needs of students. Its function is as the media to be effective and efficient. The design of effective learning media is to consider various aspects of the environment such as the application of domain knowledge, conceptual theory, and evaluation of the quality of the overall designed environment [7].

The use of technology such as smartphones and the internet as a learning media is actually very central lately. YouTube and Social Media can be an instruction media with the notion that teachers must conditioned the form of the direct learning, constructivist and participatory learning approach of integrating potential social media affordances [8]. On the other hand, e-learning as a technology-based learning media that can be accessed through computers, laptops, tablets, and smartphones is one of the learning media used by MEP students. However, e-learning as a learning media for MEP students has a special design that must be fulfilled which has four main aspects, namely aspects of needs analysis, selection and order of competence, learning development, and evaluation of learning [9]. Based on the above studies, the smartphone is clearly an ideal media as a learning media.

The use of smartphones other than as a communication tool by the school apparatus, smartphones are also commonly used as a learning media in the classroom. Features of smartphones such as mobile internet access, offline and online information media, as social media such as sms, chat, call, video call, and group chat access, as a media to run software aids to learn, and as a media entertainment video player, games, and so forth. The use of smartphones as a learning media in this era cannot be avoided as an example of a smartphone can be a media
for ubiquitous learning (u-learning) with the excellent of smartphone that is owned by almost users as well as the nature of a versatile smartphone and compatibility [10]. The use of smartphones can also enhance critical thinking, creative thinking, communication, and learners’ collaboration skills [11]. Students use their smartphones to access teaching materials or supporting information, which is usually accessible via the Internet. Students use smartphones as learning assistances for many reasons such as providing convenience, portability, comprehensive learning experience, multi-source and multitasking, and environmentally friendly. [12]. The advantages of smartphone in learning can also be combined with a software. The combination of learning applications and smartphones is very helpful in learning such as Scortative application that is student response system that allows teachers to create quizzes and online interactive games to students so as to generate real-time assessment of the students’ learning, motivation of the students and support to opportunities for active learning [13]. Based on the studies above, it can be said that smartphone is a media that can support learning. However, the use of smartphones as a learning media does not always have a positive impact on learning.

The negative effect of smartphones is that smartphones provide negative psychological effects which make someone become addicted to smartphones like the use of social media and instant communication dependence, one forgets how to face to face interaction [14]. Other negative impact on academic performance of higher learning students because students become addicted to social media like Facebook, Twitter, Instagram, WhatsApp and the like without considering the time (5-7 hours a day) [15]. A study suggests that students consider the use of smartphones in the classroom to improve their focus, concentration, and learning engagement, whereas the reality of smartphones becomes opium and distraction for them. It is therefore advisable to provide the correct use of smartphones or to seize student smartphones during classroom learning in order to enhance a conducive classroom atmosphere, focus on learning and student attention [16].

Another supportive study conducted on students that students consider the use of smartphones in the classroom can improve the focus, concentration, and involvement of their learning, when in fact the smartphone becomes opium and interference for them. It is therefore advisable to extract the knowledge of the correct use of smartphones or to seize student smartphones during classroom learning in order to improve the conducive classroom atmosphere, focus on learning and student attention [17]. In fact, internet addiction can lead to suicide. Survey conducted to 631 people ages 12-18 years as many as 30.2% of them are users who are addicted to the internet. The results show that the cause of the idea of suicide is the state of sleepless students caused by Internet addiction [18].

Another negative effect of smartphones as the study that has been done to students that smartphones have negative effects on students’ academic performance even though they were used for school-related learning activities. In fact, it was found that the students utilized their smartphones for university learning activities, on the lower their CGPA. The use of a smartphone is definitely a dominant cultural staple of this generation of university students. They use the smartphone during class time, while completing homework and while studying [19]. Based on the studies above, smartphone also gives negative impact both on the side of health and learning. The studies above were conducted against those of the millennial generation, then what about the more intense Z generation in the use of technology such as smartphones.

In general, MEP Students are currently aged 13-18 years. The children of Primary School are those between the ages of 6 and 13, subsequently, for the ages of 14 years to 17 years in the juvenile category [20]. Ages 13-18 years are teenagers who are the age of MEP students which
means they are people of the Z generation, because Z Generation is a generation born from 1990 to mid 2010 [21]. The Z Generation has the characteristics of having good multitasking capabilities where this generation is one generation that experienced a change from the traditional era to the digital era. The Z Generation basically has similarities with the Y generation, but what makes the difference is the Z generation is very superior in applying all activities such as using social media, using the phone, browsing using a PC where everything they do is related to the virtual world [22]. The Z Generation is also known as digital natives that are people who are very familiar with digital technology since birth [23]. If you look at the characteristics of the Z generation, it is impossible for teachers and parents to separate smartphones from their daily lives both in school and outside school.

2. Research Method

This research used survey method with quantitative approach. The selection of such methods was to look at the use of smartphones by students during the learning process. The location of research that has been done is at Vocational High School (VHS) Mechanical Engineering Expertise Program (MEEP) in Daerah Istimewa Yogyakarta (DIY). The sampling technique used is purposive sampling. This selection is based on the Mechanical Engineering Expertise Program as one of the Education Program based on technology and DIY as one of the education centers in Indonesia. Researchers chose one MEEP in each one city and four districts in DIY. Furthermore, the researcher selects one class on each MEEP as representative. The selected class is class XI because the students who are in the class are those who have experienced in learning longer than from class X and have a more effective learning process from class XII. The type of class chosen was a class of theoretical learning because students in the theoretical learning class can use many methods and learning media. Those methods and media used such as smartphones rather than the classroom practice where students tend to interact more with tools and practical machines only. Based on the explanation, the object of research is the disorder of the use of smartphones by students on 5th grade XI in the learning process.

Furthermore, the subjects of the study were the students and teachers who followed the learning process in 5 selected theoretical classes. The number of teachers selected was one person in each class leading the learning process. Then, the number of students selected was based on all students who follow the learning process to be observed. However, in the interview process only four students selected as representatives with the indicators of selection. Those indicators were the students who actively used the smartphone during the learning process happened.

Data collection technique in this research was observation method supported by interview method. Validity of observation instrument used content validity with Aiken's V analysis. Reliability is conducted by Intraclass Correlation Coefficient (ICC) technique. Observation methods were used to see the real state of smartphone usage at the time the learning takes placed by students in the classroom. The type of observation used in this research was passive participation observation that researchers observe from within the classroom by looking directly at the students' activities while the teaching and the learning process without getting involved in learning activities. The number of observation items was 5 items with a minimum value of 4 and a maximum value of 20. Researchers chose as many as 3 people as an observer in each class.
Furthermore, the interview method to confirm and to know more about the use of smartphones was applied as supporting data. Interviews were conducted referring to the state of the student in using smartphones and how the smartphones were used. In addition, interviews were also conducted to the teachers to confirm the observation results. Furthermore, the data obtained were analyzed by quantitative descriptive analysis technique by finding the mean value, the standard deviation, and the criteria of research results (the ideal average was 2.5 and the ideal Std. average was 0.5). The criteria of research results were grouped in four categories that were very high, high, medium, and low.

3. Results and Discussion

3.1 Results

Based on the results of the observation, the data analysis was obtained the average value of each school was greater than the ideal average value set (2.5). This showed that the disorder of the use of smartphones in the classroom in general high category, so the use of smartphones in the classroom has not fully helped the learning process. Therefore, the smartphones in detail also have the same negative impact on every VHS. The result of observation data can be seen on table 1.

<table>
<thead>
<tr>
<th>Name</th>
<th>Mean</th>
<th>Standard Deviasi</th>
<th>Very High</th>
<th>High</th>
<th>Middle</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>VHS MEEP DIY</td>
<td>3.32</td>
<td>0.08</td>
<td>67%</td>
<td>33%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>MEEP Yogyakarta City (VHS 1)</td>
<td>3.40</td>
<td>0.35</td>
<td>67%</td>
<td>33%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>MEEP Sleman Regency (VHS 2)</td>
<td>2.93</td>
<td>0.30</td>
<td>0%</td>
<td>67%</td>
<td>33%</td>
<td>0%</td>
</tr>
<tr>
<td>MEEP Bantul Regency (VHS 3)</td>
<td>3.73</td>
<td>0.11</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>MEEP Gunung Kidul Regency (VHS 4)</td>
<td>3.27</td>
<td>0.23</td>
<td>67%</td>
<td>33%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>MEEP Kulonprogo Regency (VHS 5)</td>
<td>3.27</td>
<td>0.11</td>
<td>33%</td>
<td>67%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Further discussion is to see the average value of criteria from the observation instrument that can be seen in table 2.
Table 2. The Results of Interference Data of Smartphone Usage in Learning based on indicators

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Mean of Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students play a smartphone when the teacher explained the learning materials.</td>
<td>3.07 3.33 2.67 3.67 2.67 3.00</td>
</tr>
<tr>
<td>Students do not focus when the learning process caused by the smartphones.</td>
<td>3.53 3.33 3.00 4.00 3.67 3.67</td>
</tr>
<tr>
<td>Students do not use smartphone as a learning assistant.</td>
<td>2.60 2.67 2.33 3.00 2.67 2.33</td>
</tr>
<tr>
<td>Students who use smartphones in the classroom tend to disturb other students.</td>
<td>3.73 4.00 3.00 4.00 3.67 4.00</td>
</tr>
<tr>
<td>There is no fixed regulation about the use of smartphone in the classroom.</td>
<td>3.67 3.67 3.67 4.00 3.67 3.33</td>
</tr>
</tbody>
</table>

Based on table 2 it is known that: (1) Item 1 generally receives an average value above the ideal average value (2.5) which means that the level of smartphone usage by students during the learning process is categorized high; (2) Item 2 generally obtains an average score above the ideal mean (2.5) which means that the concentration level of student learning is not focused due to the smartphone which categorized into the high category; (3) Item 3 generally obtains an average value above the ideal mean (2.5) which means that the level of smartphone usage is not as a tool included in the high category. However, when it is viewed in more detail there are two MEEP that get an average score below the ideal mean which means the students in the MEEP are on average using a smartphone for the learning process; (4) Item 4 generally obtains a mean value above the ideal (2.5) which means that the rate of the smartphone usage by students tends to disturb other students including in the high category; and (5) Item 5 generally receives an average value above the ideal average value which means point 5 is included in the high category or it can be concluded that the regulation of smartphone usage in MEEP has not been maximal or even absent.

The observation data was reinforced by interviews with teachers and four students from each MEEP. Interviews were done with five teachers where the five teachers confirm that 97% of their students owned and used smartphones in the classroom. They argue that smartphone can help the learning process as well as interrupt the learning process because students were still passive in following the learning and students still consider the smartphone as a tool for entertainment and social media. They argued that smartphones interrupted students’ focus on learning, students became addicted to smartphones, students actively used smartphones for online gaming/mobile games and even some students play games at all times, students become individualists and ignore the surroundings, eliminate interaction between friends and teachers, students are always not on time in doing homework this is allegedly because students also play online games late into the night, as a medium to cheat when the exam, students become less rest so lazy while learning practice and learning theory, students have no attitude polite and disrespectful to his friend. Teachers said that there was no official regulation on the use of smartphone in the classroom, so the rules were limited to individual teacher policy only.

The interview result that was conducted with the students indicated that all of the students used a smartphone during the learning process if instructed by the teacher to find teaching materials. However, when teachers were not instructed, they used the smartphone as entertainment (watching or playing games) and social media when learning clandestinely. All of the students used smartphones as social media and as many as 18 students used them to play games online and only used smartphones to learn if there are tasks or based on teacher's orders.
A total of 10 students addicted to playing online games with the reason that the game is challenging and nice to play. While 10 other students play games only when there is no learning task. A total of 13 students always use the smartphone as a media to play games rather than looking for teaching materials with the duration of playing every day, even as many as 5 students play games until late at night. All of the students cannot stop to use smartphones as social media and games. They feel very dependent with smartphones. The results of interviews with students were still very limited because students cannot be open to tell the use of smartphones 100% in their lives. This is because the difficulties in making an assessment of self-assessment by reason of several factors.

To overcome the unhealthy use of smartphones by the students, the teachers give several suggestions such as giving the understanding about the positive and negative impact from the use of smartphone to the students, directing the students to become busy to search the learning materials using their smartphones, make the use of smartphones orderly by giving the schedule when they should use the smartphones and when they have to stop to use the smartphones. The teachers should always make a control of the students’ learning and give the punishment to the students who do not use the smartphone orderly. The school party should make a regulation related to the use of smartphones at school in a healthy manner. The parents are also expected to be more sensitive to the children’s activity at home in order to make a good control from school party and the parents.

Based on observations and interviews, the use of smartphones has not been fully able to help the learning process. The utilization of smartphones and internet in a healthy way is not well developed by many schools. This makes the smartphone has more negative impact than positive impact. Negative impact of the smartphone such as eliminating the focus of student learning is caused by the addiction to play online games and play social media that impact on the decreasing of the student achievement. In fact, the use of smartphones by students unhealthy not only decrease the students’ achievement but also makes morale of students become ugly like students cannot be socialized well, students become insensitive to the environment, and even students become disrespectful towards teachers and have the likes insulting others.

3.2 Discussion

The use of smartphones by MEEP students in schools does not have a positive effect on the whole but is more dominated by its negative impact. Based on observations and interviews, the use of smartphones by MEEP students is more disturbing than to help the learning process. But the use of smartphones is actually very good as a learning media if it is used properly by students. For example, smartphones as learning media such as e-learning, media to run software such as ubiquitous learning, and Software Socrative. This is reinforced by a study of the utilization of smartphones connected to the internet that children aged 9-16 years using the internet as a tool to develop themselves provided face-to-face service [24]. On the other hand, the learning process more accommodated by the E-Books technology (digital books) that can be accessed from a smartphone that makes students and teachers do not have difficulty carrying a variety of books. E-Books make it easier for students and teachers to access and search for material with the right keywords. It is a convenience given smartphone in learning. However, the smartphone also provides features that can interfere with learning such as mobile games and social media are not controlled.

Based on interviews and observations, smartphones have a more dominant negative effect. This happens because students prefer to use smartphones as entertainment media such as mobile games and social media are not controlled. In effect, students become addicted to smartphones to not be able to control themselves. Students also become forgetful when it's time to play
smartphones and when it's time to learn and which is more important between those things. In
the learning process students become unfocused and they are tired to follow the learning process
in the classroom. Negative impacts also occur on students' attitudes that are low in social terms,
students also become insensitive to the environment, and students become dishonest by using
smartphones as a means of cheating. The actual use of smartphones cannot be eliminated from
MEEP students considering that they are people of the Z generation who are very familiar and
dependent on technology. However, such student circumstances must be resolved immediately
because internet addiction may degrade one's social capabilities [25]. Excessive use of
smartphones also has a negative effect as a study that people who use smartphones excessively
exert fatigue, sleep deprivation, and an unhealthy life [26]. Another study reinforces that
teenagers in India who use smartphones compulsively affect the interpersonal and family
relationships and sleep to be inadequate and unhealthy bodies [27].

The findings in this study are very contrary to previous studies that recommended
smartphones as an effective learning media. However, it is not entirely wrong. Researchers see
there is one side that becomes an important thing to be developed that is the rule about
smartphone usage by student. Based on the interview results, the teacher recommended in
accommodating the students to be given training on the use of a smartphone in healthy way.
The parties involved not only from the school but also from the parents of students. There are
many ways are offered to overcome these problems that can be done by developing applications
anti-addiction smartphone [28]. The app allows students to access it directly. Application
development can also be a game, a study of elementary school children that a "garbage disposal"
game application can deliver material to students about organic and non-organic waste and
students are also more focused on using this game as a learning media [29].

Another way is the attention of the family. Addiction to smartphones also occurs due to
parents' carelessness, so it is needed the parents' attention to their children in directing them
towards the healthy use of smartphones [30]. Teaching healthy smartphones can be done by the
parents through daily interactions and through open communication [31]. Other alternatives that
can be done to overcome the problem of smartphone use are by forced the restrictions, self-
awareness and self-control, school factors, peer support, and professional services. Therefore,
the school, parents, and society play an important role in shaping the attitude of students who
can use smartphones in a healthy manner [32].

4. Conclusion

The utilization of smartphones in the learning process is very necessary to be considered
that MEEP students are those of the Z generation who are very familiar with smartphones and
also MEEP are a technology school that both become a power of its own. However, smartphone
usage should always be monitored by teachers, schools, parents, and the community because
the free use of smartphones by students has a negative impact on the learning process and
student learning outcomes. Researchers found that students prefer to use smartphones as a media
to play games and social media rather than as a learning media. This is because playing games
and social media is more interesting than learning. Research on the characteristics of MEEP
students from the Z-generation in detail is needed in the future as a basis for determining the
learning process.

Researchers have an alternative way to overcome the use of negative smartphone that is
by providing training in the use of smartphones for the students in schools, this training is also
biased with the application of the use of smartphones in a healthy manner that can be downloaded by students. Another alternative is the presence of teachers, parents, and communities that must be involved in student education and oversee the healthy usage of a smartphone by the students. Alternatives are options that can be done in the short term where this alternative obviously has many weaknesses. The research which is done is also still has many shortcomings such as limited time and funds to select more samples and types of research that still shaped in a phenomenology.

Researchers recognize the need to develop a healthy smartphone learning model for students where the uses of smartphones to learn become more attractive for the students than games and social media. This is certainly not an easy matter, but it is very necessary and has a greater chance. The use of smartphones by students is not avoided bias because every year students who enter the MEEP are those who are increasingly familiar with the smartphones. They are from a new generation or Alpha generation so that teachers can only direct the use of smartphones in a healthy manner.

5. References


Analysis of Using Gasoline-Corncob Waste Bioethanol Blends in Four-Stroke Motorcycle Engine onto Exhaust Emission and Compression Ratio

Hanapi Hasan1, Hasan Maksum2, Safri Gunawan3, E Eswanto4, Sapitri Januariyansah5  
{hanapi_hasan@unimed.ac.id1, hasan_maksum@yahoo.co.id2, safri_gunawan@unimed.ac.id3, eswanto@unimed.ac.id4, sapitrijanuariyansyah@unimed.ac.id5}

Department of Mechanical Engineering, Universitas Negeri Medan, Indonesia1,3,4,5,  
Department of Automotive, Universitas Negeri Padang, Indonesia2

Abstract. This research utilizes corncob waste for making bioethanol by RON 109. The objective of this research is to get the best performance of exhaust emission by mixing gasoline RON 90 from E5, E10, E15, E20, to E25, and 10:1, 11:1 and 12:1 of compression ratio. In addition, the control variable covered 1400 rpm, 2400 rpm, and 3400 rpm engine speed. The testing data of exhaust emission was taken only on the carbon monoxide (CO) and hydrocarbon (HC). The result on this biethanol from corncob waste showed that the lowest exhaust emission on carbon monoxide and hydrocarbon was found on E10 fuels at 10:1 compression ratio, and E20 fuels at 11:1 compression ratio. The result obtained from this research demonstrated that the carbon monoxide and hydrocarbon emissions that produced by corncob waste bioethanol were environmentally friendly compared to gasoline use only (E0).

Keywords: Bioethanol, Corncob Waste, Gasoline, Compression Ratio, Exhaust Emission.

1. Introduction

Fossil fuels, particularly petroleum is a major energy source for vehicles where its availability is becoming more insufficient and could not be renewed [1,3]. The issue on energy crisis and environmental pollution due to the emission product of fossil fuels combustion is the most significant problem in the world nowadays. Referred to the data gathered from Central Bureau of Statistics (2019), within the last seven years, the number of vehicles increases twice with 7% in average for the annual increase [2].

On one hand, the increasing number of vehicles gives a positive impact on the economic development. In contrast, it allows bad impact as well by the increase of harmful gases derived from the fossil fuels ignition on the vehicles. Harmful gases and millions of exhaust is obviously the main contributor in air pollution among many countries including Indonesia [3]. This pollution imposes negative effect on the environment and tremendous consequences for human health like respiratory disorders, cancer, heart attack, and other malignancies. In addition, this exhaust emission also can cause mental retardation on children. Besides the air pollution, the second issue that should be faced by people is the inadequate energy needed in running their vehicles [4,8].

The energy crisis and the damage on the environment establish motivation to learn and evaluate the alcohol as the fuel on gasoline engine [1]. Ethanol has several advantages compare to gasoline, such as the subtraction on CO, volatile organic compounds (VOC), unburned hydrocarbon emission (UHC), and adequate anti-knock characteristic (denotation), that make the possibility of using the engine compression ratio getting higher. As the ethanol is a liquid fuel, its storage and emission is likewise the gasoline [6]. The use of bioethanol becoming the
vehicles fuels is a safe alternative, and can reduce the dependency on petroleum. As a matter of fact, ethanol is also used for cosmetic and pharmacy purposes [9]. Alcohol fuel, especially ethanol can be produced from the renewable sources such as sugarcane, cassava, corn, and whey which is the cheese production waste with 22.26% shared production [6], pineapple skin and sugarcane residues that produce 95 % ethanol [10], and other types of biomass waste. One of the potential materials to be extracted for ethanol raw material is corncob.

In Indonesia, corn is one of food commodities with increasing productivity level. Based on the data from Central Bureau of Statistics, in 2018 the corn production in Indonesia is as much as 29.612.435 ton. Regardless, the utilization of corn all this time is only on the corn kernels. Other part of the corn as the cob has not yet been optimally used. The use of the corncob as the raw material for producing bioethanol is closely related with the chemical components contained in it, which is coarse fibres and cellulose, where they can be extracted into bioethanol. Moreover, the corncob is composed of 46 % cellulose, 36 % hemicelluloses, and 16 % lignin. Fairly high content of cellulose in the corncob makes it possible to be used as the raw material in producing bioethanol. However, this bioethanol extracted from the corncob has not been adequately used as the gas fuel, even it is disposed as wastes. This entire time, it is often seen that stacks of corns are being wasted and burned. If this situation is kept occurring, it will add unbeneificial amount of waste. Hence, in the absence of any adequate action, it will harm the environment [11].

The aim of this research is to investigate how much the influence of using the ethanol from the corncob waste in four-stroke motorcycle engine onto carbon monoxide and hydrocarbon emissions.

Bioethanol

Among community, ethanol is widely known as alcohol. It derives from Arabic word al-kuhl (al kohl), which means volatile compounds. It is a clear, colorless, acceptable unique aroma, liquids at room temperature, and flammable [2,3]. The alcohol species which is commonly used is CH₃OH, and called as methyl alcohol (methanol), C₂H₅OH called as ethyl alcohol (ethanol), and C₂H₇OH called as isopropyl alcohol (IPA) or 2-propanol. In industrial world, alcohol refers to ethanol or ethyl alcohol or methyl alcohol with chemical formula C₂H₅OH.

Ethanol in its pure form or as gasohol (the blend of gasoline and ethanol (alcohol)) is used as an alternative fuel for vehicles. The use of ethanol is due to its boiling point likewise heptane (evaporates at similar engine temperature), distilled within the gasoline, and results to less pollutant [1,4].

Gasoline (Pertalite RON 90)

Gasoline is Hydrocarbon compound that is produced from petroleum. For gasoline engine takes gasoline, and for diesel engine takes diesel oil (petroleum-distillate fuel). Pertalite is a gasoline with renewed quality [5]. It is a type of fuels intended for two-wheeled, three-wheeled, and four-wheeled vehicles [7]. Furthermore, pertalite is a term taken in defining the complex mixture of several refined hydrocarbons of crude oil used as the engine fuel [5]. It is derived from the naphtha distillation process where its composition can be utilized as the fuel for internal combustion engine. Naphtha itself is known as light oil where its properties are between gasoline and kerosene.

Maize

In 2018, the national maize production reached 29.612.435 ton, and was estimated to escalate to 35 millions ton by 2019. This corn contains of 30 % of waste deriving from its cob. If it is converted with the total amount of production in 2018, Indonesia has the potentiality contributing 9.883.730 ton corn waste. It can be said it is a huge amount of waste and is going to be potential if it is appropriately utilized. How ever, the corncob is one of lignocellulosic
wastes that is widely available in Indonesia. It is a plantation waste containing cellulose, hemicellulose, and lignin.

The chemistry and physics characteristics of this corncob is compatible with constitute of alternative energy (bioethanol), whereby the lignin complex compounds level in the corncob is 6.7-13.9%, consisted of 39.8% hemicellulose and 32.3-45.6% cellulose. Cellulose is barely found in an absolute condition, as it is always bonded with other components which are lignin and hemicellulose [4].

2. Research Method

This research design is categorized into experimental approach. This approach is a research that utilized in investigating the influence of certain treatment onto other treatments within controlled condition. It applied the experiment model of post-test only control design where the use of this model was based on the assumption that the experiment and the comparison group chosen through voting was absolutely equivalent.

Variable is the object or the focus of a research. As for this research, its variable was four-stroke motorcycle engine. Here, the data to be retrieved was the content level of Carbon Monoxide and Hydrocarbon, and also increasing the compression ratio on the usage of pertalite and bioethanol.

<table>
<thead>
<tr>
<th>Table 1. Some properties of gasoline and ethanol</th>
<th>Gasoline</th>
<th>Ethanol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical formula</td>
<td>C8H18</td>
<td>C2H5OH</td>
</tr>
<tr>
<td>RON</td>
<td>90</td>
<td>109</td>
</tr>
<tr>
<td>Density (kg/m³)</td>
<td>733</td>
<td>794</td>
</tr>
<tr>
<td>Molecular weight (g/mol)</td>
<td>101.5</td>
<td>46.07</td>
</tr>
<tr>
<td>Oxygen (mass%)</td>
<td>0</td>
<td>34.7</td>
</tr>
<tr>
<td>Lower heating value (MJ/kg)</td>
<td>42.5</td>
<td>26.95</td>
</tr>
<tr>
<td>Latent heat (kJ/kg)</td>
<td>287</td>
<td>854</td>
</tr>
<tr>
<td>Stoichiometric air/fuel ratio</td>
<td>14.7</td>
<td>9</td>
</tr>
</tbody>
</table>

The data collection was performed by initial testing to obtain the reference data using octane 90 gasoline (Pertalite) with standard compression ratio. Further, for the testing data, was conducted by using the blends of bioethanol octane 109 with E5, E10, E15, E20 and E25. This testing was utilized fourgass analyzer at the engine speed of 1400, 2400 and 3400 rpm. As an addition, in the testing data, compression ratio increment was performed which had been changed into 10:1, 11:1, and 12:1. On each engine speed changes, the data was recorded covering the emission of carbon monoxide and hydrocarbon. Meanwhile, the data collection tools were in the form of tables, further was going to be analyzed which resulted into percentage graphs.
Table 2. Test Engine Specifications

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Engine type</td>
<td>Four-stroke SOHC, Air-cooled</td>
</tr>
<tr>
<td>2</td>
<td>Number of cylinder</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Capacity</td>
<td>109.1 cc</td>
</tr>
<tr>
<td>4</td>
<td>Bore</td>
<td>50 mm</td>
</tr>
<tr>
<td>5</td>
<td>Stroke</td>
<td>55.6 mm</td>
</tr>
<tr>
<td>6</td>
<td>Compression ratio</td>
<td>9.0 : 1</td>
</tr>
<tr>
<td>7</td>
<td>Maximum torque</td>
<td>8.4 Nm/5500 rpm</td>
</tr>
<tr>
<td>8</td>
<td>Maximum Power</td>
<td>6.2 kW/7500 rpm</td>
</tr>
</tbody>
</table>

3. Results and Discussion

In accordance with the desired research aim that finding out how much the influence of using ethanol from the corncob wastes in four-stroke engine onto carbon monoxide and hydrocarbon. Moreover, the research of carbon monoxide and hydrocarbon emissions was performed for three speeds at 1400 rpm, 2400 rpm, and 3400 rpm, and then another three times testing on each rpm. Below was the description of the influence on using bioethanol from the corncob wastes as the gasoline blend.

3.1 The Influence of Carbon Monoxide (CO) Emission

a. Compression Ratio 10:1

The CO level in exhaust is totally influenced by the comparison of the oxygen in the atmosphere and fuel amount. CO emission on the exhaust is also one of combustion completeness indications in the combustion chamber. Fig-2 shows the changes on CO exhaust emissions onto the engine speed changes. In a standard condition, gasoline produces CO emission with an average volume of 1,648 %. The biggest CO emission decrease resulted by gasoline-bioethanol blended fuel at 10:1 compression ratio was obtained in E10 blends, with 58.1% average reduction.

On average, bioethanol experienced the significant decrease at the 2400 speed, and an increase at 3400 speed. This data analysis result was in accordance with the properties of ethanol fuel where the ethanol Research Octane Number (RON) was higher than gasoline. It was also seen from the potentiality of resisting high pressure and temperature before igniting the combustion. This was due to the reason that SI engine efficiency was depended upon the compression ratio and fuels with high octane that was totally appropriate for high compression ratio [1].
b. Compression Ratio 11:1

By the increase of compression ratio up to 11:1, CO emissions was decreasing into 58,7% in E20 blends comparing to gasoline. Iodice et al [1] stated that the 34,7 wt %, oxygen content in ethanol was able to elevate the combustion efficiency and cause the bioethanol combustion temperature becoming higher, as the oxygen concentration was much provided in the engine cylinder. It resulted into a more complete combustion process (bonded effect), and the decrease of the occurrence on CO and HC emissions level.
c. Compression Ratio 12:1

Fig. 4. Variation of CO emission versus engine speed

The graphic above indicated the average of the maximum CO emissions decrease produced by bioethanol at 12:1 compression ratio was found in E15 blends, the reduction was 50.4% compared with E0 fuels. Hence, CO 15 emission value was still high compared to the value of CO in the blends, and other compression ratios. It was occurred because of high compression ratio was inappropriate to be used into low bioethanol blends.

3.2 The Influence of Hydrocarbon (HC) Emission

a. Compression Ratio 10:1

Hydrocarbon emission was decreasing as the engine speed increased. The standard testing utilized the gasoline (petrolite), and obtained the speed of 260 ppm for HC emissions value. Whereas by using bioethanol at 10:1 compression ratio, the average of the lowest HC emission decrease was in E10 blends at the speed of 203 ppm, decreasing for 21.9% compared with E0 fuels. This result was in line with the one stated by Hasan et al [3], pointed out that the oxygen content in ethanol chemistry formula led the blend of fuels and oxygen becoming homogeneous, so it decreased the HC and CO emissions level.

Fig. 5. Variation of HC emission versus engine speed
b. Compression Ratio 11:1

Moreover, Fig-6 shows the correlation between the HC content changes in the exhaust onto the engine speed increment. During the standard condition, gasoline resulted HC emission in the average speed of 260 ppm. The average of the maximum HC emission decrease produced by bioethanol fuel at 11:1 compression ratio was in E20 blends, the average reduction was 14.6% compared with E0 fuels.

c. Compression Ratio 12:1

From the graphic below, it can be seen that the HC emission decrease was not significant. The average of the minimum HC emission decrease at 12:1 compression ratio was in E15 blends at the speed of 227 ppm, the reduction was 12.7% compared with E0 fuels. The decrease of HC emission in E25 blends was not different considerably with E15, the reduction was of 11.1% compared with E0 fuels.
4. Conclusion

The influence of using corncob waste bioethanol on carbon monoxide and hydrocarbon in four-stroke motorcycle engine by performing pertalite testing yields 1,648 % vol CO and 260 ppm HC. The testing by using the blends of bioethanol E5, E10, E15, E20, and E25 obtains the result of the lowest CO and HC emissions decrease, at 10:1 compression ratio, which are 0,691% vol CO and the 203 ppm for HC. Additionally, at 11:1 compression ratio, the lowest CO is 0,680 % vol and 222 ppm for HC. Furthermore, for 12:1 compression ratio, the lowest CO is 0,817 % vol and 227 ppm for HC.

The testing result shows that the carbon monoxide and hydrocarbon emissions resulted from corncob waste bioethanol is more eco-friendly than gasoline (pertalite). The lowest testing result of carbon monoxide and hydrocarbon emissions and recommended that can be used is in E10 bioethanol at 10:1 compression ratio, and E20 fuels at 11:1 compression ratio. The results of E10 and E20 bioethanol demonstrates that the emission content of carbon monoxide and hydrocarbon is still under the restriction of State Minister for the Environment Regulatory No 05, year 2006 concerning the Treshold of Vehicles Exhaust Emission, which are 5,5 % vol for CO concentration and the speed of 2400 ppm for HC on idle cycle in four-stroke motorcycle engine.

5. References

Project Based Learning to Enhance Students' Science Process Skills in Science Learning

Halimatuss'a'diah¹, H. Sitompul², R. Mursid³
Postgraduate Educational Technology Study Program, Universitas Negeri Medan¹,²,³
halimahpanjaitan43@gmail.com

Abstract. Learning is a process of student interaction with teachers and learning resources in a learning environment. This study aims to determine the effect of applying project based learning models on science process skills on the material structure of animal and plant cells. The design used in this study is a posttest-only control design with a quasi-experimental method. The research sample consisted of 55 students and the result shows that the implementation of Project Based Learning model is better than conventional learning models. This can be seen from the t-test calculation of science process skills showing a significant result of t count 0.003 < 0.05, then Ha is accepted and Ho is rejected. From the analysis of average completeness score indicators of the experiment class science process skills reached 2.50 with good criteria while the science process skills of students in the control class reached 1.68 in sufficient criteria meaning that the science process skills of the experiment class students were higher than the science process skills of the control class. It can be concluded that the Project Based Learning model influences the Science Process Skills on the material structure of animal cells and plant cells.

Keywords: project based learning model, science process skills

1. Introduction

The purpose of Education is to develop the students' potential to become human beings who have faith, devote to God Almighty, good character, healthy, knowledgeable, capable, creative, independent, interactive, inspirational, fun, challenging, actively participate, and provide space which is sufficient for initiative, creativity, and independence in accordance with talents, interests and physical development, and to be democratic and responsible citizens. Science learning seeks to increase students' interest in developing knowledge, skills and abilities to think about the whole nature that is full of endless secrets. Based on Ministry of Education Regulation No. 20 of 2016, Competency Standards for Junior High School Education Graduates are students who can search and apply information that comes from the environment and other sources logically, critically and creatively and students can demonstrate the ability to analyze and solve problems in daily life.

The 21st century is an age of unlimited knowledge, where information and technology are increasingly developing. The 21st century learning paradigm emphasizes the students' ability to find
out from various sources, formulate problems, think analytically and cooperate and collaborate in solving problems [1]. In this 21st century the ability to learn, think creatively, make decisions, and solve problems is very necessary in getting a job, so science education should be able to help students to develop understanding and thinking habits to ensure their survival [2].

Science is the knowledge gained through observation, data collection by experimentation and deduction to produce an explanation of a phenomenon that can be trusted. The application of a scientific approach in learning involves a variety of science process skills such as observing, classifying, measuring, hypothesizing, explaining, and concluding. Science learning places more emphasis on the application of science process skills. Aspects of the scientific approach are integrated with the science process skills approach and scientific method. Two things that are important in learning science are helping students to gain a deep understanding of the material presented and helping them build problem-solving skills. Problem solving skills are part of thinking skills. Science Process skills need to be developed through direct experiences as learning experiences. Through direct experience, a person can better appreciate the process or activity that is being carried out. The science process skills approach is a learning process that is designed so that students can find facts, construct concepts and theories with students' own intellectual skills and scientific attitudes.

The fact that can be seen at this time there are many students who are not active enough in learning, information acquisition is only one way, teachers provide knowledge and students receive knowledge without reprocessing it. This raises a problem in learning that is the potential of students are not sufficiently explored, aspects of learning skills do not develop which causes student achievement to be less improved. Another obstacle is the unavailability of learning facilities to support the learning process so that students do not understand the learning material let alone abstract concepts. Lack of problem solving skills in student and understanding the concepts of science being studied requires improvement. In studying science students are more interested in conducting experiments or observations in the surrounding environment. The application of experimental learning will help students to understand the concepts. Students' concepts understanding can be seen if students are able to express verbally, in writing, and applications in their daily lives. Thus, students have the ability to explain, mention, give examples, and apply concepts related to the subject.

The learning process that can improve students' mastery of concepts and problem solving skill is a learning process that can actively involve students in building their knowledge through daily experiences, previous experiences as well as current learning. Science learning should be able to provide direct experience for students so that it adds to the ability of nature to construct, understand and apply concepts holistically, meaningfully, authentically and applicatively for the purpose of solving problems. Based on the importance of problem solving skills, it is necessary to study how to design learning models that can be applied to improve problem-solving skills in learning science at the middle school. One learning model that is expected to improve problem-solving skills is the PjBL learning model that is expected to accommodate active, innovative, creative, effective and fun learning.

Project-based learning (PjBL) is one way to develop the skills demanded in 21st century education. PjBL can train students to change the nature of learning by discovering basic concepts through the expansion of information and communication technology that will be essential for success in facing life in the future (Ledward in Ahira, 2011). Project Based Learning in general has
a step guide: 1) start with the essential question, 2) design a plan for the project, 3) create a schedule, 4) monitor the students and the progress of the project, 5) assess the outcome, and 6) evaluate the experience [3]. The six steps are carried out by students with the help of teacher as the facilitator. Project Based Learning can make students experience a meaningful learning process, students build their knowledge in the context of their own experiences and with direct learning experience that can support skills development [4]. Through direct experience a person can better appreciate the process or activity being carried out [5]. Project-based learning focuses on questions or problems that drive through concepts and principles. Project-based learning also engages students in constructive investigations. This investigation is in the form of design, decision-making, problem discovery, problem solving, discovery or the model development process. In project-based learning, these activities must be included in the transformation and construction of knowledge on the part of students. This learning encourages students to gain a learning experience to a significant degree. Project-based learning places more emphasis on autonomy, choice, uncomplicated work time, and student responsibility. The targets for project-based learning are the products produced.

The project-based learning model can empower students to develop creativity through project-based problem solving activities. Abidin [6] stated that the project-based learning model is considered as one of the excellent learning models in developing various basic skills that students must have such as decision making skills, creative abilities and problem solving skills. The same thing also expressed by Hwang [7] that creativity is an ability that can be developed through the problem solving process. According to Aktamis & Omer [8] someone who is creative will be able to find new problem solving method to solve problems they encountered in daily life. In addition, creative people will also be more sensitive to problems. In addition in carrying out learning activities based on problem solving, a person also needs certain abilities such as observing, inferring, experiment or referred to as science process skills.

Science process skills are scientific thinking skills that are useful for solving problems and formulating results [9]. Science process skills are all scientific skills that can be used to find a concept or principle or theory to develop an existing concept or to refute an invention. Science process skills are typical intellectual skills that are used by all scientists and can be used to understand any phenomenon, where these skills are needed to acquire, develop and apply concepts, legal principles and scientific theories. Project-based learning can familiarize students with scientific methods that directly provide opportunities for students to develop their science process skills [10].

In addition, according to Siwa, Muderawan & Tika [11], in project-based learning a person will learn much better because he is actively involved in the learning process, think about what is learned and then applying what has been learned in real situations [12].

2. Research methods

This research was conducted in VII class of MTsN 2 Medan. This research is a quasi-experimental study. The research designed with posttest-only control design. The experiment class (class 7 plus 1) consisted of 28 students who were treated with the Project Based Learning model, while the control class consisted of 27 students (classes 7 plus 2) were treated learning using the team discussion method. The techniques used for data collection in this study were in the form of
non-tests (observation sheets and performance) and tests (posttest). Data collection in this study uses observation sheets as data on science process skills, with Participant observation and structured observation sheets and Posttest to compare differences in students’ process skills in the two classes.

3. Results and Discussion

The Science Process Skills (SPS) of the students studied in this study include several indicators: 1) asking questions; 2) hypothesize; 3) plan an experiment; 4) observation 5) interpret / interpret; 6) communicate. This study uses two classes, the experiment class which is treated using a project-based learning model (PPA) and the control class without treatment. The results were obtained from SPS observation sheets during learning, and posttest at the end of learning. The results of the study are presented as follows.

<table>
<thead>
<tr>
<th>Table 1. Observation Result Sheet Percentage completeness (%) Experiment Class and Control Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
</tr>
<tr>
<td>----</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
</tbody>
</table>

In calculating the observation sheet this study uses a scale of 1 to 4. There are differences in the average scores of the experiment class and the control class. As shown in table 2.

<table>
<thead>
<tr>
<th>Table 2. Average score of observation classes in experiment and control classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
</tr>
<tr>
<td>----</td>
</tr>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
</tbody>
</table>

Performance evaluation is carried out to see the implementation of the project-based learning model in the experimental class. This performance evaluation consisted of three stages including planning stage, implementation and product results. As shown in table 3, the final test (Posttest) was carried out as an evaluation of the achievement of the material structure from animal cells and plant cells with indicators of science process skills. The posttest results from experiment and control class can be seen in Table 4 and Figure 1. Based on the data obtained through the observation sheet of the science process skills during three sessions, the posttest shows that there are differences between the experiment classes using the project-based learning model and the control class. The average
total score of the observation sheet was obtained that in the experimental class the average score was 2.50 that had good criteria while in the control class the average score of 1.68 had sufficient criteria. This shows that the experimental class using the project-based learning model, its science process skills are better than the control class that uses conventional learning.

### Table 3 Results of process and product performance evaluations

<table>
<thead>
<tr>
<th>No</th>
<th>Group</th>
<th>Project based Learning Model Assessment Phase</th>
<th>Total</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Planning</td>
<td>Implementation</td>
<td>Reporting</td>
</tr>
<tr>
<td>1</td>
<td>Group 1</td>
<td>11</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>Group 2</td>
<td>10</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>Group 3</td>
<td>10</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>Group 4</td>
<td>11</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>5</td>
<td>Group 5</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
</tbody>
</table>

### Table 4 Completeness percentage of each science process skills indicator in the experiment and control class

<table>
<thead>
<tr>
<th>No</th>
<th>Aspect</th>
<th>Completeness Percentage</th>
<th>Experiment Class</th>
<th>Control Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ask question</td>
<td>85%</td>
<td>75%</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Hypothesize</td>
<td>80%</td>
<td>65%</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Plan an experiment</td>
<td>75%</td>
<td>65%</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Observation</td>
<td>90%</td>
<td>80%</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Interpret</td>
<td>80%</td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Communicate</td>
<td>90%</td>
<td>75%</td>
<td></td>
</tr>
</tbody>
</table>

**Fig 1.** Diagram of posttest experiment and control grade average values
In Figure 1 it can be seen that the highest indicator of science process skills in the experiment and the control class is in the communication and interpretation skills indicator that is 70% and 55%. Both in experiment and control class observation skills get a percentage of 90 with a very good category. Observing indicators are basic skills for other process skills that lead students to find real experiences in the form of conceptual understanding. In accordance with what was stated by Katimi & Ayani [13], that students who make observations will be easier to capture what they see compared to memorizing a material. Observing skills are skills that are easier to emerge than the nine other indicators [14]. It appears that students discuss with each other in their groups about the observations they get, so that observations are obtained to the maximum. Observing indicators produce high performance scores. This has a positive impact on improving the indicators of classifying students. In accordance with what was stated [15] that the achievements of each indicator of science process skills are related to each other. The results of the achievement value of high observing skills affect the high classification skills. This is due to students who make careful observations resulting in increased classifying skills [16].

In addition to using the observation sheet this study also conducted a performance evaluation in the experiment class, this assessment was carried out in the second session, after students present the results of their project, the observers were given a performance evaluation sheet. In this experiment class students are divided into five groups, each group has its own identities, students start from the application of project-based learning models that have been instructed to make the plant and animal cell project. Performance sheet rubric assesses starting from the planning stage, the implementation stage and the results stage. Based on the assessment of the five groups, the group that obtained the highest score of group one has a value of 94 and the value of group four has a value of 92 because the products they produce are cell organelles derived from formed plasticine, used balls and used cardboard and also the appearance and suitability of the product with project objectives. Unlike the case with other groups, namely group two with a value of 83 and group four with a value of 75, they do not completely use used plastic material but they add flannel cloth and pipette. The third group with a value of 58 because the specified appearance and materials are incomplete and not in accordance with the expected project goals.

The benefits of learning done by making this project is students will easily understand the concept of learning cells that are abstract and they are more useful learning material. Based on the results of the process and product performance evaluation, it can be seen that the continuity of the use of the project-based learning model in the experimental class has very good criteria and is quite good because it is seen based on the assessment starting from the planning, implementation and results with a total value of ≥ 58. It means that the project-based learning model can be used in learning and teaching activities in the classroom. This is supported by research which states that during work on projects, students are required to play an active role in various activities. Students can directly plan activities, solve problems and communicate the results of activities or products. Students gain a variety of learning experiences and the development of process skills.

Evaluation of learning achievement by using science process skills by means of posttest in the experimental class and control class with the results of the average value of the experiment class 79.7 and the control class average value of 67.3. This shows that in the experiment class student completeness in learning is higher than the control class. According to (Schneider, 2005; Musa et al, 2011) this happens because project-based learning teaches students to be creative, innovative, sharpen skills in making projects, and can improve student performance during learning.
4. Conclusions

The application of project-based learning models has a significant effect on science process skills. The results of the observation showed the average score of the science process skills of the experiment class was higher at 2.50 with good criteria while the control class was 1.68 with sufficient criteria. The science process skills with the highest scores are seen in the observation and communication indicators that are 90%. In addition, the results of the posttest mean score of the experiment class were 79.7 and the control class averaged 67.3. Suggestions in applying project-based learning model can be applied by the teacher to find out the students’ science process skills ability, but in preparation it takes a lot of time so that the learning can work well.

5. References

Singaraja: Program Studi Pendidikan IPA, Program Pascasarjana Universitas Pendidikan Ganesha. (2013)


Assessment Standardization of Music Art Work in Music Education Study Program FBS Universitas Negeri Medan

Uyuni Widiastuti
{yuniyundai@gmail.com}

Prodi Pendidikan Musik Universitas Negeri Medan, Indonesia

Abstract. The competency assessment of Music Education Study Program is called the Music Art Work presentation which is conducted individually and in group. The competency assessment is conducted in the form of a musical instrument practice test chosen by students as a major instrument in the Music Education Study Program. It is as the presentation of a single musical work and teaching music practice material for the high school students as a group music presentation. Both music art work presentation forms have to follow the assessment provided by the Music Education Study Program in order that the assessment was conducted based on the standards of the Music Education Study Program at FBS Universitas Negeri Medan for all the students.

Keywords: Standardization, Competency assessment, Music Art

1. Introduction

Sendratasik Department of Language and Arts Faculty consists of three study programs namely Music Education Study Program, Dance Education Study Program, and Performing Arts Study Program. These three study programs have practical courses that must be taken by all students to support their competencies as music teachers, dance teachers or dance / music artists. The arts competences must have clear assessment standards. Therefore, there will be same standards for anyone who assesses and is judged to have the same assessment standards. The competency assessment in the arts must refer to graduate profiles and the resulting competencies to support graduate profiles.

Music Education Study Program is a study program that has a profile of primary graduates as music teachers / educators, while supporting graduate profiles are practitioners of art (artists) and entrepreneurs in the field of music. Students said to be worthy of competence in the field of music must take the music art competency test conducted by Music Education Study Program. Music art competency test is assessed by lecturers who take practical subjects by following the assessment format provided. Therefore, if the students graduated, the students will have a graduation certificate of music competency.

In general, competence is the authority and person ability to carry out tasks or jobs in accordance with the position borne. Competence is an ability to carry out or do a job or task based on skills and knowledge and was supported by the work attitude demanded by the job [1]. The
objectives of the study were to achieve the competence concept such as behavior, skills and knowledge that were part of the emergence of one's competence.

Furthermore, when it is related to art, it can be said that art competency is a person's ability to perform arts skills and can express human feelings that have an element of beauty in them and expressed through a media that is real, be it in the form of tone, form, motion, and poetry, which can be felt by the five human senses.

Music art is a branch of art that discusses and assigns various sounds into patterns that can be understood by humans. Music art was the expression of the sense of beauty of a human being manifested in tones or sounds that ultimately produce rhythm and harmony [2]. Music will sound beautiful because of various musical elements incorporated in it. The elements contained in the art of music are as follows:

A melody is an arrangement of notes (sounds in regular order) that sound sequentially and rhythmically and express an idea of thoughts and feelings [3]. A melody consists of duration, pitch, and tone. Pitch is a matter that regulates a series of notes with the A-G alphabet symbol. Pitch is often called timbre or sound color. The series of notes becomes a melody in a certain time series called duration. Musical notes can be produced from various musical instruments with different sound colors or referred to a tone.

Rhythm is a sequence of series of movements that form the basic elements in music and dance, rhythm in music is formed from a group of sounds and silence with various lengths of time or short lengths, forming rhythmic patterns, moving according to pulses in swinging rhythms, rhythms and can felt, sometimes felt and heard; felt and seen; or felt, heard and seen [2]. Bar is an element of musical art in the form of repeated beats / swings that come regularly at the same time. Bar is a segment that divides song sentences into the same measurements that are marked with certain symbols or numbers [2]. The bars are written in fractional numbers like 2/4, 3/4, 2/3, and so on. An even denominator whose name is evenly called bainar bar, while an odd denominator is called ternair bar.

Harmony or chorus is a composition of several different tones of high pitch that are heard simultaneously which causes harmony of sound [3]. Harmony has interval and chord elements. An interval is an arrangement of two tones if sounded, while a chord is a combination of three or more notes that are sounded simultaneously.

Tempo is the speed of a song [4]. Tempo is associated with the speed of movement of music or song, or it can be said to be a measure of the speed of a song's bar. In general, the tempo sign is divided into 4, namely Slow Tempo (Largo), Medium Tempo (Moderato), Fast Tempo (Allegro), Tempo of Change (Rit, Ritard).

Dynamic is a sign to express the level of volume, or softness of sound and changes in the sound and softness of the sound [3]. In general, dynamic signs are divided into 3, which are as follows: Soft dynamic signs (piano), Medium dynamic signs (moderate), hard dynamic signs (forte). Dynamic is the most powerful element to show the emotions or feelings contained in a musical work when compared with other elements. Dynamic can show a work of music that has emotions or feelings such as sad, carefree, happy, aggressive, or flat. The scale is a series of notes, going up and down along an octave [4]. There are 3 types of scales, namely Diatonic Scale, Pentatonic Scale and Chromatic Scale.

Timbre is the sound color found on a musical instrument [2]. A musical instrument's timbre is influenced by the sound source and how it vibrates. The timbre produced by stringed instruments
will certainly be different from the timbre produced from the striking instrument, even though both are played in the same vein.

2. Discussion

Art competency test in Music Education Study Program is called Music Art Presentation which was conducted in the form of Music Art Forum. Music Art Forum activities were carried out by representing material that has been studied from semester I to semester IV of the selected instrument courses consisting of preparatory choice instruments, basic choice instruments, intermediate choice instruments and advanced choice instruments. Elective Instruments course consist of piano, wind instruments (saxophone, flute, trumpet), string (violin, viola, cello and contra bass), percussion (non-pitched and pitched percussion), guitar and vocals. Each musical instrument has the same material, including scale (tones and tri voices), etude and songs that are adjusted to the playing technique of each of the musical instruments.

The last material will be presented again at the Presentation of Music Art activities called the Music Arts Forum. After being presented there would be a discussion about how students present the material of the musical instrument.

The following will be presented the art competency test standards that would be used in the Presentation of Music Art (Music Art Forum). There are two types of forms of presentation of music that must be presented at the Music Arts Forum, namely:

a. Single Music Forum

The Single Music Forum aimed to assess the student's practical ability to the material that had been given in lectures from semester I to semester IV on selected musical instrument courses. Students present music artwork chosen by the lecturer to be presented in a single forum. Students are also guided by a supervisor at least five times (through a forum guidance book) and are approved to conduct a Music Arts Forum. The following will be presented in the rubric assessment format on the Music Art Presentation competency test standard through the Music Arts Forum.

b. Group Music Forum

The Group Music Forum aims to assess the students’ ability in applying professional, didactic and methodical competencies in music learning toward the students in the school. The students independently or in groups must train the junior and high school / vocational high school students by teaching music practice. The materials taught is course materials that have been studied during lecturing at the Music Education Study Program, namely: Music Instrument course (wind instrument, stringed instrument, percussion instrument, stringed instrument, vocal and piano) and School Music Ensembles (orchestras, music traditional, marching band). The following is the assessment standardization of single / group music works.
<table>
<thead>
<tr>
<th>NO</th>
<th>Rated Aspects</th>
<th>Indicators</th>
<th>Very Good (4)</th>
<th>Good (3)</th>
<th>Enough (2)</th>
<th>Less Good (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Duration</td>
<td>Tempo</td>
<td>Playing / singing is in the right tempo and stable with a range: Largo 40–60 bpm, Larghetto 60-66 bpm, Adagio 66–76 bpm, Andante 76–108 bpm, Moderato 108–120 bpm, Allegro 120–156 bpm, Presto 168–200 bpm, Prestissimo 200-208 bpm in accordance with the sheet music</td>
<td>Playing / singing is in a stable tempo but <strong>not in accordance</strong> with the range: Largo 40–60 bpm, Larghetto 60-66 bpm, Adagio 66–76 bpm, Andante 76–108 bpm, Moderato 108–120 bpm, Allegro 120–156 bpm, Presto 168–200 bpm, Prestissimo 200-208 bpm in accordance with the sheet music</td>
<td>Playing / singing is <strong>an unstable tempo but in accordance</strong> with the written range: Largo 40–60 bpm, Larghetto 60-66 bpm, Adagio 66–76 bpm, Andante 76–108 bpm, Moderato 108–120 bpm, Allegro 120–156 bpm, Presto 168–200 bpm, Prestissimo 200-208 bpm in accordance with the sheet music</td>
<td>Playing / singing with a tempo and range are not accordance with the written tempo</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Accuracy</td>
<td>Playing / singing a melody is well in accordance to the simple Bar accentuation pattern (2/2, 4/4)</td>
<td>Playing / singing a melody is well, but not accordance to the simple Bar accentuation pattern (2/2, 4/4)</td>
<td>Playing / singing a melody is not well, but in accordance to the simple Bar accentuation pattern (2/2, 4/4)</td>
<td>Playing / singing a melody is not well and not accordance to the simple Bar accentuation pattern (2/2, 4/4)</td>
</tr>
</tbody>
</table>

Table 1. Music Art Presentation Assessment Rubric (Single Music Art Forum)
<table>
<thead>
<tr>
<th>NO</th>
<th>Rated Aspects</th>
<th>Indicators</th>
<th>SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Very Good (4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The note values</td>
<td>Playing / singing melodies consistently with a relative note value (1, 1/2, 1/4, 1/8, 1/16, 1/32, triol, sinkopasi) written on sheet music</td>
</tr>
<tr>
<td></td>
<td>Accuracy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Pitch</td>
<td>The scale and pitch scale accuracy</td>
<td>Playing / singing the melody is in accordance to the scale and pitch scale accuracy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The melody accuracy</td>
<td>Playing / singing melody is in each periods with antecedents</td>
</tr>
<tr>
<td>NO</td>
<td>Rated Aspects</td>
<td>Indicators</td>
<td>SCORE</td>
</tr>
<tr>
<td>----</td>
<td>--------------</td>
<td>------------</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Very Good (4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and consequence is correctly</td>
<td>(one of the phrases) correctly</td>
</tr>
<tr>
<td>3.</td>
<td>Dynamic</td>
<td>Dynamic Accuracy</td>
<td>Playing / singing the melody is in accordance to dynamic piano signs and their derivatives (p,pp,ppp,pp pp), forte and its derivatives (f, ff,fff,ffff), dynamic graduation (cresendo, decresendo) on sheet music consistently</td>
</tr>
<tr>
<td>4</td>
<td>Timbre</td>
<td>Timbre accuracy in tone area</td>
<td>Playing / singing melodies is correctly timbre in all tone areas</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Timbre quality accuracy</td>
<td>Playing / singing all the melodies is in accordance with the music timbre</td>
</tr>
<tr>
<td>NO</td>
<td>Rated Aspects</td>
<td>Indicators</td>
<td>SCORE</td>
</tr>
<tr>
<td>----</td>
<td>---------------</td>
<td>------------</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Very Good (4)</td>
</tr>
<tr>
<td>1</td>
<td>The articulation accuracy</td>
<td>instrument consistently playing/singing a melody with all the articulations: legato (melismatic), stacato, portato, marcato, pizzicato</td>
<td>Playing a melody with only one of articulation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Playing the melody in accordance with one of the ornaments on the sheet</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Playing a melody is not in accordance with the melody ornamentation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Playing / singing melodies is balance but more dominant accompanist</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Playing / singing melodies is unbalanced melody</td>
</tr>
<tr>
<td>2</td>
<td>The ornamentation accuracy</td>
<td></td>
<td>Playing / singing songs is in accordance to: appoggiatura (flam), glissando, portamento, acciatura, triller, tremolo</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Playing / singing is unbalanced melody</td>
</tr>
<tr>
<td>5</td>
<td>Harmony Balance with accompaniment</td>
<td>Playing / singing melodies is balance between solis and accompaniment that suits with the room acoustics</td>
<td>Playing / singing melodies is balance but more dominant solis</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Playing / singing melodies is balance but more dominant accompanist</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Singing a song is not in harmony</td>
</tr>
<tr>
<td>6</td>
<td>English language Accuracy</td>
<td>Presenting music concepts and</td>
<td>Presenting musical concepts as well as musical elements</td>
</tr>
<tr>
<td></td>
<td>English use accuracy</td>
<td>Presenting music concepts</td>
<td>Presenting musical concepts as well as musical elements</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>English use is uncorrectly</td>
</tr>
<tr>
<td>NO</td>
<td>Rated Aspects</td>
<td>Indicators</td>
<td>SCORE</td>
</tr>
<tr>
<td>----</td>
<td>---------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>elements of music in English correctly and smoothly</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>and musical elements in English fluently and not yet correctly</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>in English unsmoothly</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>IT/ICT</td>
<td>IT / ICT use in the artistic performance of musical works is in accordance with the theme of the musical work</td>
<td>A small part of the performance of musical works is using artistic in accordance with the theme of the musical work</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IT / ICT use is not in accordance with the theme of music</td>
<td></td>
</tr>
</tbody>
</table>

### 3. Conclusion

The competency assessment must be owned by each study programs to assess the ability of students before graduating from the study program. The competency assessment of Music Education Study Program is called the Presentation of Music Art Work which is conducted individually and in group. Music Education Study Program competency assessment has an assessment standard that can be used by all assessors (lecturers) and examinees (students). The competency assessment is in the form of a musical instrument practice test chosen by students as a major instrument in the Music Education Study Program. In this competency assessment, students will play the last practical material given by the lecturer (semester IV) as the presentation of a single musical work and teach music practice material for the high school students as a presentation of group music.

### 4. References

Influence of Organizational Culture, Job Satisfaction, and Work Motivation to The Commitment of The Organization of Primary School Teachers of The Sub District Sumbul Pegagan District Dairi

Romaulina Siburian¹, Paningkat Siburian², Khairil Ansari³
Education Administration Study Program¹, State University of Medan, Indonesia²,³
ulina211989@gmail.com

Abstract. This research aims to describe and know (1) The influence of organizational culture to work satisfaction, (2) influence of organizational culture to the motivation of work, (3) influence of organizational culture to organizational commitment, (4) influence Job satisfaction of organizational commitment, and (4) effect of work motivation to the commitment of the state elementary school teacher in Sumbul Pegagan District Dairi. The type of research used is quantitative research with pathway analysis approach. The sample amount amounted to 187 people with sampling techniques using proportional random sampling. Research instrument in the form of poll, before the hypothesis testing conducted test analysis requirements, namely the test of data normality with Lily flowers, the test of linearity and the sense of regression with the analysis of variances on the level of α significance of 0.05. The results of the study found: (1) The organizational culture directly influence positively to job satisfaction, (2) The organizational culture of direct influence positively towards the motivation of work, (3) The organizational culture of direct influence positively to the commitment Teacher organizations, (4) Positive direct impact work satisfaction towards teacher organization commitments, (5) motivation of working positive direct influence on teacher's organizational commitments. The higher the influence of organizational culture, job satisfaction and the motivation of the teacher's work, the higher the commitment of the organization of elementary school teachers in Sumbul Pegagan District Dairi.

Keywords: Organizational Commitment, Organizational Culture, Job Satisfaction, Work Motivation

1. Introduction

Educational institutions are places to provide knowledge, develop skills and shape one's attitude. School is a place where the educational process takes place and is commonly called the teaching and learning process, where the process is expected to achieve educational goals, including equipping students to have three domains (cognitive, affective and psychomotor), so that students will later become human resources reliable and responsible in the midst of society, nation and state. This is where the role of schools becomes an important institution for the growth and development of individuals and communities.
Law of the Republic of Indonesia Number 14 of 2005 concerning teachers and Lecturers article 7 explains that the teaching profession is a special work carried out based on the principle of having a commitment to improve the quality of education, faith, piety and noble character. Professional teachers must have work commitments, academic qualifications, competencies, and responsibilities required as a basis for being able to carry out their work effectively and efficiently.

Regarding professional teachers in Indonesia, various efforts have been made to improve the quality of teachers in order to implement the national education system and realize national education goals. The education certification program through Teacher Professional Education and Training (PLPG) activities along with the provision of professional allowances, training, training, seminars and further education through the Educational Undergraduate Program for Teachers in office (PSKGJ) or through program 1 to several universities is as an effort has been and is being done to turn teachers into professional staff who have good competence, strong organizational commitment, high job satisfaction, work motivation and strong organizational culture. Thus, teachers as learners are expected to be able to carry out their duties and functions properly in realizing national education goals.

Based on these data the focus of the discussion in this paper is about “how The Effect of Organizational Culture, Job Satisfaction and Job Motivation on Organizational Commitment Teacher of State Elementary in regional incitement District Dairi”.

Luthans [1] states the organizational commitment as attitude is: (1) Commitment comes from the word commit. Echols [2] states, commitment means to do, then commitment means to make promises and responsibilities. Commitment is the decision of someone with himself, whether he will do an activity. Commitment is an attitude because it is a reflex of one's feelings (like or dislike) towards the organization in which the individual works. Robbins' opinion emphasizes commitment as a work attitude or belief that reflects the strength, personality and involvement of individuals in an organization. Commitment is the decision of someone with himself, whether he will do some activity, the strong desire to remain as a member of the organization; (2) the desire to strive according to the wishes of the organization; and (3) certain beliefs and acceptance of the values and goals of school organizations. Colquitt, LePine, Wesson [3] argues that organizational commitment includes effective commitment influenced by organizational culture, leadership styles & behavior, personality and cultural values (personality & culture) values), and motivation (motivation).

Organizational commitment is degree to which employees believe in and accept organizational goals and desire to remain with the organization Mayer & Allen in [4] said organizational commitment is a condition in which a particular employee sits on a particular organization and its purpose and desire to maintain membership in the organization. Organizational culture according to Colquitt, LePine, Wesson [3] is a shared social knowledge in an organization about rules, norms, and values that shape employee attitudes and behavior. This definition helps highlight a number of aspects of organizational culture. First, culture is social knowledge among members of the organization. Employees learn about the most important aspects of culture through other employees. Second, culture tells employees what the organization's rules, norms, and values are. What is the most important work outcome is to focus. Third, organizational culture shapes and reinforces certain employee attitudes and behaviors by creating a system of control over employees.

Job Satisfaction According to Colquitt, LePine, Wesson [3] job satisfaction is the level of pleasant feelings obtained from the assessment of one's work or work experience. In other words job satisfaction reflects how we feel about our work and what we think about our work. Job satisfaction is a positive feeling about work as a result of evaluating its characteristics.
Wahjusumidjo [5] provides states motivation can be interpreted as a psychological process that reflects the interaction between attitudes, needs, perceptions, and satisfaction that occurs in a person.

2. Research Method

This research was conducted using quantitative methods. The model used is a path analysis model (path analysis) or often referred to as a pattern of cause and effect relationships. According to Riduwan and Kuncoro [6] path analysis is used to analyze the pattern of relationships between variables in order to determine the direct or indirect influence of a set of independent (exogenous) variables on the dependent variable (endogenous).

This research was conducted at the SD Negeri Sumbul Subdistrict, Dairi Regency. Which was carried out in September 2019. In this study, the population was all elementary school teachers in Sumbul Subdistrict, Dairi Regency, spread in 37 schools totaling 349 people. Researchers took the number of samples using the Slovin formula with a chance of error or significance level $\alpha = 0.05$ with a sample of 187 people. The research sampling technique used is proportional random sampling. The data collection in this study used a questionnaire of organizational commitment, organizational culture, job satisfaction, and achievement motivation in the form of a Likert scale.

3. Result and Discussion

This study has four variables and the results of data collection and analysis can be described as follows.

- a) Correlation Between X1 Variable with Variable X2
  From distribution list t with df = 187 and the level of significance 5% is obtained this = 1.653. Thus, it turns out that $t_0 < t$ (2.618 > 1.653) so that it can be concluded that there is no meaningful correlation between variables of the X1 variable with X2.

- b) Correlation Between X1 Variables with X3 Variables
  From distribution list t with df = 187 and the level of significance 5% is obtained this = 1.653. Thus, it turns out that $t_0 > t$ (4.430 > 1.653) so that it can be concluded that there is a meaningful correlation between variable X1 variables with X3.

- c) Correlation Between X1 Variable With X4 Variable
  From distribution list t with df = 187 and the level of significance 5% is obtained this = 1.653. Thus, it turns out that $t_0 > t$ (4.139 > 1.653) so that it can be concluded that there is a meaningful correlation between variable X1 variable with X4.

- d) Correlation Between The Variable X2 With The X3 Variable
  From distribution list t with df = 187 and the level of significance 5% is obtained this = 1.653. Thus, it turns out that $t_0 > t$ (3.797 > 1.653) so that it can be concluded that there is no meaningful correlation between variable X2 variables with X3.

- e) Correlation Between Variable X2 And X4 Variables
From distribution list t with df= 187 and the level of significance 5% is obtained this = 1.653. Thus, it turns out that the < this (5.037 < 1.653) t_b so it can be concluded that there is a meaningful correlation between variable X2 variables with X4.

f) Correlation Between X3 Variable with X4 Variable

From distribution list t with df = 187 and the level of significance 5% is obtained this = 1.653. Thus, it turns out that t_b > this (4.913 > 1.653) so that it can be concluded that there is no meaningful correlation between variable X3 variables with X4.

Hypothesis 1

The proposed hypothesis is: H0: P21 = 0: The culture of the Organization has a direct effect on the work satisfaction of the state elementary school teacher Sumbul, Dairi district. H0: P21 ≠ 0: Culture of organization does not directly affect the positive work satisfaction of elementary school teachers in Sumbul district, Dairi District. Further to know the significance of the analysis of the path, then compared between the probability value 0.05 with a Sig value with the basis of decision making as follows if the probability value (0.05 < Sig) then Ho accepted and Ha rejected, the meaning is not significant. If the value of probability (0.05 > Sig) then Ho is rejected and Ha accepted, it means significant.

For the hypothesis test seen in the Sig column (significant) in table 4:16 Coefficients obtained the value of Sig 0.00 (0.05 > 0.00), then Ho rejected and Ha accepted means that the organizational culture directly affects the satisfaction of work. It means that the hypothesis is proposed that the task commitment directly affect work satisfaction is acceptable.

Hypothesis 2

The proposed hypothesis is H0: P31 = 0: The culture of the Organization has a direct effect on the motivation to work of elementary school teachers in Sumbul district, Dairi District. H0: P31 ≠ 0: Culture of organization does not directly affect the positive working motivation of elementary school teachers in Sumbul district, Dairi District. Further to know the significance of the analysis of the path, then compared between the probability value 0.05 with a Sig value with the basis of decision making as follows if the probability value (0.05 < Sig) then Ho accepted and Ha rejected, the meaning is not significant. If the value of probability (0.05 > Sig) then Ho is rejected and Ha accepted, it means significant.

To test the hypotheses seen in the field of GIS (significant) in table 4:16 Coefficients obtained the value of Sig 0.00 (0.05 > 0.00), then Ho rejected and Ha accepted means that the organizational culture directly affects the motivation of work. It means that the hypothesis is proposed that the organizational culture directly affects the motivation of work acceptable.

Hypothesis 3

The proposed hypothesis was H0: P41 = 0: The culture of the organization has direct effect on the commitment of the organization of elementary school teachers in Sumbul district of Dairi District. H0: P41 ≠ 0: Culture of organization has no direct effect on the commitment of the organization of elementary school teachers in Sumbul district Dairi. Further to know the significance of the analysis of the path, then compared between the probability value 0.05 with a Sig value with the basis of decision making as follows if the probability value (0.05 < Sig) then Ho accepted and Ha rejected, the meaning is not significant. If the value of probability (0.05 > Sig) then Ho is rejected and Ha accepted, it means significant.

For the hypothesis test seen in the Sig column (significant) in table 4:16 Coefficients obtained the value of Sig 0.00 (0.05 > 0.00), then Ho rejected and Ha accepted means that the
organizational culture directly affects the commitment of the Organization. It means that the hypothesis is proposed that the organizational culture directly affects the organizational commitments acceptable.

**Hypothesis 4**

The proposed hypothesis is \( H_0: \beta_{42} = 0 \): Job satisfaction has a direct positive impact on the commitment of the state elementary school teacher in Sumbul, Dairi district. \( H_0: \beta_{42} \neq 0 \): Job satisfaction has no direct positive effect on the commitment of the state elementary school teacher Sumbul District Dairi. Further to know the significance of the analysis of the path, then compared between the probability value 0.05 with a Sig value with the basis of decision making as follows if the probability value (0.05 < Sig) then \( H_0 \) accepted and \( H_a \) rejected, the meaning is not significant. If the value of probability (0.05 > Sig) then \( H_0 \) is rejected and \( H_a \) accepted, it means significant.

To test the hypotheses seen in the field of GIS (significant) in table 4:16 Coefficients obtained the value of Sig 0.00 (0.05 > 0.00), then \( H_0 \) rejected and \( H_a \) acceptable means that the satisfaction of the work directly affects the commitment of the Organization. It means that the hypothesis is proposed that work satisfaction directly affects the organizational commitments are acceptable.

**Hypothesis 5**

The proposed hypothesis is \( H_0: \beta_{53} = 0 \): The motivation of work has a direct positive impact on the commitment of the state elementary school teacher in Sumbul District, Dairi District. \( H_0: \beta_{53} \neq 0 \): Work motivation has no direct positive effect on the commitment of the state elementary school teacher Sumbul District Dairi. Further to know the significance of the analysis of the path, then compared between the probability value 0.05 with a Sig value with the basis of decision making as follows if the probability value (0.05 < Sig) then \( H_0 \) accepted and \( H_a \) rejected, the meaning is not significant. If the value of probability (0.05 > Sig) then \( H_0 \) is rejected and \( H_a \) accepted, it means significant.

To test the hypotheses seen in the field of GIS (significant) in table 4:16 Coefficients obtained the value of Sig 0.00 (0.05 > 0.00), then \( H_0 \) rejected and \( H_a \) acceptable means that the motivation of work directly affects the commitment of the Organization. It means that the hypothesis is proposed that the motivation of work directly affects the organizational commitments are acceptable.

**5. Conclusion**

Based on the results of the study as described in chapter v, the following research findings are summarized: a) Organizational culture has a direct positive effect on job satisfaction of elementary school teachers in Sumbul sub-district, Dairi district. In other words, the stronger the organizational culture, the greater the job satisfaction of elementary school teachers in Sumbul sub-district, Dairi district; b) Organizational culture has a direct positive effect on the work motivation of elementary school teachers in Sumbul Subdistrict, Dairi Regency. In other words, the stronger the organizational culture, the higher the work motivation of elementary school teachers in Sumbul Subdistrict, Dairi Regency; c) Organizational culture has a direct positive effect on the commitment of elementary school teacher organizations in Sumbul Subdistrict, Dairi Regency. In other words, the stronger the organizational culture, the higher
the commitment of the elementary teacher organization in Sumbul Subdistrict, Dairi Regency; d) Job satisfaction has a direct positive effect on the commitment of elementary school teacher organizations in Sumbul Subdistrict, Dairi Regency. In other words, the higher the job satisfaction, the stronger the commitment of the elementary teacher organization in Sumbul Subdistrict, Dairi Regency; e) Work motivation has a direct positive effect on the commitment of elementary school teacher organizations in Sumbul Subdistrict, Dairi Regency. In other words, the higher the work motivation, the stronger the commitment of the elementary teacher organization in Sumbul Subdistrict, Dairi Regency.

6. References

Analysis of Implementation of Standards for Facilities and Infrastructure of State Aliyah Madrasah in Medan City Based Minister of National Education Regulation Number of 2007

Lia Khairia Harahap¹, Ibnu Hajar², Arif Rahman³

Master of Education Administration, State University of Medan, Indonesia¹, Lectures of Education Administration, State University of Medan, Indonesia²,³

khairia922@gmail.com

Abstract. The Minister of National Education Regulation Number 24/2007 is a policy regarding educational facilities and infrastructure standards. State Aliyah Madrasah facilities and infrastructure in Medan are available in the appropriate category. This study focuses on how the Minister of National Education Regulation Number 24/2007 conducted by Madrasah Aliyah Negara Kota in Medan. Data analysis uses the theory put forward by George C. Edward III regarding policy implementation. This research is qualitative with data collection techniques through interviews, document reviews, observations, and making field notes. The results of this study explain that the implementation of Minister of National Education Regulation Number 24 of 2007 has been carried out since 2009. Implementation of Minister of National Education Regulation Number 24 of 2007 carried out by state madrasas in Medan, can not be separated from the role of the Regional Office of the Department of Religion of North Sumatra Province through the Madrasah Education Sector facilities and infrastructure section. In the technical implementation of the regulation, there is work synergy between the Madrasah Education Sector, facilities and infrastructure section of the Office of the Ministry of Religion, North Sumatra Province and the Aliyah Madrasah State in Medan. This synergy can be seen from the activities of training guidance, workshops, coordination, and work meetings between work units to build a shared vision and mission.

Keywords: Policy Implementation, National Education Regulation Number 24 of 2007, State Aliyah Madrasah in Medan City

1. Introduction

The Minister of National Education Regulation Number 24/2007 is a standard provision of facilities and infrastructure that is a reference for every formal education institution (school) in Indonesia. Every educational institution is required to make available educational facilities in accordance with these regulatory standards. Through this regulation, it is expected that there will be an even distribution of quality of education, particularly in terms of the availability of facilities and infrastructure, in every region in Indonesia. Based on The Minister of National Education Regulation Number 24/2007, the facilities and infrastructure to support the learning
of Madrasah Aliyah Negeri (MAN) in Medan have been available in the category of good condition and are ready to be operational. This condition can be seen from the presence of modern buildings and equipment, such as laboratories and teaching aids (language, biology, physics, computers, chemistry), mosque, UKS room, library room. In addition there are several infrastructures that support extracurricular activities, including: Da'wah cadre courses, scouts, marching bands, Paskibra, PMR (youth red cross), youth scientific works, nasyid groups, regional dances, green madrasas, English clubs, sports extracurricular (such as volleyball, table tennis, badminton, basketball and futsal), sismantap (anti-drug madrasa students). Based on these data, the focus of the discussion in this paper is how is the implementation of Government regulation No. 24 of 2007 regarding facilities and infrastructure carried out Madrasah Aliyah in Medan City.

The theory used in referring to the grand theory proposed by George C. Edward III, which states that the process of policy implementation has 4 important variables that are interconnected with one another. The four variables are communication, resources, disposition, and bureaucratic structure [1]. The relationship between the four variables on the results of implementation can be explained as follows:

a) Communication; is the process of delivering policies from policy makers to policy implementers. There are three things in this communication that need attention: (1) Transmission; model or method of delivering policies from policy makers to policy implementers. (2) Clarity; The submitted policy must be clear and not confusing or ambiguous. (3) Consistency; policies must be consistent, not changeable, which can confuse the implementer.

b) Resources; resources relating to all resources that can be used fatherly to support the successful implementation of a policy, both physical resources, such as the Implementer (implementer), facilities goods / equipment and non-physical resources, such as, access to information, authority.

c) Disposition or attitudes; is the attitude of the will or desire and commitment of the implementer towards the implementation of the policy. Disposition requires two things, namely staffing, staffing and intensive giving.

d) Bureaucratic structure; with regard to the mechanism of work in a bureaucracy relating to Standard Operating Procedures (SOP) and the division of work responsibilities in work units.

So, based on the explanation above, the factors of communication, resources, disposition, and bureaucratic structure influence the degree of success of policy implementation. Each of these factors interacts with and influence one another, which in turn influences policy implementation. Regarding the form of interaction between the four factors that influence the implementation of this policy can be seen in Figure 1:
2. Research Methods

This research was conducted using qualitative research methods, which are classified as field research (Field Research). To achieve the expected data in this study, the authors use several data collection techniques such as those used by Lincoln and Guba, namely using interviews, and reviewing documents (records or archives) that support and complement each other in fulfilling the required data as research focus. In addition, other data collection techniques that have been done by the author is by doing observation and making a field note when doing research. To check the validity of the data obtained in this study, researchers used the Triangulation technique developed by Lincoln and Guba, which consisted of: credibility, transferability, dependability, confirm ability. While the data analysis model used refers to the data analysis of the Miles and Huberman model [3], including: data reduction, data presentation.

3. Results and Discussion

In implementing the Regulation of the Minister of National Education of Republic of Indonesia Number 24 of 2007 Concerned on the Facilities and Infrastructure Standards of Elementary Schools/Madrasah Ibtidaiyah (SD/MI), First High Schools/ Madrasah Tsanawiyah (SMP/MTs), and Middle Schools/Madrasah Aliyah (SMA/MA) cannot be separated from the role of the Regional Office of the Ministry of Religion of North Sumatra Province (hereinafter abbreviated as the North Sumatra Ministry of Religion) through the facilities and infrastructure of Madrasah Education Sector as the parent of religious education institutions at the district / city level. Because basically the North Sumatra Ministry of Religion in the field of madrassa education is responsible for efforts to improve the quality and quality of madrassas under its auspices, including those related to facilities and infrastructure.
a) Transmission / Delivery of Messages

In the Implementation of government regulation no. 24 of 2007 concerning facilities and infrastructure, the North Sumatra Ministry of Religion through the madrasah education sector conveyed the technical implementation of the policy to the heads or Vice principal III in the area of madrasah facilities and infrastructure carried out by means of socialization, workshops and training of the Technical Guidance and meetings of leadership leaders madrasa. Within the scope of madrasah schools, the implementation of regulation was also disseminated to teachers and also school committees conducted by the leadership or Vice Principal III in the field of madrasah education facilities and infrastructure.

b) Clarity

Clarity of information in the implementation of governmen regulation no.24 of 2007 occurred because the implementers in each work unit formulated a common vision and mission in the implementation of the regulation. The formulation of the vision and mission of implementing the regulation gave birth to clarity related to the implementation of the regulation. As proof of the clarity of the submission of government regulation no.24 of 2007 and its top-down implementation agenda, it can be seen from the achievements of the accreditation of madrasah in Medan City which already has accreditation A.

c) Consistency

The socialization activities, workshops, and technical guidance on government regulation no.24 of 2007 organized by the North Sumatra Ministry of Religion in the field of madrasah education to the heads of madrasah or Vice principal III in the field of facilities and infrastructure have been carried out consistently since 2009. However, in 2019 the socialization, training, and technical guidance for the implementation of infrastructure are not specifically carried out in one activity. This is caused by two main factors that are interrelated with one another, namely first, the agenda of the North Sumatra Ministry of Religion in the field of madrasah education is focused on the development and improvement of the madrasa curriculum, second, the limited DIPA budget to carry out these activities. Even so, efforts to build communication related to the implementation of the regulation continue to be carried out through work meetings and discuss of leaders and work units as implementers.

Readiness of Supporting Resources for Policy Implementation

a) Human Resources

The task and responsibility of implementing rules of Minister of Education Regulation number 24 of 2007 is carried out by the implementers at each level. At the provincial level there is the North Sumatra Ministry of Religion's Regional Office, particularly in the field of madrasah education in terms of facilities and infrastructure, as the party that has functions, duties and responsibilities in relation to the implementation of government regulation no.24 of 2007 in madrasah at the district/city level. Whereas within the scope of state-owned Islamic schools in Medan there are Vice principal III in the field of facilities and infrastructure that function, task and are responsible for the process of implementing the regulation.

a) Information

Information related to the implementation of government regulation no.24 of 2007 in state-owned madrasah in Medan, there are two mechanisms for delivering information, namely hierarchical and non-hierarchical. First, hierarchically; Hierarchical information model is a top-down information model (from superiors to subordinates) and bottom-up (from bottom to
top). In this context the information model is top-down, information on the implementation of government regulation no.24 of 2007 is based on information from the Head of the North Sumatra Ministry of Religion, to the head of madrasa education sector, to the head of facilities and infrastructure section and then to the head of madrasah and staff. While information is bottom-up (from bottom to top) is information that appears from subordinates. This is because subordinates get new information related to the implementation of the regulation. Second, non-hierarchical information; in this context, implementers at the level of facilities and targets in the madrasah education sector and Vice principal in the infrastructure and facilities in madrasah generally take the initiative to seek information to add, clarify, and understand the implementation agenda for government regulation no. 24 of 2007.

b) Authority
Authority (authority) is legitimacy for the implementers of the policy (implementer) that is formal. First, is in the North Sumatra Ministry of Religion. In the institutional structure in the North Sumatra Ministry of Religion there is a work field, namely the madrasa education sector. In the field of madrasa education there are work units that are specifically related to facilities and infrastructure, namely the facilities and infrastructure section. Second, is in the madrasah environment. In the bureaucratic structure in Madrasah in Medan, the headmaster is given the authority to appoint and place 1 Deputy Head of Madrasah (WKM) in the field of facilities and infrastructure, generally called Vice Principal III. Vice principal III in the field of facilities and infrastructure is a functional position based on SK (Certificate) as a form of legality of his position.

c) Budget Resources
In the implementation of government regulation no.24 of 2007 concerned on facilities and infrastructure in Medan City Madrasas, there are two budgets, namely: First, the DIPA fund budget of the Ministry of Religion is the budget of the government that is handed down to madrasah through the North Sumatra Ministry of Religion in the Field of Madrasah Education, Madrasah Education. Second, madrasa committee funds are sourced from grants or donations from parents / guardians of students. The parents / students give a sum of grant money or donations.

d) Equipment / Facilities Resources
The availability of supporting facilities for the implementation of Permendiknas number 24 of 2007 and a mandatory requirement for the implementer is a set of computers or laptops and printer machines, in addition to desks, rooms and others that have become facilities that must exist in every agency / institution. The computer or laptop functions as a medium for input of facility and infrastructure data into the Infrastructure Management Information System (SIM-SARPRAS) application, and the Electronic Monitoring and Evaluation of Madrasah Facility and Infrastructure Assistance (E-MONEV) applications. This application is a non-physical supporting facility. Through this application, the parties concerned, especially the facilities and infrastructure section of the madrasah education sector of the North Sumatra Ministry of Religion, can find out the achievements of the facilities and infrastructure based on the standards specified in government regulation no.24 of 2007.

Disposition of Policy Implementation
Disposal of policy implementation requires two main factors, namely the appointment of bureaucracy and the provision of incentives.
a) Appointment of Bureaucracy

In the implementation of Minister of Education number 24 of 2007, there is a separated mechanism in the North Sumatra Ministry of Religion and the MAN in Medan City in selecting and appointing people as implementers. Within the North Sumatra Ministry of Religion's Regional Office, the Head of Madrasah Education has the authority to appoint the section head of madrasah facilities and infrastructure. Where in the madrasah environment, the madrasah head has the authority to appoint WKM III in the area of madrasah facilities and infrastructure as well as its operator staff.

b) Incentives

In carrying out the duties and responsibilities related to the implementation of Minister of Education Regulation number 24 of 2007 there are incentives given to implementers. Within the scope of madrasas, WKM III in the field of facilities and infrastructure as well as incentive operator staff are fully provided by the madrasah head that comes from DIPA funds. DIPA funds provided by the North Sumatra Ministry of Religion are then allocated as incentives based on school principal approval.

Bureaucratic Structure in Policy Implementation

Bureaucratic structure in policy implementation relates to 2 main characteristics, namely operational forced (SOP) standards and the division of responsibilities.

a) Implementation Manual or Operational Procedure (SOP) Standards

The SOP on the technical implementation of government regulation no.24 of 2007 was not / not yet formulated by the North Sumatra Ministry of Religion in the Field of Madrasah Education, but the effort to implement and also manage facilities and infrastructure was based on the workflow mechanism determined in each field. This workflow is formed based on the division of tasks and responsibilities in each area of the work unit. In State Madrasah Aliyah in Medan City, the technical SOP on the implementation of the regulation was also not/not yet formulated. Matters related to the implementation of the implementation of madrasa facilities and infrastructures are adjusted directly to the contents of government regulation no.24 of 2007.

b) Division of Responsibilities

In the organizational structure in the North Sumatra Ministry of Religion there are several fields that have their respective duties and functions, one of which is the madrasa education sector. Within the scope of the madrasa education sector there are 5 sections and 1 group of functional positions, namely the curriculum and evaluation section, the educator and teaching staff section, the facilities and infrastructure section, the student section, the institutional section and the madrasa information system. The implementation of the policy on state-owned alyiah madrasa infrastructure in the city of Medan is responsible for the facilities and infrastructure section of the madrasah education sector of the North Sumatra Ministry of Religion. While within the scope of state madrasas in Medan, the duties and responsibilities related to the implementation of government regulation no.24 of 2007 and management of educational facilities and infrastructure are carried out by Deputy Head of Madrasah III in the field of facilities and infrastructure.

4. Conclusion

The implementation of The Minister of National Education Regulation Number 24/2007 conducted by state madrassas in Medan cannot be separated from the role of the Regional
Office of the Ministry of Religion of North Sumatra Province (North Sumatra Ministry of Religion) through the Sector of Madrasah Education in the facilities and infrastructure section. In this context the Madrasah Education Sector facilities and infrastructure section conducts guidance, coordination and work meetings related to the implementation of government regulation no.24 of 2007. Implementation of these regulations has been carried out from 2009.

Synergy between work units in implementing Minister of National Education Regulation Number 24/2007 has been based on the elements of implementation that include the dimensions of communication. Availability of supporting resources, disposition of policy implementation in the form of bureaucratic appointment and provision of incentives, and division of work tasks based on mechanism / work flow between each work unit. So that MAN education facilities and infrastructures in Medan City reach the standards determined by Minister of Education Regulation No.24 of 2007.

6. References


Needs Analysis of Junior High School Teachers at Kecamatan Hamparan Perak, Deli Serdang

Muhammad Rizki Syahputra¹, Darwin², Salman Bintang³
Master of Education Administration, State University of Medan, Indonesia¹
State University of Medan, Indonesia²,³
{muhammadrizkisyahputra08@gmail.com¹}

Abstract. This research aims to determine the need for analysis of junior high school teachers in the Kecamatan Hamparan Perak, Deli Serdang. Analysis of teacher needs is done by analyzing, 1) Analyze the actual condition map of the number of teachers based on junior high school subjects in the Kecamatan Hamparan Perak, Deli Serdang, 2) Analyzing the map needs of the ideal teachers based on the middle school subjects in the Kecamatan Hamparan Perak, Deli Serdang, 3) Analyzing the shortage of state junior high school teachers needed based on the subjects in the Kecamatan Hamparan Perak, Deli Serdang, 4) To analyze the solution to the number of disadvantages of junior high school teachers in the Kecamatan Hamparan Perak, Deli Serdang. The type of research used is a necessity analysis with a qualitative approach. This research was conducted in the state Junior High School in the Kecamatan Hamparan Perak Deli Serdang from July to October. Data collection techniques is using interview methods, documentation and observation studies. The results showed that 1) the actual map of the number of teachers based on junior high school subjects in the Kecamatan Hamparan Perak, Deli Serdang amounted to 61 teachers, 2) Map of the ideal teachers’ needs based on junior high school in the Kecamatan Hamparan Perak, Deli Serdang amounted to 91 teachers, 3) Shortage of state junior high school teachers needed based on the subjects in the Kecamatan Hamparan Perak, Deli Serdang amounted to 31 teachers. 4) Solution of fulfillment of the number of disadvantages of junior high school teachers in the district of the Kecamatan Hamparan Perak, Deli Serdang by reporting data of DAKL shortage of teachers to the district Education Office of Deli Serdang and to recruitment of honorary teachers for the subjects That there is a vacancy in the number of teacher subjects with funds from the School operational Assistance.

Keywords: Needs Analysis, Junior High School Teacher

1. Introduction

Teachers are resources that determine the success of national education development, the success of the education process depends on the role of teachers. Guru is one element of education stakeholders who play a leading role in educational institutions, the role of teachers in improving the quality of education cannot be ignored as the teacher has a central role and in the success of national education.

The teacher's position needs to get attention like the needs and disadvantages of teachers who happen to each school. Analysis of teacher needs as a process to determine the number of teachers needed by the school, analysis of teachers’ needs to ensure that teachers’ needs are
met. The conditions that occurred in some schools today have an excess number of teachers and there is a school that is still lacking in teachers. This is in line with the opinion of Engkoswara and Komariah suggests that one of the purposes of planning is to ensure the achievement and the use of resources efficiently, effectively, fairness and sustainable, the resources in the mean of course human resources, learning resources, curriculum or facilities [1].

Analysis of teacher needs is done in order to know the number of teachers’ needs in the future so that it can be used as a reference or guideline in determining the number of teachers needs. Analysis of the needs of teachers to avoid the proportion of the number of teachers is too much compared to the number of teachers needed, so that the government does not spend too much budget for teacher salaries.

The problem of this teacher's needs occurred in the district of Perak, Deli Serdang District, the Perak expanse of Deli Serdang District is one of 22 districts in Deli Serdang Regency. In Kecamatan Perak, there are 3 junior high schools. The lack of inaccuracy of teachers in Deli Serdang district is seen as an excess of the teacher in the state Junior high School, the District of Serdang. The needs of junior high school teachers in the sub-district, Deli Serdang District, 73 teachers, the existence of junior high school teachers in the Kecamatan Perak region of Deli Serdang, 56 teachers and disadvantages of junior high school in the district 19 teachers.

The availability of adequate teachers is the key to the sustainability of the teaching and learning process in every institution, the problem is that the spread of teachers that do not evenly impact the needs of teachers, the existence of teachers and Lack of teachers in several subjects that took place in junior high school in the district of Perak region Deli Serdang District.

Lack of the accuracy of the Master of State Junior high School in the district of Deli Serdang Regency has resulted in an excess of teachers in the schools and there is shortage of even vacancies in other schools. The unavailability of certain teacher of subjects, the limitations of central and local governments in the provision of teachers’ quota in the recruitment process of civil servants and limited number of teachers graduates of certain subjects is one of the causes a certain subject void. Schools lacking a teacher's subjects indicated that the planning and distribution of the teacher's subjects had not been well done. The teacher's energy planning directs the management of teachers for the better, and also balances the teacher's need for teacher demand with a teacher supply.

The shortage of teachers will impede the implementation of quality improvement and equitable education programs, the teacher's deficiency will result in the cause of task for the teacher and otherwise excess teacher means the financial waste of the State and source Human resources. Besides, the efforts of the use of existing teachers is felt less effective due to the accuracy of teachers who are not good. This is reflected in the fact that there is a shortage of teachers in a school and an excess of teachers in other schools.

The need for teachers who are not met between supplies and demand will impede the learning process in school, lack of teachers in school indicated that the analysis of teacher needs has not been well patterned, so that the research is very Important for the purpose of obtaining an overview of how the business meets the needs of junior high school teachers in the district in the Perak region of Deli Serdang District, especially in the education office of Deli Serdang District.

Teacher Needs Analysis

Analysis is the process of solving a complex problem into small parts so that it can be easier to understand. Etymologically, the word analysis comes from the English language analysis which means careful examination. Meanwhile, the analysis is a thinking activity to
describe a whole as a component so that it can recognize the signs of components, contact each other and function respectively in one whole integrated [2].

The above opinion gives the idea that the analysis summarizes a large amount of data that is still raw into the information that can be interpreted. Categorisation or separation of the relevant components or parts of a data set is also a form of analysis used, all of which seeks to illustrate certain patterns consistently in the data so that the results can be learned and translated in a simple and meaningful way. The need for that is a gap between what is now with how it should be. If viewed in the context of education, the necessity is everything that can support all things that can create the process of education well. Both in the needs of teachers, infrastructure, curriculum, or other educational facilities that are able to influence the educational activities [3]. The needs of teachers is a reflection on the demands of the use of professional services teachers to provide education services to the students at the education institution of the teacher's school. Teachers' need to provide certain education services must meet certain requirements ensuring that the service is demanded in accordance with the expectations of the user. The requirements that are expected are crucial because the education organizer demands a professional skill of the teacher who not everyone can have it [4].

Based on the above, it can be said that teachers are needed in order to create quality educational outcomes. But in fact in the field, the needs of teachers become problems facing the current education. Before planning the needs of teachers, there needs to be the creation of basic assumptions and special assumptions, the average population of migration, form of government, politics, economic organization, while the special assumption is an assumption centered on local conditions.

**Human Resource Planning**

Human Resource planning is a process that organizations use to ensure that the Organization has the right amount of manpower, available the right type of workforce, at the right time, at a position or place The place and do the proper work [5]. Furthermore, planning is the function of manager which involves the selection from alternatives of objectives, policies, procedures and programs. It means that planning is a manager's function that relates to choosing the objectives, policies, procedures, programs, and alternatives that exist [6]. Furthermore, it is a systematic and continuous process in analyzing the needs of the organization of human resources in a condition that is always changing and developing policies to the organization's long-term plan [7]. Human resource planning is the first function and should be implemented in the organization. Human resource planning is the specific measures taken by management to ensure that the appropriate employees are available to occupy various positions, and the right employees at the right time [8].

The various understandings that have been outlined can conclude that human resource planning is a systematic planning in terms of the need and provision of human resources that meet the requirements/qualifications to occupy various positions, which is useful to anticipate the shortage of human resources for the organization in the future, so that an organization will have the right amount of manpower, working at the right time, and doing the right job.

2. **Methodology**

Research analysis needs of junior high school teachers in the sub-districts of Deli Serdang District type qualitative research. According to Creswell in Darmadi qualitative research is a
study based on a methodology that investigates a social phenomenon and human problems. In qualitative research, researchers made complex depictions, examined written or oral words, attitudes, detailed reports, or documentation from respondents or subjects that were subject to study and studied in a natural and described situation in the form of research reports [9].

The location that was used as a research site is junior high School in the Kecamatan Perak District Deli Serdang. The time of research started in July expires October 2019 until the data obtained saturated. Saturated data is a term to describe the data gained when the data source provides similarity to information or similarity of data. The subject in this study is the informant or the person providing the information needed in the collection of research data. The subject of research in this research is the perpetrators of both directly and indirectly involved in the analysis of the needs of junior high school teachers in the district of the Perak region of Deli Serdang District. The subject of research is Kabid coaching and the demonstration of the Education office of Deli Serdang Regency and head of SMP Pendidikan in the sub-district of Deli Serdang Regency. In addition to the above subject, the data of the existence of junior high school teachers in Deli Serdang District Education Office is also used as a requirement for analysis.

As an initial informant is chosen Purposif, which understands the object of research that overwhelsm the problem studied (Key informant). Further information is requested to the initial informant to show others who can provide information and then the information is asked to also show other people who can provide information, as well as so on. This is usually referred to as a snowball that is performed sequentially.

3. Results and Discussion

3.1 Map of Actual Number of Teachers Based on Junior High School in The Perak Region of Deli Serdang District

Based on the teacher DAKL SMP Negeri 1 subdistrict of the silver-level Deli Serdang District, DAKL teachers SMP Negeri 2 District of the silver expanse of Deli Serdang District and DAKL teachers SMP Negeri 3 sub-district in the district of Deli Serdang, map of actual conditions number of teachers Based on junior high school in the Sub-district of the Perak region of Deli Serdang, the total number of 61 teachers, with details on the number of teachers The silver expanse of Deli Serdang Regency 35 Teachers, the number of teachers of SMP Negeri 2 sub-district Perak District Deli Serdang 20 teachers, and the number of teachers of SMP Negeri 3 subdistrict of the district of Deli Serdang 6 teachers.

Based on the results of the study can be concluded that the actual condition map of the number of teachers based on junior high school in the Sub-district of the Perak region of Deli Serdang Total 61 teachers, with details on the number of teachers The silver expanse of Deli Serdang Regency 35 Teachers, the number of teachers of SMP Negeri 2 sub-district Perak District Deli Serdang 20 teachers, and the number of teachers of SMP Negeri 3 subdistrict of the district of Deli Serdang 6 teachers.

3.2 Map of Ideal Teacher Needs Based on The Public Junior High School in The Perak Region of Deli Serdang District

Based on the implementation guidelines for the needs of the teachers of the Ministry of Education and Culture, Directorate General of Teachers and education year 2018, map of the ideal teacher needs based on the subjects in the District Junior high School overlays Regency of
Deli Serdang The total number of 91 teachers. With details needs of SMP Negeri 1 sub-district Perak District Deli Serdang amounted to 48 teachers, the need of SMP Negeri 2 sub-district of the regency of Deli Serdang, a total of 26 teachers and junior high School 3 sub-districts in Deli Serdang A total of 17 teachers, in the form of tables and graphs are described below.

Based on the results of research can be concluded that the map needs an ideal teacher based on the middle school subjects in the sub-district of the Perak region Deli Serdang Total number 91 teachers. With details of teachers’ needs in SMP Negeri 1, the Kecamatan Perak district of Deli Serdang amounted to 48 teachers, the needs of teachers in SMP Negeri 2 sub-districts of Deli Serdang District amounted to 26 teachers, and the needs of teachers at SMP Negeri 3 subdistrict Overlays The Perak Deli Serdang District amounted to 17 teachers.

3.3 Shortage of state junior high school teachers needed based on the subjects in the Perak expanse of Deli Serdang District

Based on the implementation guidelines for the needs of junior high school teachers, Ministry of Education and Culture Directorate General of Teachers and education year 2018 the ideal teachers and data of existing teachers based on the subjects in the junior high School of the Sub-district in the region of Deli Serdang District, then the number of shortages of teachers needed based on the subjects The district of Perak, Deli Serdang District. State Junior High School in the Sub-district of Deli Serdang District lacked 31 number of teachers with details of shortage of teachers in SMP Negeri 1 sub-districts of Deli Serdang district amounted to 14 teachers, lack of teachers in SMP Negeri 2 sub-districts The Perak Deli Serdang District amounted to 6 teachers and lack of teachers in SMP Negeri 3 sub-district of Deli Serdang District amounted to 11 teachers.

Based on the results of the study can be concluded that the shortage of state junior high school teachers needed based on the subjects in the district of Perak region of Deli Serdang Total 31 teachers. With details of the shortage of teachers in SMP Negeri 1 sub-districts of Deli Serdang District amounting to 14 teachers, shortage of teachers in SMP Negeri 2 sub-districts of Deli Serdang District amounted to 6 teachers, and lack of teachers in SMP Negeri 3 subdistrict. The silver overlay of Deli Serdang district amounted to 11 teachers.

3.4 Fulfilment solution for total shortage of public junior high School in the Perak region of Deli Serdang District

Based on the results of the study can be concluded that the solution to fulfill the number of disadvantages of junior high school teachers in the sub-district of Deli Serdang District as in SMP Negeri 1 sub-district of Deli Serdang District reported deficiency data The number of teachers to the Education office of Deli Serdang District and to conduct the recruitment of honorary teachers for the subjects that there is a vacancy with the cost of the school Operational Assistance Fund, solution for the number of lack of teachers in SMP Negeri 2 The Perak border district of Deli Serdang District reports the lack of the number of teachers to the district Education Office of Deli Serdang and the recruitment of honorary teachers for the subject of vacancy with the cost of the grants School operations and principals of SMP Negeri 2 in the district of the Perak district of Deli Serdang entered into teaching to fulfill the number of teachers lacking in IPS at SMP Negeri 2, The fulfillment of the number of shortage of teachers in SMP Negeri 3 sub-districts of Deli Serdang District reported that the data for the shortage of teachers to the district Education Office of Deli Serdang and recruitment of honorary teachers for the subjects Vacancy with the cost of the school's Operational Assistance Fund.
4. Conclusion

Based on research conducted in junior High School (SMP) state in the district of Perak expanse of Deli Serdang Regency can be taken into the following conclusions:
1) Map of actual conditions of the number of teachers based on junior high school subjects in the district of Deli Serdang District Perak amounted to 61 teachers. That the actual condition of the number of teachers of SMP Negeri 1 sub-district of Deli Serdang Regency amounted to 35 teachers, map of actual conditions of the number of teachers based on the subjects in SMP Negeri 2 sub-district in the district of Deli Serdang, 20 teachers and The actual map of the number of teachers based on the subjects in SMP Negeri 3 sub-district of the district of Deli Serdang is 6 teachers,
2) Map of ideal teachers’ needs based on junior high school in the district of Perak region Deli Serdang amounted to 91 teachers. That the total needs of the teachers are ideal based on the subjects in SMP Negeri 1 sub-district in the district of Deli Serdang, amounting to 48 teachers, the number of ideal teacher needs based on the subjects in junior high School 2, Kecamatan Perak Deli Serdang District amounted to 26 teachers and number of ideal teachers’ needs based on the subjects in SMP Negeri 3 sub-districts of the district of Deli Serdang, 17 teachers,
3) Shortage of state junior high school teachers needed based on eye clumps In Deli Serdang District, a total of 31 teachers. Lack of teachers in SMP Negeri 1 sub-district Perak District Deli Serdang amounted to 14 teachers, shortage of teachers in SMP Negeri 2 sub-districts of Deli Serdang District amounted to 6 teachers and lack of teachers in SMP Negeri 3 sub-district, Perak Deli Serdang Regency amounted to 11 teachers,
4) solutions for the number of shortcomings in the District Junior high School in the Perak region of Deli Serdang District. In fulfilling the lack of teachers in SMP Negeri 1 sub-district of Deli Serdang District reported that the data was lacking in the teachers to the district education office in Deli Serdang and to undertake the recruitment of honorary teachers for the subjects.

There is a vacancy in the number of teacher subjects with funding from the School operational Assistance (BOS). Solution SMP Negeri 2 Sub-district Perak District Deli Serdang in fulfillment of the lack of the number of teachers in SMP Negeri 2 sub-district of Recruitment of honorary teachers for the subjects with funding from the school's operational Assistance (BOS). But not all subjects that there is void the number of teachers in fulfill with an honorary teacher only a few subjects, this happens because the funding from the School operational Assistance (BOS) is insufficient if the funds to the honorary teachers. Solutions SMP Negeri 3 sub-district Perak District Deli Serdang in fulfillment of the lack of the number of teachers in the state junior high School 3 sub-districts of Deli Serdang by reporting data Kekurangan the teacher to the Education office of Deli Serdang District and Add hours to the teachers to fulfill subjects that lack the number of teachers available in SMP Negeri 3 sub-districts of Deli Serdang Regency, as well as hiring honorary teachers for subjects That there is a vacancy in the number of teacher subjects with funds from the School operational Assistance (BOS).

5. References


The Implementation of Management Training Model Diploma in Mechanical Engineering, Faculty of Engineering, State University of Medan

Leni Purwati¹, Rosmala Dewi², Darwin³
Postgraduate Students at Universitas Negeri Medan, Indonesia¹
Jurusan Psikologi Pendidikan dan Bimbingan Universitas Negeri Medan, Indonesia²
Jurusan Pendidikan Teknik Bangunan Universitas Negeri Medan, Indonesia³
lenipurwati1975@gmail.com

Abstract. This research aims to determine the Implementation of Training Management Models for Diploma (D3) Students in Mechanical Engineering, Faculty of Engineering, The State University of Medan. This research uses descriptive method with a qualitative approach. Data collection techniques used were field studies in the form of observation, interviews, and documentation with the Head of Study Program, Head of Workshop, Students and Employees of the Diploma in Mechanical Engineering at the Faculty of Engineering, Universitas Negeri Medan related to management training in the Diploma (D3) in Mechanical Engineering Universitas Negeri Medan. The results of the study showed that the training management model in Diploma (D3) of Mechanical Engineering, Faculty of Engineering, Universitas Negeri Medan had not been well-organized planning, because the training management itself was still attached to the product design courses, this was due to the absence of a stand-alone training program independently, both internally and in collaboration with outside training institutions. But the implementation is good because students are already skilled in using tools and drawing designs. It is therefore recommended to establish management training that is independent and separate from the course, so that the training carried out at Diploma (D3) of Mechanical Engineering, Faculty of Engineering Unimed is more effective and in accordance with the expected achievements.

Keywords: Model Implementation, Training Management.

1. Introduction

The main problem facing our nation, especially in the field of education in the face of globalization is the low level of competence and quality of human resources. The development of a technology is inseparable from the potential of human resources who have the skills to produce new products creatively and innovatively. Qualified population is a supporting factor for the success of development. Improved workforce skills are obtained through structured training, which for the production process will not be able to work optimally without being accompanied by providing broader and deeper training. Training shows that activities are planned to achieve mastery of skills, knowledge, and positive attitudes. For this reason, training is usually coupled with development that is more focused on improving decision-making abilities and broadening human relations for top management and middle management.
2. Research Method

This research is a descriptive qualitative research where in the future it will find the widest knowledge about a particular object by gathering as much information as possible in order to describe things that are specific to the object under study. To facilitate the design of this study based on the problems and literature review described previously. Qualitative methodology is a research procedure that produces description data in the form of written or oral words from people and observable behavior. The object of study in this research is the implementation of the management training model of the Diploma Three students of Mechanical Engineering, Faculty of Engineering, Universitas Negeri Medan.

Analysis of the data in this study leads to descriptive analysis or analysis that describes factual information. For this reason, data analysis techniques use qualitative descriptive analysis techniques and do not test the hypothesis or the relationship between variables. This qualitative descriptive analysis is to answer the research questions that have been prepared in the previous chapter. The level of descriptive analysis depth in this study only reached the presentation of facts and systematic description of data relating to information and the phenomenon of the implementation of the management training model of the Diploma Three students of Mechanical Engineering, Medan State University. The next step, after the data is collected, then the data needs to be analyzed. Data analysis consists of 3 (three) activities that occur simultaneously namely data reduction, data presentation, drawing conclusions / verification. So in this research the data analysis is done by using an interactive model or inductive analysis techniques namely: 1) data collection; 2) data reduction; 3) data presentation and; 4) drawing conclusions.

![Graph showing proportions of Indonesian workers 2018](image-url)
3. Results and Discussion

Based on the management function, the management training found in the Universitas Negeri Medan D3 Mechanical Engineering Diploma Program is as follows:

1. Planning
   a) The training activities have been designed through the RPS (Semester Program Design) and are in accordance with the IQF curriculum, but have not fully designed the stages of the training implementation that will be carried out throughout the meeting. Material supporting the training activities of product design courses has not been arranged properly, so students are required to search for literature independently through assignments given by lecturers or through courses in the previous semester.
   b) Providing training in product design courses is in accordance with the goals and vision and mission of the D3 Universitas Negeri Medan Mechanical Engineering Study Program, which is to create students who are skilled and competitive in the field of production machinery.
   c) The evaluation is still using the Assessment Standards for courses namely DPNA, not using the assessment for student competency tests.

2. Organizing
   a) Determination of competency-based training instructors has been done based on the expertise and experience of the instructors.
   b) Facilities and infrastructure such as the availability of practical materials and machine tools making equipment are quite complete, but the practice room lighting is still lacking.
   c) There are no prerequisites for students who will participate in product design training, so students who have not passed the courses below are allowed to attend the training.

3. Implementation
   a) The training has been carried out using the guided inquiry method guided by the lecturer as an instructor.
   b) Objective student competency information is not neglected objectively, even though this information is important for teachers to condition participants according to their competencies in training activities.
   c) Allocation of training time carried out is in accordance with the RPS, which is as many as 16 times meeting 100 minutes (2 credits) each

4. Control
   a) The lecturer performance has been carried out by the D3 Unimed Mechanical Engineering Study Program
   b) Feedback on student activities has not been clearly detailed
   c) Tracer Study is still carried out manually so there is no tracer study system

Based on the analysis of trends obtained by researchers, it can be concluded that the learning model that has been applied is quite good, but to improve student competence in designing products requires a certain training model, because training requires a certificate of competency test results as a companion diploma. To improve student competency in product design, well-organized training is needed, starting from planning, organizing, implementing, to controlling. Existing training management must also be adjusted to the Level 5 National Work Qualification Standards (SKKNI) Training Methodology Subdivision. The facilities and facilities that support the training in the Universitas Negeri Medan D3 Mechanical Engineering Study Program are complete enough, namely by having enough machining tools to be used by all students in one
class, totaling approximately 15 people. The workshop / workshop room is also spacious and far from noise, and is able to reduce the noise from the workshop.

Basically the training has been going well, but several things that need to be developed are the making of practicum modules, with the aim that students can design the production machine more directed. Students are already skilled enough in designing products, but have not been able to create appropriate production machines in society. This is one proof that training modules are really needed so that students do not only rely on their creativity, but can also be guided by existing literature, such as work modules. Based on the analysis obtained by the researcher, it can be concluded the results of internal validation that the design of training management in Diploma Three of Mechanical Engineering, Faculty of Engineering, State University of Medan can be seen that management training shows that planning and implementation are included in the already good category. All have been carried out in accordance with what has been expected by the study program. Although overall it can be said to be in a good category but in its implementation, there are still some deficiencies in certain aspects.

Based on the results of the study and studied in theory it can be concluded that the implementation of the training management model is going well, this is seen from several aspects which include the achievement of targets, product completion time, and customer satisfaction. As confirmed by the results of the interview, it has been going well, but there are several evaluation programs that must be carried out involving all the management parties, study programs, production unit heads, lecturers, students and staff in order to improve quality

4. Conclusion

1. The theoretical design of management training in the Unimed Diploma 3 Mechanical Engineering Study Program has led to the concept of BLK as an organizational concept but not yet. However, to improve student competency in designing products, certain training
models are needed, because training requires a certificate of competency test results as a companion diploma. To improve student competency in product design, well-organized training is needed, starting from planning, organizing, implementing, to controlling. Existing management training must also be adjusted to the National Level Work Qualification Standards (SKKNI) Level 5 Subdivision Training Methodology. The facilities and facilities that support training in the Unimed Diploma in Mechanical Engineering Three Study Programs are quite complete, namely by having sufficient machining tools to used by all students in one class, totaling approximately 15 people. The workshop / workshop room is also spacious and far from noise, and is able to reduce the noise from the workshop. Basically the training has been going well, but a number of things that must be developed are the making of practicum modules, with the aim that students can design production machines more directed

2. The results of the validity of the training management model in the Universitas Negeri Medan D3 Mechanical Engineering Study Program included in the category are feasible and valid to be applied to students. Training management in Diploma Three of Mechanical Engineering, Faculty of Engineering, State University of Medan can be seen that management training shows that planning and implementation are included in the already good category. All have been carried out in accordance with what has been expected by the study program. Although overall it can be said to be in a good category but in its implementation there are still some deficiencies in certain aspects.

3. The implementation of the training management model in the Unimed Diploma 3 in Mechanical Engineering Study Program is in accordance with the planned steps and procedures. The implementation of the training management model went well this was seen from several aspects including the achievement of targets, product completion time, and customer satisfaction. As confirmed by the results of the interview, it has been going well, but there are some program evaluations that must be carried out by involving all management parties, including study programs, heads of production units, lecturers, students and staff in order to improve quality.

5. References


The Influence of Learning Strategy (Blended Learning and Expository) and Prior Knowledge on Information Technology and Communication (ICT) Learning Outcomes

Resien¹, Harun Sitompul², Julaga Situmorang³
{resien.chiu@gmail.com¹}

Postgraduate Education Technology, Universitas Negeri Medan, Indonesia ¹, Jurusan Pendidikan Teknik Bangunan, Universitas Negeri Medan, Indonesia ², Jurusan Pendidikan Teknik Mesin, Universitas Negeri Medan, Indonesia ³

Abstract. The objectives of this research are to determine the effect of learning strategies (blended learning and expository learning) and prior knowledge on ICT outcomes. This research conducted at SMA Methodist Tanjung Morawa during September to November 2016, and used a quasi-experimental method with a 2x2 factorial treatment by level design. The participants were 26 students divided into two treatment classes. Data analysis showed that variance with significance level 0.05. The results indicated that; student’s ICT outcomes who used blended learning was better than expository learning; student’s ICT outcomes who had higher prior knowledge was better than student’s in lower prior knowledge; there is an interaction between learning strategy and prior knowledge; student’s ICT outcomes who used blended learning was higher than expository learning to the student group of higher prior knowledge; and student’s ICT outcomes who used blended learning was lower than expository learning to the student group of lower prior knowledge.

Keywords: blended learning, expository learning, prior knowledge, ICT

1. Introduction

Nowadays, Indonesian education is continuously making various improvements. Therefore, the use of ICT should be a strategic program that is used to support the teaching and learning process in the classroom. The teachers are not only faced with the problems of improving the quality and quality of Education for their students, but also for themselves as educators to have the competence and self-efficacy in utilizing ICT as a learning media. The teacher as a facilitator should prepare a learning strategy to make the students to be able to understand and to master the materials provided.

ICT subject is a new subject included in the curriculum of the national Education system in 2006 which is called the Education Unit Level Curriculum (KTSP). With the rapid development of technology in various aspects of life, now it has become an academic lesson in ICT 4.0 introduced, practiced and mastered by students in the academic world with a very rapid change, what is now that has entered the era of the industrial revolution 4.0. In the face of such rapid change, it requires the ability and willingness to learn all the way through life quickly and intelligently. ICT results help a lot of people to learn quickly. Therefore, ICT is not only utilized...
in daily life, but ICT also can be utilized for learning process that ultimately adapt students to education in the environment and the work world.

Based on the observation, it was seen that ICT learning had not been carried out with the right learning strategies. ICT learning in general was conducted by using lecture method and learning resource was only book. Learning time was also more widely used by teachers to explain the concepts and principles in ICT learning rather than the students were educated to learn and to do their own duties. By having the rapid development of technology in various aspects of life, now students have to mastered Information Technology and Communication. Generally, learning is an activity that expects behavioral change in the individual concerned. Learning is influenced by a variety of factors such as: learning material, instrumental factors, environments and individual conditions of learning [1]. Therefore, by providing appropriate learning strategies, students are expected to learn better.

Learning understanding must have three points: (1) long-term; (2) cognitive changes that are seen in changes in behavior such as those from the unknown process; and (3) depends on the experience of the students in other words how the participants of the education or in other words how the participants understand what happened [2].

Learning strategy that can provide solutions in learning problems are blended learning strategy. Blended learning is the combination of instruction from two historically separate models of teaching and learning: Traditional learning system and distributed learning system. It emphasizes the central role of computer-based technologies in blended learning [3]. Blended learning is the most logical and natural evaluation of our learning agenda [4]. It suggests an elegant solution to the challenges of tailoring learning and development to the needs of individuals. It represents an opportunity to integrate the innovative and technological advances offered by online learning with the interaction and participation offered in the best of traditional learning. It can be supported and enhanced by using the wisdom and one-to-one contact of personal coaches. However, blended learning is (1) combining or mixing web-based technology to accomplish an educational goal; (2) combining pedagogical approaches (e.g. constructivism, behaviorism, cognitivism) to produce an optimal learning outcome with or without instructional technology; (3) combining any form of instructional technology with face-to-face instructional-led training; and (4) combining instructional technology with actual job tasks [4].

Learning strategies that also play an important role in this research are expository learning strategies. The expository learning strategy is known with the term direct learning strategy [6]. Through this strategy the teacher conveys the lesson of structured learning with the expectation that the teaching material delivered can be mastered by the student well [7]. Direct instruction has been use by researchers to refer to a pattern of teaching that consists of teacher’s explaining a new concept or skill to students, having them test their understanding by practicing under teacher direction and encouraging them to continue to practice under teacher guidance [8].

Prior Knowledge is one of the factors that influence learning outcome prior knowledge is a knowledge that students already have before learning takes place which is a prerequisite for following the Research process [9]. Prior knowledge is a set of skills that should be owned by students before they follow the new learning process. The prior knowledge that students must have before they start learning is related to knowledge, skills and attitudes [10]. Prerequisite skill as "the thinking of a person needs to be known" before someone is in position for another learning [11].

The Research of research was about learning strategy using blended learning with expository learning used by teacher toward the students’ knowledge about the materials delivered by the teacher.
The formulation of the problems in this research were as follow: (1) as a whole, were there any differences in ICT student learning outcomes that used blended learning strategies versus students who used student learning strategy; (2) Was there an interaction effect between learning strategies (blended learning and expository) with initial knowledge (high-low) on ICT learning outcomes; (3) Were there differences in ICT student learning outcomes that used blended learning strategies versus students who used expository learning strategies, on students who have high knowledge; (4) Were there differences in students’ ICT learning outcomes using blended learning strategies versus students using expository learning strategies, on students who had low prior knowledge.

The Research is aimed to determine the effect of learning strategy (blended learning and expository) and prior knowledge on ICT learning outcomes.

2. Research Method

This Research conducted a quasi-experimental method through treatment design by level 2x2. The research variable consisted of one dependent variable which was ICT learning outcomes and two independent variables namely learning strategy (blended learning and expository) as the treatment variables toward prior (high-low) knowledge that was as moderator/attribute variable.

Time and Place of the Research

The Research was conducted at SMA Swasta Methodist Tanjung Morawa. The Research was conducted at the eleventh-grade students. It was conducted for semester 1 of 2016/2017 year. The research activities began in the month of September-November 2016.

Data Source

The target population of this research was all of the students of SMA Swasta Methodist Tanjung Morawa as many as 104 students. The study was assigned to the eleventh grade students through a technique of positive purposive sampling with the tenth grade students who were not learning ICT lesson. While the twelfth-grade students were not permitted to learn ICT since they would face the National Final Examination (UAN). For the total analysis of 64 students the experiment and control groups were taken 27% of the student limit 52 and 27% of the lower student limit 52. Thus, the total samples of 64 students were contributed toward each 16 students.

Data analysis technique

The analysis technique data used was the analysis of variance (ANOVA) which continued by using the Tukey test [12]. Before the hypothesis test the analysis requirements were conducted which consisted as follow: (1) normality test; and (2) homogeneity test.

3. Results

Descriptive statistical analysis of the research results was presented in Table 1.
Table 1. Descriptive Statistical Analysis of Research Data

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Prior Knowledge</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>BL Strategy</td>
<td>High PA</td>
<td>81.9692</td>
<td>9.26308</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Low PA</td>
<td>68.4785</td>
<td>6.58846</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>75.2238</td>
<td>10.45668</td>
<td>26</td>
</tr>
<tr>
<td>DI Strategy</td>
<td>High PA</td>
<td>68.8200</td>
<td>7.41848</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Low PA</td>
<td>72.0646</td>
<td>7.98456</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>70.4423</td>
<td>7.73013</td>
<td>26</td>
</tr>
<tr>
<td>Total</td>
<td>High PA</td>
<td>75.3946</td>
<td>10.60929</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Low PA</td>
<td>70.2715</td>
<td>7.40142</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>72.8331</td>
<td>9.41906</td>
<td>52</td>
</tr>
</tbody>
</table>

Hypothesis test in this research was related to: (1) the main effect, namely SPBL (A1), SPE (A2), High PA (B1), and low PA (B2); (2) the interaction effect, between SP and PA; and (3) the influence of simple effect. The calculations result using ANOVA was presented in table 2.

Table 2. Summary of Hypothesis Test using ANOVA

Tests of Between-Subject Effects

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>1548.655*</td>
<td>3</td>
<td>516.218</td>
<td>8.326</td>
<td>.000</td>
</tr>
<tr>
<td>Intercept</td>
<td>275842.169</td>
<td>1</td>
<td>275842.169</td>
<td>4449.074</td>
<td>.000</td>
</tr>
<tr>
<td>Strategy</td>
<td>297.220</td>
<td>1</td>
<td>297.220</td>
<td>4.794</td>
<td>.033</td>
</tr>
<tr>
<td>PA</td>
<td>341.197</td>
<td>1</td>
<td>341.197</td>
<td>5.503</td>
<td>.023</td>
</tr>
<tr>
<td>* PA Strategy</td>
<td>910.238</td>
<td>1</td>
<td>910.238</td>
<td>14.681</td>
<td>.000</td>
</tr>
<tr>
<td>Error</td>
<td>2975.995</td>
<td>48</td>
<td>62.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>280366.819</td>
<td>52</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>4524.650</td>
<td>51</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. R Squared = .342 (Adjusted R Squared = .301)

The hypothesis calculation showed that there was an interaction between SP and PA, then it was carried out further by using the Tukey test. Tukey test result presented on Table 3.
Table 3. The summary of Tukey test Multiple Comparisons

<table>
<thead>
<tr>
<th>Dependent Variable: Learning Outcomes</th>
<th>Tukey HSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction</td>
<td>Mean Difference (I-J)</td>
</tr>
<tr>
<td>A1B2</td>
<td>13.4908*</td>
</tr>
<tr>
<td>A1B1</td>
<td>13.1492*</td>
</tr>
<tr>
<td>A2B1</td>
<td>-.3415</td>
</tr>
<tr>
<td>A1B1</td>
<td>.3415</td>
</tr>
<tr>
<td>A2B1</td>
<td>-9.9046*</td>
</tr>
<tr>
<td>A2B1</td>
<td>3.2446</td>
</tr>
</tbody>
</table>

Based on observed means.
The error term is Mean Square (Error) = 62.000.
* The mean difference is significant at the .05 level.

**ICT learning outcomes difference of students using SPBL and SPE**

Based on the ANOVA calculation (Table 2) on the intermediate source A, it showed that total $F_{\text{count}}$ of 4.794 > total $F_{\text{table}}$ namely 4.23 on $\alpha = 0.05$ (26, 1), $H_0$ was rejected, and $H_1$ was accepted. It meant that there was the difference in ICT learning outcomes between students taught by the SPBL and the SPE. It was proven by the average learning outcomes of the students group taught with SPBL $\bar{Y}_{A1} = 75.22$ and the students groups taught with SPE $\bar{Y}_{A2} = 70.44$. Thus, students' ICT learning outcomes taught with SPBL were higher than SPE.

**Difference between high and low PA of students’ ICT learning outcomes.**

Based on ANOVA calculation result (Table 2) on the source of variable B, it showed that the $F_{\text{count}}$ was 5.503 > $F_{\text{table}}$ total was 4, 23 on $\alpha = 0.05$, $H_0$ was rejected, and $H_1$ was accepted. It meant that there is difference of ICT learning outcomes between students who had high and low PA. On the other hand, the acquisition of student learning group that has PA in average of $\bar{Y}_{B1} = 75.39$ more than the average of students who had PA with an average $\bar{Y}_{B2} = 70.27$. Thus, students’ ICT learning outcomes which had a higher GPA were better than students who had a lower GPA.

**Interaction between SP and PA toward ICT learning outcomes (interaction effect)**

Based on ANOVA calculation (Table 2) on the source of variance $A \times B$ showed that the total was calculated = 14.681 > $F_{\text{table}}$ = 4.23 on $\alpha = 0.05$, $H_0$ was rejected, and $H_1$ was accepted. It means that the SP had an influence on ICT learning outcomes depending on the PA, as opposed to reverse. The interaction graph was shown in Figure 1.
The differences of students’ ICT learning outcomes taught by using SPBL and SPE, in students who had a high PA (simply effect).

The results of further tests in Table 3 for A1B1 with A2B1 obtained Sig values 0.001 < 0.05, H₀ was rejected and H₁ was accepted, with a value of \( Y_{(A1B1)} = 81.97 > Y_{(A2B1)} = 68.82 \), thus the ICT learning outcomes of students using SPBL were higher than the students’ learning outcome values using SPE whose was high PA.

The difference of students taught by using SPBL and SPE, in students who had low PA (simple effect)

Based on the result of further test using the Tukey test in Table 3 for A1B2 with A2B2 values obtained Sig 0.654 > 0.05, H₀ was rejected and H₁ was accepted. Therefore, there was a significant difference in the ICT learning outcomes of students who used SPBL and SPE in students who had a low PA. On the other hand the average value of \( Y_{(A1B2)} = 68.48 < Y_{(A2B2)} = 72.06 \). However, the statistical difference was not valuable. Thus, it could be concluded that there was not the difference of ICT student learning outcomes taught by the SPBL or SPE, for students who had a low PA.

The difference of students’ ICT learning outcomes with high and low PA, and the students taught through SPBL

Further test result through the Tukey test in Table 3 for A1B1 with A1B2 obtained Sig values 0.000 < 0.05, H₀ was rejected and H₁ was accepted, with value \( Y_{(A1B1)} = 81.97 > Y_{(A1B2)} = 68.48 \). Thus, the students ICT scores were high and low were was accepted, with a value of \( Y_{(A1B1)} = 81.97 > Y_{(A1B2)} = 68.48 \), thus there was the difference of the students' ICT whose high and low PA taught by using SPBL.
Difference of student ICT learning outcomes with high and low PA, on students taught by using SPE

The result of the test continued by Turkey test in Table 3 for A2B1 with A2B2 obtained Sig values 0.721 > 0.05, H0 was accepted and H1 was rejected, with $Y_{(A2B1)} = 68.48 < Y_{(A2B2)} = 72.06$. Even though the average of A2B1 < A2B2 however the statistics was not significantly different. Thus, the result taught by the SPE did not have any difference.

4. Conclusion

Based on the results of the study, it could be concluded as follows: (1) the student ICT learning outcomes who used SPBL higher compared to SPE. Thus the SPBL was able to have a better impact on improving students’ ICT learning outcomes; (2) the students’ ICT learning outcomes who had high PA had better learning outcomes compared whose lower PA; (3) there was interaction between SP and PA toward ICT learning outcomes.

Therefore, the students’ ICT learning outcomes were taught with the SPBL was different from the students who in lowest PA, it meant that SP and PA are two factors that determine ICT learning outcomes; (4) There was difference in students’ ICT learning outcomes that was reflected in the use of SPBL with the high-level students with their student learning by using SPE with the lowest PA; (5) There was differences in students’ ICT learning outcomes taught by using the SPBL and having high PA with learning outcomes taught by using SPE and having low PA.

5. References


The Effect of Direct Instruction Strategy and Students’ Social Interaction on Learning Achievement of Pancasila and Civic Education

Evi Susilawati¹, Harun Sitompul², Julaga Situmorang³
Universitas Islam Sumatera Utara, Indonesia¹
Universitas Negeri Medan, Indonesia²³

evi.utnd@gmail.com

Abstract. The purpose of this study was to look at the effect of learning outcomes of Pancasila and Civic Education based on students' social interactions using the Direct Instruction (DI) strategy on students of SMP Negeri I Labuhan Deli, North Sumatra Province in the 2015/2016 academic year. The population of this research was 377 students and the sample was 77 students. The sampling technique uses cluster random sampling. Data collection methods in this study were obtained using student learning outcomes tests and hypothesis testing using Anava. Before the hypothesis test was performed, the data analysis test prerequisites were done using the normality test and homogeneity test. From the two prerequisites that had been made it can be seen that the data comes from a normally distributed population and the sample comes from the same variant, then a hypothesis test can be performed. Based on the research’s hypothesis test shows that the average learning outcomes of Pancasila and Civic Education of students taught using DI learning strategies in students who have social interaction characteristics of cooperative students is 66.70, and who have social interaction characteristics of competitive type students is 74.806. Hypothesis testing results show that the learning outcomes of Pancasila and Civic Education of students taught using the DI strategy on social interaction characteristics of competitive students is higher than students who have social interaction characteristics of cooperative students.

Keywords: Direct Instruction Strategy, Social Interaction Student, Learning Achievement of Pancasila and Civic Education.

1. Introduction

Industrial Era 4.0 will bring many changes that can not be dammed. The urgency is that if the state needs to make maximum efforts and be more vigorous in giving understanding to all elements of society about the nature of the industrial revolution 4.0 era with all its logical consequences, then the state must take the initiative to encourage all elements of society to be more concerned with changes and challenges that occurred in the industrial revolution era 4.0. Preparing millennials to have cooperative and competitive behavior in the industrial revolution 4.0 era is also an urgent need. The essence of the industrial revolution 4.0 is a cultural revolution, human revolution in various aspects of life not only a revolution in technology, but a revolution in social behavior and cultural behavior [3]. It is very important for the learning activities of
Pancasila and Civic Education to meet the challenges and needs of the current era of the industrial revolution 4.0. Pancasila and citizenship education learning can help millennial generation to gain knowledge to become more competitive students in their field. Pancasila and citizenship education can encourage the improvement of human resource competencies in Indonesia that are skills for competitiveness in all fields. Furthermore, the industrial revolution 4.0 is faced with economic challenges with the growing need for cooperation and collaborative in terms of: (1) compromising and cooperative skills, (2) ability to cooperate in teams, (3) communication skills, and (4) networking skills [10].

This challenge shows how important it is to develop social interaction of cooperative and competitive types of students in learning Pancasila and Civic Education. A number of studies have shown that social interactions of cooperative type students in learning activities can optimize student participation in learning, give more time to students to think, discuss, and assist students in developing concepts in the subject matter that is in them [9]. Likewise, the need for social interaction of cooperative type students is very necessary because the changing world is now entering the era of the industrial revolution 4.0 which demands that schools must prepare quality graduates and be able to compete globally is important for everyone and important for the future of a country [7]. Thus, the support and role of education is expected to increase the competitiveness of the Indonesian people in the midst of the global competition of the rapid development of the industrial revolution 4.0. In the era of industrial revolution 4.0 found the phenomenon of low levels of student motivation in competing caused by mental weakness and personality of the younger generation to be able to excel, courage to take risks, tenacity, struggle, self-confidence, creativity, and innovation. However, to develop social interaction of students in cooperative and competitive types requires a learning activity that can provide an interesting learning experience and have a creative effect on student learning. This is influenced by the learning strategy used by the teacher. Symptoms that can be seen in the learning process at SMP Negeri 5 Labuhan Deli, Deli Serdang Regency, so far most of the teachers in the Pancasila and Civic Education subjects did not help students develop these two types of social interaction. Therefore we need a learning strategy that is able to help students to be able to easily understand the subject matter being studied [4]. The learning strategy in question is the Direct Instruction (DI) strategy.

The DI strategy is a strategy that uses the smallest possible number of examples to produce as much learning as. The advantage of the DI strategy is to provide a guide for each student to interact with the physical environment directly. This physical environment strengthens and gives different responses to each student. In the DI strategy, the teacher as an intelligent adult is the learning environment that is closest to students and is around students. In this case, the teacher as the most effective model and can arrange and rank student learning experiences by teaching concepts and problem-solving skills better than other models because the teacher is the only standard of behavior that students must emulate.

The design of the DI strategy has significantly increased school success in teaching various skills to students. The DI strategy applied in this study is a learning strategy that guides students to learn the Pancasila and Civic Education material by the teacher using examples rather than examples. By using the DI strategy, social interaction of cooperative and competitive type students will be built up and students will be maximized, more active and focused in learning, students will experience firsthand so students' understanding of the material can be measured in a structured way. The use of DI strategies makes learning Pancasila and Civic more effective.
Direct Instruction (DI) Learning Strategy

Learning strategies contain action plans or a series of learning activities including the use of methods and use of various resources or strengths in learning that are structured to achieve learning objectives effectively and efficiently. In order to achieve these objectives, various forms of learning strategies are used. One of the forms of learning strategies is the direct instruction strategy. The DI strategy has an empirical basis derived from Piaget's theory with behavioristic learning flow about cognitive processes and response stimuli which holds that learning depends on the stimulus response process including giving feedback [8]. The application of Piaget's theory in learning is giving reinforcement and feedback to students in learning [15].

Limitation of DI strategy as a strategy that presents lessons through verbal speech or direct explanation to students are in the form of examples and not examples [13]. Another understanding of the DI strategy is a learning strategy carried out through face-to-face between teachers and students with learning information sources using scripts with well-structured learning steps [14]. Face-to-face activities in direct learning strategies are a set of teacher actions to support student learning processes, taking into account internal and external events that can be known or predicted during the face-to-face process. Before students learn further information and skills, they must first master the basic information and skills provided in the form of examples and not examples. For the acquisition of basic information and skills requires an interesting classroom management and maintain student attention from the beginning until the completion of the learning process. In this case the teacher must pay close attention to the formulation of learning objectives and assignments given to students. The dominance of the teacher is very important in implementing the direct learning strategy. When implementing this learning strategy, the teacher must demonstrate knowledge and skills in the form of examples and not examples contained in the text that will be trained to students [12].

Direct learning strategy is a strategy of presenting lessons done by the teacher using the lecture and question and answer method to transfer all the knowledge he has. The process of transmitting knowledge from the teacher to students is due to 2 (two) objectives of using direct learning strategies namely (1) knowledge by description, namely: the transmission of student knowledge is described from those who have learned first from students; (2) knowledge by acquaintance, namely: the ability to receive knowledge obtained by students themselves accurately [11]. The role of the teacher in direct learning is very dominant according to the teacher center paradigm. In the teacher centered paradigm, the teacher's presence is crucial in the ongoing learning process. The presence of teachers in class is related to the importance of the teacher's attention in managing the class because the teacher also plays an important role in fostering a positive class climate such as: regulating the tempo of learning, smooth learning flow, maintaining order and the presence of students in class, and fast handling in the event of deviations student behavior [2]. The DI strategy has unique characteristics seen in Table 1 below:
Table 1. Characteristic of DI Strategy

<table>
<thead>
<tr>
<th>Approach</th>
<th>Theory</th>
<th>Direct Instruction Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theme DI Strategy</td>
<td>Teacher Centered</td>
<td></td>
</tr>
<tr>
<td>Theory</td>
<td>Direct Instruction Strategy</td>
<td></td>
</tr>
<tr>
<td>Teaching-Learning</td>
<td>1. Every student who is economically disadvantaged can catch up with their peers who are more economically fortunate if they are given effective and efficient learning.</td>
<td></td>
</tr>
<tr>
<td>Main Objectives</td>
<td>2. Formation of students' basic academic skills</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Development of students' conceptual skills</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Development of cognitive aspects of students</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Development of affective aspects, especially on self-actualization and self-confidence of students</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6. Development of student academic performance</td>
<td></td>
</tr>
<tr>
<td>Class</td>
<td>1. Students of the same age</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Students with small group learning with groups of 5-10 people</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. All students in the class are taught the same material</td>
<td></td>
</tr>
<tr>
<td>Teaching Steps</td>
<td>4. Learning takes place in the classroom</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Conveying goals and preparing students</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Demonstrating knowledge and skills</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Guiding students</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Check understanding and feedback</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Provide an opportunity to repeat the material and application</td>
<td></td>
</tr>
<tr>
<td>Teaching Method</td>
<td>1. Direct learning with the lecture method</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Direct learning with the question and answer method</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Direct learning with methods using examples and not examples</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Direct learning with simple training methods</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Direct learning with the method of responding together</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6. Learning is carried out in a structured manner</td>
<td></td>
</tr>
<tr>
<td>Teaching Materials</td>
<td>1. Learning based on textbooks and learning script guides</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Learning resources are textual in the form of texts using examples and not examples</td>
<td></td>
</tr>
<tr>
<td>Content</td>
<td>1. Memorize facts and objective information</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. The process of developing cognitive structures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Development of the basic concepts of an object</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Development of combined knowledge is knowledge about the change of an object</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Development of complex knowledge of an object</td>
<td></td>
</tr>
<tr>
<td>Social Aspects</td>
<td>1. The intensity of students' social interactions is constant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. The teacher is considered as an example to be followed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Students must obey the teacher's instructions.</td>
<td></td>
</tr>
<tr>
<td>Curriculum Implementation</td>
<td>1. The teacher conducts learning activities based on an existing curriculum</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. The curriculum is usually implemented in an integrated manner for all students, regardless of students' abilities or interests.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. The contents of the lesson are generally linear</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Each student receives units of study at the same speed in the same context</td>
<td></td>
</tr>
</tbody>
</table>

Referring to the characteristics of the DI strategy, the use of the DI strategy in the Pancasila and Citizenship Education subjects in this study uses the following steps: (1) Step 1: In step 1 this is the activity of conveying objectives and preparing students with the activities carried out
by the teacher is to convey Citizenship Education learning objectives, lesson background information, the importance of students learning the material to be delivered, and preparing students for learning; (2) Step 2: In step 2 this is the teacher's activity in demonstrating knowledge and skills by presenting information step by step and using examples and not examples; (3) Step 3: In step 3 this is the activity of guiding students; (4) Step 4: In step 4 this is the activity of checking student understanding and feedback; (5) Step 5: In step 5 this is an independent training activity in which the activities carried out by the teacher are to provide opportunities to repeat the material and apply the material to more complex situations.

Students' Social Interaction

Social interactions that occur in learning activities are interactions that occur between teacher and students, and between students and students. These social social interactions of students are social interactions within the study group because each student as a group member is interdependent with each other, and at least they have the potential to carry out social interactions with each other. Through social interaction within the group, not only does the transfer of knowledge but friendship, the student community occur, so that it forms a social system that leads to the integration of students and all of that will affect student learning outcomes both cognitive, affective, and psychomotor learning outcomes. Related to the social situation of students in social interaction with their friends students often engage in prosocial behavior. Sometimes, students as individuals in groups interact in a cooperative type where they help each other, share information, and work together for mutual benefit and interact interactively where they outperform and compete with one another. The social type of social interaction of the cooperative type students is shown through cooperative relationships while the social interaction of students of the competitive type is shown through competitive relationships.

This cooperative type of social interaction is important in the learning activities of Pancasila Education and Nationality because schools are a place for students to try to cooperate with each other. Cooperative type student social interaction becomes a necessity for students to improve their learning outcomes. Cooperative type student social interaction is needed in terms of: (1) working together to achieve common goals; (2) students in groups interact with each other sharing ideas and information, seeking additional information, making decisions on their findings throughout the class; learning that fosters collaboration towards a strong emphasis on learning goals rather than on performance goals which encourages teachers to use alternative assessment techniques; and (3) through working together can help improve student achievement and retention, increase self-esteem and intrinsic motivation as well as develop more positive attitudes towards learning abilities and social skills. Likewise in the social interaction of competitive type students developed at school will have an impact on the following things: (1) increasing student independence in completing their assignments, (2) trying to get the best value in order to obtain recognition from others, (3) always expressing independent ideas to be always appreciated by others, (4) students can still work in their groups even though faced with competition between group members and competition with other groups, and competition situations like this can be the most effective way to make the class more productive, (5) each student who is joined in a group will form their own subgroups and always strive to be the best in their groups to obtain awards or prizes [6].

Pancasila and Civic Education Learning Achievement

Pancasila and Civic Education subjects are subjects that consist of a series of processes to direct students to become citizens of Indonesian national character, intelligent, skilled and
responsible so that they can play an active role in society in accordance with the provisions of Pancasila and the 1945 Constitution. These definitions can be broken down into 2 (two Pancasila and Civic Education subjects objectives namely: (1) general objectives consisting of: (a) civic confidence, civic commitment, and civic responsibility; (b) knowledge of civic; (c) civic skills including civic competence and civic responsibility; (2) specific objectives consisting of the ability of students in terms of: (a) displaying a character that reflects the appreciation, understanding, and practice of values and morals of Pancasila personally and socially; (b) has constitutional commitment supported by a positive attitude and a full understanding of the 1945 Constitution of the Republic of Indonesia; (c) think critically, rationally, and creatively and have a national spirit and love for the motherland imbued with Pancasila values, the 1945 Constitution of the Republic of Indonesia, the spirit of Unity in Diversity, and the commitment of the Unitary Republic of Indonesia, and (d) participate actively, intelligently, and responsibly as members of the community, the nation's budding, and citizens in accordance with their dignity and dignity as creatures created by God who lives together in various socio-cultural settings [1].

PPKn subjects are developed as a conductive social order or provide an atmosphere for the development of various personal qualities of students. Junior High School is a level of primary and secondary education which is an integral part of the community that needs to be developed as a center for lifelong student culture and empowerment, which is able to set an example, build willingness and develop student creativity in the process of democratic learning. Empowering students who are able to set an example and develop student creativity in the democratic learning process reflects the students’ learning achievement of Pancasila and Civic Education. The learning outcomes of Pancasila and Civic Education are defined as a set of knowledge for students’ understanding of various civic discourses; have democratic and responsible behavior, and have good character and personality, in accordance with the norms that apply in the life of society and the state. Aspects of learning achievement for Pancasila and Civic Education in the form of civic knowledge competencies are described as follows: (a) civic knowledge competencies involving academic-scientific abilities developed from various political, legal and moral theories or concepts; (b) civic skills include intellectual skills and participatory skills in the life of the nation and state; and (c) the character or character of citizenship (civic dispositions) which is the estuary development of the two competencies above, namely: citizenship knowledge and citizenship skills.

Learning achievements of Pancasila and Civic Education in the form of civic knowledge can be seen from the ability of the Pancasila and Civic Education material mastered by students which includes knowledge about the rights and responsibilities of citizens, human rights, principles and processes of democracy, government and non-government institutions, national identity, government based on rule of law, and free and impartial justice, the constitution, and the values and norms in society. Student civic skills learning achievements can be seen from intellectual skills and participatory skills in the life of the nation and state owned by students. While learning outcomes in the form of civic dispositions can be seen from the character of students in terms of behaving in the community which is shown by virtuous behavior and good civic character. Thus students as citizens first need to have good civic knowledge, especially knowledge in politics, law, and morals in the life of the nation and state.

Furthermore, students as good citizens are expected to have intellectual and participatory skills in the life of the nation and state. In the end, knowledge and skills will form an established character or character, so that it becomes an attitude and habit of daily life. Character or daily life habits that reflect good citizens such as religious attitude, tolerance, honesty, fairness, democracy, respect for differences, respect the law, respect the rights of others, have a strong
national spirit, have a sense of social solidarity, and other attitudes. These characters must be displayed in the form of educational programs carried out in curriculum activities in schools.

3. Research Methods

This research is quantitative research with a descriptive approach. The research method uses the experimental method. This research was conducted in the 2015/2016 academic year at State Junior High School (SMPN) 1 Labuhan Deli, Deli Serdang Regency, which is located at Jalan Veteran Pasar IV, Deli Serdang Regency. The research treatment was carried out by adjusting the school lesson schedule. Provision of treatment carried out during 11 (eleven) meetings. The 1st meeting (First) held a pretest. The second meeting (two) provides a questionnaire for student social interaction. The third meeting up to the 10th meeting conducted treatment, while the 11th (eleventh) meeting held a final test. It was held each week with 1 (one) time face-to-face with 3x40 minutes learning time.

This research was conducted at SMP N 1 Labuhan Deli of class VII (seven) SMP Negeri 1 Labuhan Deli, Deli Serdang Regency, the population are ten classes with 377 students. The sampling technique in this study uses Cluster Random Sampling, which is a sampling technique with each element of the population having the same opportunity and is known to be selected [5]. The sampling method in this study was done by writing the class name on the rolled-up paper then randomly selected as the treatment class applying the DI strategy with a group of students who have social interaction characteristics of cooperative and competitive type students as many as 77 people. The curriculum used in this study is Curriculum class VII on second semester.

4. Result and Discussion

The normality test data check is used to find out if the sample is from a normally distributed population. Testing is done using the Lilliefors Test on eight groups of samples. A summary of the results of normality calculations can be seen in Table 3 below:

<table>
<thead>
<tr>
<th>No</th>
<th>Group</th>
<th>dk</th>
<th>Lhitung</th>
<th>L tabel</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Learning achievement of Pancasila and Civic Education in DI strategy classes</td>
<td>77</td>
<td>0,075</td>
<td>0,101</td>
</tr>
<tr>
<td>2</td>
<td>Pancasila and Civic Education learning achievements on the characteristics of cooperative students' social interaction</td>
<td>82</td>
<td>0,070</td>
<td>0,098</td>
</tr>
<tr>
<td>3</td>
<td>Pancasila and Civic Education learning achievements on the characteristics of cooperative students' social interaction</td>
<td>72</td>
<td>0,096</td>
<td>0,104</td>
</tr>
<tr>
<td>4</td>
<td>Pancasila and Civic Education learning achievement in the DI strategy class with the characteristics of cooperative type student social interaction.</td>
<td>41</td>
<td>0,113</td>
<td>0,138</td>
</tr>
<tr>
<td>5</td>
<td>Pancasila and Civic Education learning achievement of DI class strategies with the characteristics of social interaction of competitive type students</td>
<td>36</td>
<td>0,117</td>
<td>0,148</td>
</tr>
</tbody>
</table>
From table 3 above it is obtained that the PPKn learning outcomes data in the DI strategy class is normally distributed. This is known from the magnitude of \( \text{Lhitung} < \text{Ltable} \) at a significance level of 5%, ie \( (0.075 < 0.101) \). Learning outcomes of Pancasila and Civic Education of cooperative type student social interaction is normal distribution type. This is known from the large \( \text{Lhitung} < \text{Ltable} \) at a significance level of 5%, namely \( (0.070 < 0.098) \).

Data on learning outcomes of Pancasila and Civic Education on the characteristics of social interaction of competitive type students are normally distributed. This is known from the magnitude of \( \text{Lhitung} < \text{Ltable} \) at a significance level of 5%, \( (0.096 < 0.104) \). PPKn learning outcomes data on the social interaction characteristics of cooperative type students in the DI strategy class were normally distributed. This is known from the magnitude of \( \text{Lhitung} < \text{Ltable} \) at a significance level of 5%, \( (0.113 < 0.138) \). Data on learning achievements of Pancasila and Civic Education on the characteristics of social interaction of competitive type students in the DI strategy class are normally distributed. This is known from the magnitude of \( \text{Lhitung} < \text{Ltable} \) at a significance level of 5%, \( (0.117 < 0.148) \).

Furthermore, Homogeneity test results can be seen in the following Table 4:

**Table 4. Summary of Data Homogeneity Test Calculation Results**

<table>
<thead>
<tr>
<th>No</th>
<th>Group</th>
<th>( N )</th>
<th>Average</th>
<th>Standard Devias</th>
<th>Varians</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Learning achievement of Pancasila and Civic Education in DI strategy classes</td>
<td>77</td>
<td>70.532</td>
<td>10.853</td>
<td>117,788</td>
</tr>
<tr>
<td>2</td>
<td>Pancasila and Civic Education learning achievements on the characteristics of cooperative students' social interaction</td>
<td>82</td>
<td>71.390</td>
<td>10.996</td>
<td>120,912</td>
</tr>
<tr>
<td>3</td>
<td>Pancasila and Civic Education learning achievements on the characteristics of cooperative students' social interaction</td>
<td>77</td>
<td>74.736</td>
<td>8.876</td>
<td>78,783</td>
</tr>
<tr>
<td>4</td>
<td>Pancasila and Civic Education learning achievement in the DI strategy class with the characteristics of cooperative type student social interaction.</td>
<td>41</td>
<td>66.780</td>
<td>10.880</td>
<td>118,374</td>
</tr>
<tr>
<td>5</td>
<td>Pancasila and Civic Education learning achievement of DI class strategies with the characteristics of social interaction of competitive type students</td>
<td>36</td>
<td>74.806</td>
<td>9.101</td>
<td>82,828</td>
</tr>
</tbody>
</table>

Referring to Table 4, it can be seen that the data on learning outcomes of Pancasila and Civic Education obtained homogeneity tests were carried out using the F Test and the Barlett Test. Based on the calculation of homogeneity obtained data on learning outcomes of Pancasila Education and Citizenship in the DI strategy class is homogeneous. This is known from the large \( \text{Fcount} < \text{Ftable} \) at a significance level of 5%, \( (1.501 < 1.82) \). Thus it can be concluded that the distribution of Pancasila and Civic Education learning outcomes in the DI strategy class is homogeneous. Furthermore, it is known that the Pancasila and Civic Education learning outcomes data on the social interaction ability of cooperative type students and the characteristics of social interaction of competitive type students is homogeneous. This is known from the large \( \text{Fcount} < \text{Ftable} \) at a significance level of 5%, \( (1.535 < 1.82) \). Thus, it can be concluded that the distribution of Pancasila and Civic Education learning achievement data on the characteristics of social interaction of cooperative type students and the characteristics of social interaction of competitive type students is homogeneous. From the two prerequisites above it can be seen that the data comes from normally distributed populations and the samples come from the same variants, then the next hypothesis test can be performed which can be seen in Table 5 below:
Table 5. Summary of Data from Descriptive Analysis Calculation Results

<table>
<thead>
<tr>
<th>Students’ Social Interaction</th>
<th>Direct Interactions Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Cooperative Type</td>
<td>41</td>
</tr>
<tr>
<td>Competitive Type</td>
<td>36</td>
</tr>
<tr>
<td>Total</td>
<td>77</td>
</tr>
</tbody>
</table>

Based on table 5 above, it can be seen that the average learning achievement of Pancasila and Civic Education taught using the DI strategy on the social interaction characteristics of cooperative type students is 66.70, while students taught with the DI strategy on the social interaction characteristics of competitive type students are 74.806. This shows that the learning outcomes of Pancasila Education and Civic students who are taught by using the DI strategy on the characteristics of social interaction of competitive type students is higher than students who have social interaction characteristics of cooperative type students. There is a significant difference between the students’ learning achievement of Pancasila and Civic that have cooperative type social interaction characteristics and competitive type social interactions taught using the DI strategy from the findings of this study prove that direct learning strategies have been tested to improve students’ learning achievement of Pancasila and Civic Education.

This proves that learning Pancasila and Civic Education using DI strategies is suitable for students who have characteristics of social interaction of competitive type students. Pancasila and Civic Education learning activities for students who have the characteristics of competitive type social interaction taught using the DI strategy want to master the learning material of Pancasila and Civic Education on their own abilities and try to outperform each other in learning activities. With such learning activities, the acquisition of Pancasila and Civic Education learning achievement can be achieved to the maximum because the DI strategy requires each student to deal with assignments individually and condition the learning activities from the beginning of the learning activities to the end of the learning activities to be able to compete with their peers the first to master the subject matter and to obtain the best learning achievement of Pancasila and Civic Education.

5. Acknowledgements

Writers would like to express their deepest gratitude to: (1) Rector of Medan State University, along with his staff, (2) Director of Postgraduate of Medan State University, along with his Staff, (3) Head of the Study Program of Doctor of Education Technology in Medan State University, along with his Staff, (4) Rector of the Islamic University of North Sumatra,
along with his staff, (5) Dean of the Faculty of Education and Education of the Islamic University of North Sumatra, and their staff, may God Almighty give them health.

6. References

The Influence of Learning Models and Cognitive Styles on Geography Learning Outcomes at SMAN 2 Percut Sei Tuan

Zuilen V Bay Sinaga¹, Abdul Hamid K², Sugiharto³
Education Technology Postgraduate Universitas Negeri Medan, Indonesia¹,²,³
zuilenvanboy16@gmail.com

Abstract. This study aims to: (1) Know the learning outcomes of students who are learning geography learning with problem based learning models and STAD learning models (2) to find out the geography learning outcomes of students who have independent cognitive styles, and dependent cognitive styles (3) know the interactions between learning models with cognitive styles in influencing student learning outcomes in geography. This research is a quasi-experimental research. Student learning outcomes taught by the problem based learning model are higher than students who are taught with the STAD learning model.

Keywords: learning model, problem based learning model, STAD learning model, cognitive style and learning outcomes

1. Introduction

One of the problems facing the world of education today is the weakness of the learning process in the classroom. In classroom learning students are not encouraged to develop thinking skills. The learning process in the classroom only encourages students to remember and memorize information [1]. Effective learning should prioritize the empowerment of students in processing information in the learning process. Teacher-oriented learning has to be changed by student-oriented learning, which is why a learning model is needed that encourages students to construct the existing knowledge within the students themselves. Geography lessons are considered very important because as a study of natural phenomena and life on earth as well as interactions between humans and the environment in relation to spatial and territorial relations or arrangement. Geography material in class XI IPS that discusses Indonesia as a World Maritime Axis is material that is it is very important for students to understand that our country is a unitary state that is connected by many islands. Students must also understand that our country has a lot of marine potential that must be exploited and enforced. The above material must be taught properly by using learning models that are able to foster student interest in learning, especially students who live close to sea areas such as Percut Sei Tuan [2] in her research concluded that there was a significant influence of PBL models on problem solving abilities. Gain score learning that uses PBL models is higher than conventional. The average value of the gain score of the experimental class was 22.9032 and the control was 11.0938. The results of the analysis of the Independent Sample T-Test, the difference shows the p-level value of 0.000. The p-level value is smaller than 0.05 (p < 0.05). So, the conclusion "PBL model has a significant effect on the ability to solve high school geography problems." Research Karuniasih [3] The results of this study indicate that the ability to solve problems in students has increased
from before being given an action that is 18% increased to 64.7% in Cycle I and increased again to 88.2% in Cycle II. Based on these results it can be concluded that by applying the PBL learning model the ability to solve the problem of Geography lessons of students has increased.

Research conducted by Istianah [4] showed that the application of the Problem Based Learning model could improve students' critical thinking skills. In the first cycle, the average value of students' critical thinking skills reached 55.97, while in the implementation of the second cycle actions reached 74.81. Based on these results it is known that an increase in critical thinking skills is 33.66%. The conclusion of this research is that the application of the Problem Based Learning model can improve the critical thinking skills of students of class X IPS-I of SMA Laboratory of State University of Malang on atmospheric material. The objectives of this study are (1) To find out the differences in the learning outcomes of students who are taught by the learning model of problem-based learning and the learning outcomes of students who are taught with the STAD type learning model. (2) Knowing the differences in geography learning outcomes of students who have independent field cognitive styles and geography learning outcomes of students who have field dependent cognitive styles. (3) Knowing the significant interaction between learning models and cognitive styles in influencing student learning outcomes in geography.

2. Research Method

This research is a quasy experiment research because in this study the class that received treatment (experiment) is a class that has been previously formed without changing the situation and conditions of the class that has been formed which aims to approach estimates for the state that can be achieved through actual experiments in circumstances that make it impossible to control and / or manipulate all relevant variables. One sample class was given treatment with the implementation of learning using the problem-based learning (PBL) learning model and another class was given treatment by implementing learning using the Student Team Achievement Divisions (STAD) learning model.

3. Result and Discussion

<table>
<thead>
<tr>
<th></th>
<th>STATISTIK</th>
<th>PBL</th>
<th>STAD</th>
<th>JUMLAH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent</td>
<td>N</td>
<td>20</td>
<td>12</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>∑X</td>
<td>684</td>
<td>334</td>
<td>1018</td>
</tr>
<tr>
<td></td>
<td>∑X²</td>
<td>23552</td>
<td>9386</td>
<td>32938</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>34.2</td>
<td>27.83</td>
<td>31.81</td>
</tr>
<tr>
<td>Field Dependent</td>
<td>N</td>
<td>10</td>
<td>19</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>∑X</td>
<td>318</td>
<td>564</td>
<td>882</td>
</tr>
<tr>
<td></td>
<td>∑X²</td>
<td>10168</td>
<td>16898</td>
<td>27066</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>31.8</td>
<td>29.68</td>
<td>30.41</td>
</tr>
<tr>
<td>JUMLAH</td>
<td>N</td>
<td>30</td>
<td>31</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>∑X</td>
<td>1002</td>
<td>898</td>
<td>1900</td>
</tr>
<tr>
<td></td>
<td>∑X²</td>
<td>33720</td>
<td>26284</td>
<td>60004</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>33.4</td>
<td>28.96</td>
<td>62.36</td>
</tr>
</tbody>
</table>
Table 2. 2-way ANOVA analysis results 2x2 factorial

<table>
<thead>
<tr>
<th>Sumber varian</th>
<th>JK</th>
<th>db</th>
<th>RJK</th>
<th>Fhitung</th>
<th>Ftabel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antar baris</td>
<td>299,51</td>
<td>1</td>
<td>299,51</td>
<td>4,66</td>
<td>4,01</td>
</tr>
<tr>
<td>Antar kolom</td>
<td>29.76</td>
<td>1</td>
<td>299,51</td>
<td>36,93</td>
<td>4,01</td>
</tr>
<tr>
<td>Antar baris dan kolom (interaksi)</td>
<td>31,73</td>
<td>1</td>
<td>31,73</td>
<td>5,91</td>
<td></td>
</tr>
<tr>
<td>Dalam kelompok kekeliruan</td>
<td>462,67</td>
<td>57</td>
<td>8,11</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>61</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. The first hypothesis

The first hypothesis testing is the learning outcomes of students' geographies that are taught using the PBL learning model are different from the groups of students who are taught by the STAD learning model. From the results of data analysis, it was found that the average geography learning outcomes of groups of students who were taught with PBL learning models was 33.4 and the average results of learning geography of students who were taught with STAD learning models of 28.96. Based on Anova calculation, $F_{count}$ was 3.66 while $F_{table}$ was 4.01 so Ho was rejected. Thus it can be concluded that the geography learning outcomes of groups of students who were taught with the PBL learning model were higher than the groups of students who were taught with the STAD Class learning model whose truth was tested.

b. The second hypothesis

The second hypothesis testing is the learning outcomes of groups of students who have a cognitive style of FI and FD. From the results of data analysis found the average geography learning outcomes of students who have a Field Independent cognitive style of 31.81 and the average geography learning outcomes that have a field dependent cognitive style of 30.41. Based on the Anova calculation, it was obtained that the $F_{count}$ was 36.93 while the $F_{table}$ was 4.01 so that Ho was rejected. Thus it can be concluded that the geography learning outcomes of groups of students who have independent cognitive field style is higher than the group of students who have field dependent cognitive styles whose truth is tested.

c. Third hypothesis

The third hypothesis testing is the interaction between learning models and cognitive styles on geography learning outcomes. Based on data analysis found the average value of student geography learning outcomes taught with PBL models that have independent field cognitive styles of 34.2 and the average geographic learning outcomes learned with PBL learning models that have field dependent cognitive styles of 31.8, then the average geography learning outcomes of the students studied with the STAD learning model that has an independent field cognitive style of 27.83 and the average geography learning outcomes of students taught with the STAD learning model that has a field dependent cognitive style of 29.68. Based on the Anova calculation, $F_{count}$ 5.91, while $F_{table}$ 4.01 for $df$ (1.57) with a 5% significance level, it turns out that the calculated $F$ value is 5.91 > $F_{table}$ 3.98 so that Ho is rejected. Thus it can be concluded that there is an interaction between learning models and cognitive styles on geography learning outcomes.

4. Conclusion

1. There are differences in geography learning outcomes taught using PBL learning models compared to using STAD learning models, student geography learning outcomes taught
with PBL learning models are higher than student Geography learning outcomes using STAD learning models.

2. There are differences in learning outcomes of independent and field dependent cognitive style geography, independent field geography learning outcomes are higher than field dependent geography learning outcomes.

3. There is an interaction between learning models and students' cognitive styles on geography learning outcomes, students who have independent field cognitive styles and are taught with PBL models are higher than students who have field dependent cognitive styles and are taught with STAD model learning models.

5. References


The Effectiveness of Student Worksheet (LKM) Based on Guided Discovery Learning on Matrix Material of Building Engineering Education Students

Enny Keristiana Sinaga1, Zulkifli Matondang2, Suhairiani3, Siti Zulfa Yuzni4
{ennysinaga@unimed.ac.id1}

1,2,3,4Universitas Negeri Medan, Indonesia

Abstract. The need for teaching materials that are able to facilitate and guide students for independent learning makes it easier for students to find and understand concepts correctly as the background of this research. Text books have not been able to help students understand and remember mathematical concepts well. Therefore, a concept of “Student Work Sheet” (LKM) based on guided discovery learning on matrix material was developed. After the SWS developed, it has shown the effectiveness of the use of the SWS in the learning process. The subjects of this study were students of Building Engineering Education Study Program at the State University of Medan that were able to study basic engineering mathematics courses. Based on the analysis it was found that the percentage of post-test was greater than the percentage of pretest (84.85> 24.24%) and was filed in the Good criteria and the results of paired simple-t test showed that the value of tcount (18.3715) > ttable (2.037). This means that LKM based on guided discovery learning is declared effective for use.

Keyword: Effectiveness, Guided Discovery Learning, Student Worksheet.

1. Introduction

Matrix material is one of the basic subjects of Basic Engineering Mathematics taught in the Building Engineering Education Study Program in semester I. This material must be mastered by students because it is one of the materials that supports (compatible) with other engineering subjects such as structure analysis courses. It is expected that by studying matrix material, students can: (1) explain the characteristics of a matrix, (2) write information in the form of a matrix, (3) recognize a square matrix, (4) perform algebraic operations on two matrices, (5) reduce the properties matrix operations through examples, (6) Determine the determinant of a matrix, (7) determine the inverse of a matrix, and (8) Solve a set of linear equations and solve problems related to the field of civil engineering.

Based on the researchers’ experience and the results of interviews / discussions with the teaching team of basic mathematics courses in the Building Engineering Education Study Program, the matrix material is one of the materials that is difficult for students to understand. Difficulties faced by students are the inability of students to solve more complex matrix problems, such as applying the matrix in a broader context and in the context of everyday life. This is due to the low understanding of students' mathematical concepts. In other words, the lack of understanding of the concept of student matrices causes students to be unable to solve
problems related to more complex matrices, which demand critical thinking skills.

Based on the difficulties experienced by students in solving mathematical problems shows the importance of understanding the concepts contained in mathematics. Therefore, understanding previous concepts in mathematics is a prerequisite for understanding subsequent concepts, so the implications for learning mathematics must be gradual and sequential systematically and based on past learning experiences.

Students will understand the material well if students learn the material independently. One alternative teaching material that can be developed to direct the mindset of students and build student independence is the Student Worksheet (LKM). LKM contains assignments and steps that guide students to manage mindset in a directed manner. The role of the lecturer as a facilitator can be maximized. With LKM students are expected to be able to study independently, understand and carry out a written form [1].

Many educators were still using conventional teaching materials, namely teaching materials that were left in use, left to buy, instant, and without preparing and compiling themselves [5]. Where the teaching material is not contextual, not interesting, monotonous and does not fit the needs of students. As one of the lecturers supporting basic engineering mathematics courses, teaching materials used during the learning process are only in the form of one textbook. The textbook that is used has not provided an opportunity for students to find concepts from a material and coupled with the lazy attitude of reading students make problem solving in textbooks must still be explained by the lecturer. Seeing the existing problems, it is necessary to have teaching material as a companion to textbooks. The intended teaching material is teaching material that can guide students in understanding the material being taught. One of the textbooks accompanying teaching materials that is able to guide students to active and independent learning is LKM (Student Worksheet).

Student Worksheet is one of the tools that can be used by the teacher (lecturer) to increase student involvement in the learning process [4]. This is because, LKM has its own advantages compared to other teaching materials, one of the advantages of LKM is the content of LKM has summarized from several sources presented in a simpler form so that it is easy for students to understand.

Constructivism learning theory and discovery learning theory Bruner explains that students (students) must discover new knowledge by themselves based on prior knowledge, so students play an active role in the discovery process and are believed to be able to provide good results. The learning process will run well and creatively if the teacher (lecturer) provides an opportunity for students to find a concept, theory, rules, or understanding through the examples found [2].

Based on the characteristics of students of the Building Engineering Education Study Program, Faculty of Engineering, University of Medan, a suitable finding is that students find concepts through guidance and direction from lecturers because in general most students still need basic concepts to be able to find something. So students can process and construct their own knowledge, while lecturers guide them in the right direction.

Guided discovery learning methods are learning methods that regulate teaching in such a way that students gain knowledge, which they did not know before, not through notification but partially or wholly discovered by students themselves. The syntax of guided discovery learning that has been adapted is as follows: 1) Explain the purpose / prepare students; 2) Student orientation on problems; 3) Formulate a hypothesis; 4) Conduct guided discovery activities; 5) Present the results of guided discovery activities; 6) Evaluate guided discovery activities [6].

The purpose of this study is to examine the effectiveness of using student worksheets (LKM) based on guided findings on matrix material. Thus this study is entitled “The Effectiveness of Using Student Worksheets (LKM) Based on Guided Findings on Student
Matrix Materials in Building Engineering Education Study Programs”. Therefore, learning basic technical mathematics, especially on matrix material, should use a guided discovery-based student worksheet (LKM) that is expected to be effective.

2. Research method

This type of research is research and development. Research and development methods are research methods used to produce certain products and test the effectiveness of these products [5]. The product produced from this research is the effectiveness of MFI based on the discovery of matrix material. Development of MFIs based on guided matrix material is carried out using a 4-D model that has been modified to become 3-D. Consisting of three stages of development, namely the definition (Define), design (Design), development (Develop). This research was carried out until the development stage due to time constraints.

![Fig1. Research Design, Research and Development 4-D Model](https://via.placeholder.com/150)

The define stage is defining the learning objectives contained in the curriculum by conducting (a) curriculum analysis which aims to look at Competency Standards (SK) and Basic Competencies (KD) as stated in the content standards with due regard to the syllabus and assessment system; suitable learning strategies and literature related to LKM based on guided discovery, (b) student analysis to see the difficulties faced by students during the mathematics learning process in class, and (c) concept analysis which is a collection of procedures for determining the content of a lesson.

The design phase which aims to design LKM based on guided discoveries for teaching in accordance with the specified indicators and learning objectives. This stage begins with the preparation of the LKM which is the first step to link define and design stages, and continues with the selection of the LKM format that is tailored to the needs needed in the LKM.

The development phase includes the LKM’s validation by material experts and media experts. LKM are validated from the aspects of content worthiness, presentation worthiness, graphic worthiness and language worthiness. A valid LKM is then tested to find out its practicality and effectiveness in learning basic engineering mathematics.

This research data consists of quantitative and qualitative data. Quantitative data is carried out through concept understanding tests on the experimental class and the control class. The form of test used is the essay test. The data obtained in the form of the results of the pretest, posttest, and analyzed statistically using paired t-test with a confidence level of 5%. The effectiveness analysis was assessed from the concept understanding test in the form of pretest and posttest. To determine the classification of data interpretation the following guidelines are used:
The following are guidelines that will determine the interpretation of student learning completeness data presented in Table 1 [3].

<table>
<thead>
<tr>
<th>Range</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>$p &gt; 80$</td>
<td>Very Good</td>
</tr>
<tr>
<td>$60 &lt; p \leq 80$</td>
<td>Good</td>
</tr>
<tr>
<td>$40 &lt; p \leq 60$</td>
<td>Good Enough</td>
</tr>
<tr>
<td>$20 &lt; p \leq 40$</td>
<td>Poorly</td>
</tr>
<tr>
<td>$p \leq 20$</td>
<td>Very Poor</td>
</tr>
</tbody>
</table>

Teaching material (LKM) based on guided discovery learning to improve the ability of understanding the concept of PTB students Semester I (odd) Academic Year 2019/2020 is considered effective if the percentage of posttest is greater than the percentage of pretest and Good classification.

Teaching material (LKM) based on guided discovery learning to improve the ability of understanding the concept of PTB students Semester I (odd) Academic Year 2019/2020 is considered effective if the percentage of posttest is greater than the percentage of pretest and Good classification.

The formula for paired t-test is as follows:

\[
\begin{align*}
 t_{\text{count}} &= \frac{\bar{d}}{S_d / \sqrt{n}} \\
 \text{dumana : } \bar{d} &= \frac{\sum d_i}{n} \quad \text{dan } S_d = \sqrt{\frac{\sum (d_i - \bar{d})^2}{n-1}}
\end{align*}
\]
3. Result and discussion

Effectiveness of Student Worksheets (LKM)

The effectiveness test of statistic textbooks was conducted on 33 students. Effectiveness is obtained from the value of learning outcomes data from test results, namely pre-test before being treated (treatment) and post-test after being treated (treatment). Learning outcomes here are included to find out the improvement in learning outcomes after the pretest and posttest. This test aims to determine whether a certain value (which is given as a comparison). The effectiveness test aims to determine the effectiveness of the LKM. The average pretest scores obtained are:

\[
\bar{x}_{\text{pretest}} = \frac{\sum x_i}{n} = \frac{1780}{33} = 53.94
\]

While the average posttest score obtained is:

\[
\bar{x}_{\text{posttest}} = \frac{\sum x_i}{n} = \frac{2675}{33} = 81.06
\]

Percentage of completeness (p) Pretest = \(\frac{8}{33} \times 100\% = 24.24\%\)

Percentage of completeness (p) Posttest = \(\frac{28}{33} \times 100\% = 84.85\%\)

Based on the analysis it was found that the percentage of posttest was greater than the percentage of pretest (84.85 > 24.24%) and was in the Good criteria. So, it can be concluded that teaching material (LKM) based on guided discovery is effective to use, then paired t-test with the help of SPSS 25 software, to find out the significance of an increase in student test results can be seen in table 2 below.

<table>
<thead>
<tr>
<th>Paired Differences</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest - Posttest</td>
<td>27.121</td>
<td>8.481</td>
<td>1.476</td>
<td>24.114 to 30.128</td>
<td>18.371</td>
<td>32</td>
<td>.000</td>
</tr>
</tbody>
</table>

Hypothesis

H₀ : \(\mu_1 = \mu_2\) (There is no difference in student learning achievement before and after using LKM based guided discovery)
H₀ : μ₁ ≠ μ₂ (There are differences in student learning achievement before and after using LKM based guided discovery)
Significance level (α) = 5% = 0.05 → t_{table} = t_{0.05;32} = 2.037

Decision making:
If t_{count} (18.3715) > t_{table} (2.037) then H₀ is rejected. This means that there are differences in student learning achievement before and after using an LKM

4. Conclusion

Based on the results of research and discussion, it can be concluded that, the feasibility of the Student Worksheet (LKM) based on guided discovery and the application of the LKM based on guided discovery in learning, is effective enough to foster understanding of student concepts.

5. Acknowledgements

Thanks to the Department of Building Engineering, at the Medan State University for competitiveness research at the faculty level (KDBK) in 2018.

6. References

Development of E-Learning Based On “SMILE” Learning Model to Improve Economic Learning Outcomes of Class X Students of Senior High School 1 Pahae Jae 2019/2020

Dwi Fany Butar-butar¹, Efendi Napitupulu², Dina Ampera³
Teknologi Pendidikan Pascasarjana Universitas Negeri Medan, Indonesia¹,²,³
dwivanny24@gmail.com

Abstract. This study aims to: (1) Produce learning models that are feasible to use, easy to learn and can be used for learning (2) to determine the effectiveness of learning models based on E-learning. This research is a type of development that uses the product development model Borg and Gall and combined with the model's learning design Dick and Carey. The method used in this study is a quasi-experimental method. The results of the hypothesis test study prove that there are significant differences between economic learning outcomes that are learned using the E-learning "SMILE" learning model with economic learning outcomes that are learned using inquiry learning models.

Keyword: e-learning based "smile" learning model, inquiry learning model, economic learning outcomes

1. Introduction

The use of internet in learning has become one of the new innovations in the use of learning resources and learning media. Very many applications and facilities available on the internet can be utilized to improve the quality and quality of learning. Researchers want to develop learning models based on E-learning in economic subjects to improve student learning outcomes.

Clark and Mayer [1] said that “E-learning is a command that is delivered into a computer or mobile device to achieve the objectives of the learning process"¹. Russel [2] also explains that E-learning is online learning that comes from teaching results delivered through electronics using computer-based media². The learning model that will be developed in this research is the "SMILE" learning model based on E-learning. Learning using the E-learning based learning model is a learning process that is carried out electronically using computer-based media by utilizing the internet and using the Google Classroom application as a means of delivering teaching materials and means of interaction carried out to achieve learning goals.

Can be seen in the content of the meaning of the "SMILE" learning model, namely (S) elf Efficacy is the belief that each individual has the ability to control thoughts, feelings, and
behavior (M) motivation, namely in the learning process, motivation as a mobilizer that guarantees the learning process and give direction or direction in learning so that what goals can be achieved, (I) identification, namely identifying the objectives of the learning plan. The process of designing learning starts from how to identify a problem. The activity of preparing a learning plan is one of the tasks of a teacher in the learning process. In order for the learning process to run well, the teacher must be required to compile and formulate learning goals. (L)earnings by doing, that is Learning by doing is direct learning that is done by students actively both individually and in groups. This learning directly practices what is on the subject matter both individually and in groups. Active learning or learning by doing, namely students must be involved in the learning process spontaneously and from the curiosity of students about new things encourage students to be actively involved in the learning process. Active learning can foster students’ learning abilities and explore the potential of students and teachers and the last (E) valuation is the process of giving an assessment to students, where assessment is seen when the teacher gives an initial quiz and a final quiz. The teacher makes the decision to what extent the teaching objectives have been achieved by students.

2. Research Method

This study uses a research and development approach (Research and Development), better known as R&D studies, which in the process includes the development and validation of educational products, as expressed by Borg & Gall. Borg and Gall [3] said that Education Research and Development (R&D) is a process used to develop and validate educational products. In this study the steps taken in the study only reached the fifth step of the ten steps, namely: (1) Introduction, (2) Creating learning designs, (3) Collection of materials, (5) making and implementing learning models, (5) Review or field test in the context of formative evaluation and product revision. Formative evaluation continues as long as the development process starts from the analysis, design, production and implementation stages until the results are obtained in accordance with the stated objectives, and finally the product effectiveness test.

As stated, if in making a learning model "SMILE" that has been made it cannot be directly tested first, but it must be the product design first, and the product design is tested. Product designs must be validated and then revised, and then the next product is made in the form of a prototype. This prototype is then tested. The initial stage of the trial is carried out by simulating the use of the "SMILE" learning model. After being simulated, it can be tested on a limited group. Testing is done to find out information whether the learning model is more effective and efficient than the inquiry learning model. For this reason, testing can be done experimentally, which is to compare the effectiveness of the E-learning based "SMILE" learning model with the inquiry learning model. An indicator of the effectiveness of the "SMILE" based e-learning learning model is the increase in student economic learning outcomes. The research subject or respondent is the party that is used as a sample in a study, research subjects discuss about the characteristics of the subjects used in research, and subjects in research for the development of learning models in this research development are adjusted to the trials conducted on individual trials a sample of 3 students, a small group sample of 6 students and a main trial of 36 students
3. Result and Discussion

1. Feasibility research test

The results of the study conducted by material, design and media experts in every aspect of the overall assessment are determined by the average score in their respective categories. The results of the study are then analysed to determine whether or not the learning model is developed. The average percentage of the results of research material experts, learning design experts and media experts will be described as follows:

<table>
<thead>
<tr>
<th>No</th>
<th>Indicator</th>
<th>Average Percentage</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Theory</td>
<td>91%</td>
<td>Very Good</td>
</tr>
<tr>
<td>2</td>
<td>Design</td>
<td>94%</td>
<td>Very Good</td>
</tr>
<tr>
<td>3</td>
<td>Media</td>
<td>88.7%</td>
<td>Very Good</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>91.23%</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

Based on the above table, it can be concluded that the "SMILE" Learning Model based on E-learning in economic subjects is proven to be feasible because it has passed material experts, design experts, media experts, individual trials, small group trials and field trials and the results are stated "Very good".
2. Effectiveness research test

The results of studies that conducted by individual, small group and field tests determined by the average score in each category. The average percentage will be explained as follows:

<table>
<thead>
<tr>
<th>No</th>
<th>Indicator</th>
<th>Average Percentage</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Individual</td>
<td>89.9%</td>
<td>Very Good</td>
</tr>
<tr>
<td>2</td>
<td>Small Group</td>
<td>88.3%</td>
<td>Very Good</td>
</tr>
<tr>
<td>3</td>
<td>Field</td>
<td>91.1%</td>
<td>Very Good</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>89.7%</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

Table 2. The results of the effectiveness of the products that have been tested by individuals, small groups and the field

According to Hanum [4] that e-learning learning can be used as a tool in learning in schools and can be used to improve the understanding of the material and expand the source of teaching materials and increase learning activities and assist teachers in streamlining learning time in the classroom [4]. Hakim [4] said that through the Google Classroom application it was assumed that learning objectives would be more easily realized and full of meaningfulness [5]. Therefore, the use of Google Classroom makes and makes it easier for teachers to manage learning and convey information precisely and accurately to students. From the results of the research data processing conducted there are differences in student learning outcomes using E-learning "SMILE" learning models in economic subjects with students using inquiry learning models namely the average economic value taught using the E-based "SMILE" learning model - learning in
economic subjects is higher than that using the inquiry learning model of the test results using the t test, obtained $t_{count} = 3.08$ while $t_{table} = 1.99$. Because $t_{count} = 3.08 > 1.99$, it can be concluded that the learning outcomes of students who use the E-learning "SMILE" learning model are higher than student learning outcomes using inquiry learning models.

This can be seen from the average economic value taught using the E-learning based "SMILE" learning model, which is 18.22% higher than those using the inquiry learning model viz. This data proves that the "SMILE" learning model based on E-learning can improve student economic learning outcome.

4. Conclusion

Based on the formulation, the purpose of the discussion, the results and research discussion of the development of the learning model "SMILE" based on E-learning in economic subjects that have been tested in class X students of SMA N 1 Pahae Jae, it can be concluded as follows:

1. The "SMILE" learning model based on E-learning is stated in terms of both products and is suitable for use in the tenth grade students of SMA Negeri 1 Pahae Jae for economic learning.
2. The use of the "SMILE" learning model is more effective in improving student economic learning outcomes compared to using inquiry learning models.

5. References

Development of Tutorial Video Media Based on Project Based Learning in Class XI State of SMKN 1 Lubuk Pakam

Fahrul Rozi¹, Abdul Hamid K², Keysar Panjaitan³
{ fahrulrozilbs93@gmail.com}

Education Technology Postgraduate of Medan State University, Indonesia¹,²,³

Abstrak. This research aims to: (1) know the feasibility of the media Video tutorial based on the project based learning software application and interior building, and (2) to determine the effectiveness of the use of media video tutorial based project based learning on software application learning and building interiors can improve the learning outcomes of software applications and building interiors. This type of research is development research using R&D models from the Borg and Gall combined with the Dick and Carey instructional design models. The method used in this study is a quasi-experimental method. The results of the hypothesis test study prove that there are significant differences between the learning outcomes of software applications and building interiors that are studied using video based tutorials on project based learning with the learning outcomes of software applications and building interiors that use visual media.

Keywords: video tutorials, project based learning, media visual, learning outcomes, software applications and interior building.

1. Introduction

Lubuk Pakam State Vocational School Has a Building Modeling and Information Design Expertise Program carrying out a series of learning activities covering various engineering training subjects. Training courses in the Building Design and Information Design expertise program can be classified into three, namely: normative training courses, adaptive training courses and productive training courses. Of these three training courses, productive training courses are skills training courses that are directly related to student skills. One of the productive training courses received by students of class XI Building Design and Information Design Expertise Program is Building Software and Interior Applications. In the Software Building and Interior Application subjects, students are expected to have expertise and skills in Drawing With Software using software, such as Autocad.

Based on observations at SMK Negeri 1 Lubuk Pakam it was found that in the learning that took place the teacher only explained the material visually so that the students only focused on the teacher was impressed students could not directly practice it on their computers, but the learning was still felt to be less detailed and effective. The media used by the teacher has not been able to increase student interest in learning. In addition, visual media has not facilitated students learning independently.
Submitting practical material is not enough just to explain with visual media only. To overcome this, we need learning media that can support the teaching and learning process. Thus the teacher no longer has difficulty in explaining the material and not only relies on the material contained in the e-book but can be supplemented with instructional video tutorial media on the material How to Draw Window and Door Construction and Ventilation With AutoCAD.

Chen [1] in the results of his research explained that the video tutorial as part of curriculum-based skills, meaning effective methods to be introduced for novice students. Thus the video tutorial can provide students with knowledge but also motivate learning and be able to follow the process of the teacher delivering the material with the video so it is suitable for teaching in skills. Nasir [2] in his research results explained that the video tutorial not only provides knowledge to the audience but also motivates them to learn. Henderson, Selwyn dan Aston [3] in the results of his research explained that has shown the video in an authentic context, allowing students to have the use of very special controls, for example if students skip the parts they already know or the speed of teacher demonstrations in delivering the material then with video tutorials students can follow it.

To increase the activeness of students in the classroom in the learning process, it can be handled by applying the learning model, the success of a student in the learning process is not only determined by good teaching staff or a sound curriculum, but also determined by the learning methods used by the teacher. Putra [4] in his research to obtain the optimal activeness achievement required a supportive learning environment and environment and an interesting learning process so that it is possible to have a good and appropriate application of learning models that actively involve students. Saputra [5] related to the project based learning model shows that the implementation of the project based learning model has an impact on increasing student learning activities that continue to be expressed in each learning cycle. So it is very clear that the project based learning model is very suitable for learning skills.

The objectives of the study are: (1) To find out the feasibility of Project Based Learning Based Video Tutorial Media on learning Software Applications and Building Interiors. (2) To find out the effectiveness of using Project Based Learning Video Based Tutorial Media on learning Building Software and Interior Applications.

2. Research Method

This research uses a research and development approach (Research and Development), better known as R&D studies, which in the process includes the development and validation of educational products, as revealed by Borg & Gall. Borg and Gall [6] say that Educational Research and Development (R&D) is a process used to develop and validate educational products. In this study the steps taken in this study reached step nine out of ten steps, namely: (1) Introduction, (2) Making learning designs, (3) Collection of materials, (4) making and implementing learning models, (5) Review or field test in the context of formative evaluation and product revision. (6) Main Field Testing, (7) Operational Product Revision, (8) Operational Field Testing, (9) Final Product Revision Formative evaluation continues during the development process starting from the analysis, design, production, and implementation stages until the results are obtained in accordance with the objectives stated, and finally the product effectiveness test.

Next validate 3 instruments to each validator consisting of severe experts consisting of instructional design experts, media experts, and material experts, then provide more instruments
or individual tests consisting of 3 students then small group tests consisting of 9 students last limited field test which includes all students in the class. Then the results obtained are tested again on 65 students consisting of 2 classes, the experimental class and the control class. The experimental class consisted of 33 students with project-based learning video tutorial media and the control class consisted of 32 students with visual media to gain effectiveness.

3. Results and Discussion

1. Feasibility research test

The results of study by material experts, design experts and media experts in each aspect of the overall assessment are determined by the average score in each category. The results of the study were then analyzed to determine whether learning media was developed or not. The average percentage of results from research material experts, learning design experts and media experts will be explained as follows:

<table>
<thead>
<tr>
<th>No</th>
<th>The Experts</th>
<th>Average Percentage</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Learning Design Expert</td>
<td>91.91%</td>
<td>Very Decent</td>
</tr>
<tr>
<td>2.</td>
<td>Media Expert</td>
<td>83.59%</td>
<td>Decent</td>
</tr>
<tr>
<td>3.</td>
<td>Theory Expert</td>
<td>95.19%</td>
<td>Very Decent</td>
</tr>
<tr>
<td>4.</td>
<td>Individual Trial Students</td>
<td>81.81%</td>
<td>Very Decent</td>
</tr>
<tr>
<td>5.</td>
<td>Small Group Trial Students</td>
<td>90.90%</td>
<td>Very Decent</td>
</tr>
<tr>
<td>6.</td>
<td>Field Trial Students</td>
<td>91.48%</td>
<td>Very Decent</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>89.13%</td>
<td>Very Decent</td>
</tr>
</tbody>
</table>

Based on the table above, it can be concluded that the Video Based Tutorial Learning Media Project Based Learning in software and interior building subjects has proven to be very feasible because it has passed material experts, design experts, media experts, individual trials, small group trials and tests try the field and the results are stated “Very Decent”.

2. Research effectiveness test

The media is said to be feasible after showing satisfactory results in achieving the specified goals. In this case, a product trial is conducted in the learning process. Media effectiveness is obtained from the value of student learning outcomes. Chen, et al. [1] also stated that video tutorials are part of curriculum-based skills, meaning effective methods to be introduced for novice students. Viewing video tutorials, like in a classroom, is a reasonable method for teaching her specific skills. Saputra [5] states that project based learning models show that the implementation of project-based learning models has an impact on increasing student learning activities that continue to be expressed in each learning cycle. From the results of data processing research conducted there are differences in student learning outcomes using learning media Video Based Project Based Learning on Software Application and Interior Building subjects with students using visual learning media that is the average value taught using instructional media based Video Tutorials Project Based Learning in the Building Software and Interior Application subjects is higher than that using visual learning media from the results of tests using the t test, obtained \( t_{\text{tung}} = 5.63 \) while \( t_{\text{abel}} = 1.63 \). Because \( t_{\text{tung}} = 5.63 > 1.63 \), it can
be concluded that the learning outcomes of students who use Video Based Project Based Learning media are higher than student learning outcomes using visual learning media.

4. Conclusion

Based on the results and discussion of the research development of learning media based on Project Based Learning Video in the subjects of Software Applications and Interior Buildings that have been tested on class XI students of SMK N 1 Lubuk Pakam, it can be concluded as follows: (1) Video learning media Project Based Learning based Tutorials on Building Software and Interior Application subjects are declared to be very feasible and suitable for use in class XI students of SMK N 1 Lubuk Pakam in Building Software and Interior Application subjects, (2) Use of Project-based Video Tutorial learning media Based Learning is more effective in improving student learning outcomes in Software Applications and Interior Buildings compared to using visual learning media.

5. References


Antnet Algorithm in Route Searching on Computer Networks

Harvei Desmon Hutahaean 1, R. Mahdalena Simanjorang 2, Penda Sudarto Hasugian 3
{harvei11@unimed.ac.id1, relimahdalenasimanjorang@yahoo.co.id2, penda.hasugian@gmail.com3}

1 Department of Electrical Engineering, Universitas Negeri Medan, Medan, Indonesia
2,3 STMIK Pelita Nusantara Medan, Indonesia

Abstract. The speed of technological development makes the process of transformation of information as a major human need that will be easily obtained with an increasingly broad range of computer network developments following the revolution that occurs in Personal Computers. With the existence of computer technology as a support in data processing, information has become a necessity, the information needed must be obtained quickly and accurately. In fact, one of the most important factors in information technology is the network or media access which is the bridge between sources of information for various parties. Network characteristics such as traffic load and topology on a network can change dynamically. The Antnet algorithm is a multi-agent distribution system that is inspired by the stimulation communication model carried out in ant colonies. The algorithm is implemented in the search for the shortest route on a computer network, the search for the shortest route on a computer network is used to get the fastest and without delay.

Keywords: Shortest Route, Computer Network, Antnet Algorithm.

1 Introduction

The speed of technological development makes the process of information transformation as a major human need that will be easily obtained with a broader scope of development of computer networks following the revolution that occurs on PCs. Mass production of Personal Computer makes ownership of this device easier and cheaper. Local Area Network (LAN) is evolving to accompany the PC development revolution. Increased LAN capability in exchanging files and messages between computers in a relatively small geographic area. Other computers can share resources and act as file providers, bus topologies connecting each computer / node with a communication cable through a computer interface card. Every computer can be connected to other computers on the network, meaning all computers have the same position on the network and are not dependent on a central server computer. When you want to access other computers in a computer network, you only need to know the address of the computer / node to be addressed to and can directly communicate and also different ring, star, mesh, and tree topologies. The ring topology is connected to a single cable and forms part of a ring and the data is sent across several existing nodes to the destination node. Whereas the star topology of several computers will be connected to one computer center and different from the mesh topology has a double path at each node / network node and tree topology is a combination of star topology and bus topology and because of that LAN network and BUS topology are very suitable in the search for the shortest route.
Finding the shortest route on a computer network is very important. The reason for searching the shortest route on a computer network is to get the results of the quickest route and without delay, because it requires a way to overcome the problem. This shortest route search is often called the router algorithm. There are so many algorithms that can be used to solve this problem like the AntNet algorithm. In solving the shortest route problem, this algorithm has several advantages which are discussed further in this research. This study aims to analyze the Antnet algorithm in solving problems determining the search for the shortest route on a computer network. So with this script, it is hoped that it can be concluded that the right antnet algorithm for searching the shortest route on a computer network.

Where has a large influence on the overall performance of a network. Network characteristics such as traffic load and topology on a network can change dynamically. This research proposes the use of the AntNet algorithm to overcome the optimization of data packet delivery. Antnet is a multi-agent distribution system that is inspired by the stimulation communication model carried out in ant colonies. From the simulation results, AntNet shows a better performance than the Dijkstra algorithm on the performance of the results of the packet throughput and time delay. There are several types of routing problems, one of which is the nature of distribution, so a solution that assumes access to all forms of global information is not wanted.

Routing

Routing is the process of moving data across a network by going through several network segments using equipment called a router. Router (route regulator) will choose the right data path according to the direction of the data destination. Placement of routers on the network will combine and connect small routers that will form an entity called between networks or interworks.

The router will manage information about the direction of the data path from a file into a scheme called a route table. This table contains network router (or port) interface information that is used to send data through certain network segments. The router will not run broadcast packets with no known purpose. The router will manage a packet that is sent if it has a specific purpose.

Antnet Algorithm

The AntNet algorithm uses two mobile agents called forward ants and backward ants to update the value of the routing table. Forward ants use the heuristic method in the routing table to move towards the destination past existing nodes and get information about the distribution of traffic on a network. Backward ants use the path from the forward ants used in the opposite direction. At each node, the backward ants update the routing table and additional tables that contain the distribution of traffic on the network. AntNet has been known to have better results than OSPF, Bellman-Ford, etc. routing protocols with various and close traffic loads. For example a network with graph G (N, L) contains N nodes and L paths. All lines on the network are bidirectional where the transmission capacity and transmission delay have been determined. Each node is assumed to be a communication between end-point (host) and router.

Each node of the network maintains an input buffer composed of a single queue and output buffer is composed of high priority queues and low priority queues for each neighbor node or output path. High priority queues are served before low priority queues. All packets on the network can be divided into two classes:
a) Data packet: shows information about exchanges between hosts with each other. In ant-routing, data packets do not maintain routing information, ant-routing use information that has been stored in the routing table to roam from the origin source to the destination node.

b) Mobile agents (forward ants and backward ants): used to update routing tables and distribute information about traffic loads on the network.

2. Research Method

AntNet is divided into two homogeneous mobile agents called forward ants and backward ants. These agents have the same nature, it's just different placement of the situation and environment, so they can receive different inputs and produce different outputs. In general, these ant agents can be classified as deliberative, because they have the behaviour to regenerate again and at the same time they can maintain a complex internal status. Each agent communicates indirectly or staggery. Agents capture the information they read and write the information obtained in the two data structures stored at each network node as shown in Figure 1 below.

![Data Structure Stored By AntNet](image)

**Fig 1.** Data Structure Stored By AntNet
A layer can communicate "vertically" with another layer that is directly below or above it.

Information flowing from one layer to another will experience transformation. To understand this, consider the following illustration that illustrates the transformation of information from the Application layer to the Physical layer.

1. Information starts from the Application layer and then passes through the Presentation layer and the Session layer. At this stage, data transformation is not done yet. Information through these three layers is called PDU (Protocol Data Unit) or data only.
2. After arriving at the Transport layer, the data will be transformed into another form called a segment.
3. Segments flow to the network layer and then convert into packets (sometimes called datagrams).
4. Packets flow to the Data Link layer and then convert into frames.
5. Frame flows to the Physical layer and then converted into bits converted into physical quantities, such as electric current, electromagnetic waves.

The process of "changing shape" from one layer to the next is done by adding a special header, this is what is called encapsulation. The encapsulation process becomes repetitive until the data is converted into bits. Then these bits are sent to the target host via network media. After the information (changed bits) reaches the target host, the reverse process, which is to release the header one by one from the layer carried up to the top layer will be done, this process of removing the header is called de-encapsulation. The process of encapsulation and de-encapsulation can be analogized to sending goods via post. Items sent will be wrapped, given an address, delivered to the destination address. After arriving at the destination, the recipient can open the package again.

3. Result and Discussion

The ant algorithm is adopted from the behavior of the ant colony known as the ant system (Dorigo, 1996). An ant colony is naturally able to find the shortest route on the way from the nest to the places where food sources, based on footprints on the track that has been passed. The
more ants that pass through a track, the clearer the footprints. This causes the path the ants traverse in small amounts the less the ant density that passes through it, or it will not even be crossed at all. We recommend that the trajectory that is passed by ants in large quantities the longer will increase the density of ants that pass through it or even all ants pass through that path. There are two groups of ants that travel, L group of ants depart from left to right and group of ants R depart from right to left. Both groups depart from the same point and in the decision making position which way to take, group L divides two groups again. Some pass through the upper road and some pass through the lower road, this also applies to group R. The pheromones left behind by the ants that pass through the upper road are experiencing a lot of evaporation because the ants that pass the upper path are few compared to the path below. This is due to the distance traveled longer than the road below, whereas the pheromones that are at the bottom of the evaporation tend to be longer. The other ants finally decide to go down the road because there are already a lot of pheromones left, while the pheromones on the upper road have evaporated so much that the ants don't choose the upper way. The more ants that pass through the road, the more ants that follow it, the fewer ants that pass through the road, the pheromones left behind are reduced and even disappear. From this, the shortest path between nests and food sources was chosen.

### Step 1

Initialize the price of algorithm parameters, initialized parameters are:

1. The intensity of the ant trail between the city and its changes ($t_{ij}$)
2. Many cities (n) including x and y (coordinates) or $d_{ij}$ (distance between networks)
3. Determination of networks and goals
4. Tetapan siklus semut ($Q$)
5. The control set of ant trail intensity ($\alpha$)
6. Visibility control settings ($\beta$)
7. Visibility between cities $= (1/d_{ij} \eta_{ij})$
8. Number of ants ($m$)
9. Evaporation constant trace ants ($\rho$)
10. Maximum number of cycles ($NC_{max}$) is fixed as long as the algorithm is run, meanwhile $t_{ij}$ will always be updated in value at each cycle of the algorithm starting from the first cycle ($NC=1$) until the maximum number of cycles is reached ($NC = NC_{max}$) or until convergence occurs.

The Antnet testing parameter is:

- $T_{ij} = 0.1$
- $\alpha = 1$, $\beta = 1$, $Q = 1$, $\rho = 0.5$, $n = 3$, $d_{ij} = 10$, $x_i = 4$, $x_j = 2$, $y_i = 6$, $y_j = 3$

### Step 2

Fill out the first city into the tabu list. The results of the initialization of the first ant city in step 1 must be filled in as the first element of the tabu list. The result of this step is to fill in the first tabu list element of each ant with the first network index.

### Step 3

Preparation of the path of each ant visit to each network. The ant colony that has been distributed to the first city will start traveling from the first city as the city of origin and one of the other cities as the destination city, and then from the second city, each ant colony will
proceed by selecting one of the cities that is not on \(\text{tabu}_k\) as the next destination the ant colony journey continues until it reaches the city that has been determined. If \(s\) states the order of visit, the city of origin is stated as \(\text{tabu}_k(s)\) and other cities are declared as \(\{N-\text{tabu}_k\}\), then to determine the destination city used the probability equation of the city to be visited as follows, With \(d_{ij}\) is the distance between city \(i\) and city \(j\) calculated based on the equation,

\[
P^k_{ij} = \frac{\langle t \cdot [t, j]\rangle^\alpha \cdot [y_{ij}]^\beta}{\sum_k \in (N-\text{tabu}) \langle T_{ij} \rangle^\alpha \cdot [n_{ik}]^\beta} \quad \text{untuk } j \in \{N-\text{tabu}_k\}
\]

\(P^k_{ij} = 0\), for \(j\) where \(i\) is the origin word index and \(j\) is the destination city index.

\[
P^k_{ij} = \frac{[0,1]^\alpha \cdot [1/10]^\beta}{\sum_{e \in (N-\text{tabu})} [tik]^\alpha \cdot [n_{ij}]^\beta}
\]

\(0 = \frac{[0,1]^\alpha \cdot [0,1]^\beta}{\sum_{e \in (N-\text{tabu})} [tik]^\alpha \cdot [n_{ij}]^\beta \sum [tik]^\alpha}
\]

\(\sum_{e \in (N-\text{tabu})} [tik]^\alpha \cdot [n_{ik}]^\beta = 0.1 , 0.1
\)

then \(\sum_{e \in (N-\text{tabu})} [tik]^\alpha \cdot [n_{ik}]^\beta = 0,01
\)

**Step 4**

a. Path length calculation of each ant
   Calculation of the length of a closed path (length closed tour) or \(L_k\) each ant is done after one cycle is completed by all ants. Calculations are based on \(\text{tabu}_k\).

b. Shortest route search
   After \(L_k\) is calculated, a minimum path length will be obtained for each cycle or \(L_{\text{minNC}}\) and the minimum price of the total length of the closed lane is or \(L_{\text{min}}\).

c. Calculation of changes in the price of ant footprint intensity between cities.

The ant colony will leave footprints on the path between the city in its path. Evaporation and differences in the number of ants that pass, causing the possibility of changes in the price of the intensity of ant footprints between cities. The equation of change is

\[
d_{ij} = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2}
\]

\[
d_{ij} = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2}
\]

\[
d_{ij} = \sqrt{(4 - 2)^2 + (6 - 3)^2}
\]

\[
d_{ij} = \sqrt{2^2 + 3^2}
\]

\[
d_{ij} = \sqrt{4 + 6}
\]

\[
d_{ij} = \sqrt{10}
\]

then
\[ \Delta t_{ij} = \Delta t_y = \sum_{k=1}^{m} \Delta t^k_{ij} \]
\[ \Delta t_{ij} = \Delta t_y = \sum_{k=1}^{m} \Delta t^k_{ij} \]
\[ \Delta t_{ij} = 25 \cdot d_{ij} \]
\[ \Delta t_{ij} = 25 \]

**Step 5**

Calculation of the price of ant footprint intensity between cities for the next cycle. The ant footprint intensity between cities on all trajectories between cities is likely to change due to evaporation and differences in the number of ants that pass through. For the next cycle, the ants that will pass through the path the price of the intensity has changed. The price of ant footprint intensity between cities for the next cycle is calculated by the equation:

\[ t_{ij} = \rho \cdot t_{ij} + \Delta t_{ij} \]
\[ t_{ij} = \rho \cdot t_{ij} + \Delta t_{ij} \]
\[ t_{ij} = 0.5 \cdot 0.1 + t_{ij} \]
\[ \Delta t_{ij} = 0.05 \]
\[ \Delta t_{ij} = 0.1 \]
\[ \Delta t_{ij} = 0.5 \]

**4 Conclusions**

In accordance with the discussion and trial results of the program carried out it can be concluded the antnet algorithm can be used to find the shortest route from a connectionless network. In the process of finding the shortest route on a connectionless network by knowing the nodes left by the ant. Antnet algorithm is very good in finding the shortest route on the network IP address.

**5 References**


Development of the Body Care E-Modul Learning Based on Discovery Learning in Department of Cosmetology Education on Students at Universitas Negeri Medan

Wuri Dwiyati¹, Harun Sitompul², R. Mursid³
{dwii.wuridwiyatispd@gmail.com¹}

Education Technology Postgraduate Program, Universitas Negeri Medan¹, Fakultas Teknik Universitas Negeri Medan, Indonesia²,³

Abstract. The study is intended to: (1) determine the feasibility of e-module learning care agency-based discovery learning, and (2) determine the effectiveness of the e-module learning care agency-based discovery learning. Type of research this is the research development using the product Borg and Gall were combined with the model of development of learning Dick and Carey. This model includes six stages namely: literature study, planning and design development, product development, expert validation, trials, revisions, and final products. Subject test try consists of a two-person expert material two-person expert design of learning, two expert video media learning, three students to test individual, Nine students for the test group of small, and four thirty the students to test the field. The result of the filing of hypotheses prove that: (1) the media e-modules of learning worthy of use in learning care agency on the program of study education that a dressing university land terrain, (2) there is a difference that is significant between the results of learning of students who be taught to use the e-module learning care agency with the result of learning of students who be taught to use the media to learn the book text. This is indicated by the results of data processing t arithmetic = 3.285 at a significance level α = 0.05 with dk 40 obtained t table = 1.67, so t arithmetic > t table, the effectiveness of using e-module body care learning = 80.46%. Results of study groups of students who taught without the use of e-module learning care agency by 71.72%. From the data have proved that the use of e-module learning care agencies more effective in improving the competence and knowledge of students on study treatment weight of at without using the medium of e-modules of learning care.

Keywords: Discovery Learning, Development of E-Module, Learning Care Agency

1. Introduction

Information and Communication Technology (ICT) is currently highly developed in society. Generally, Information Technology is a technology that is used to manage data, including in it: processing, obtaining, compiling, storing, manipulating data in a variety of ways and procedures to produce quality information and high-value use. The development of ICT continues to increase along with the increasing human needs, especially in the field of Education [1]. At present the trend of the use of e-electronic, which means a lot of emerging, such as e-education, e-learning, and so on, including the use of e-modules. At present information
technology seems to have become a teacher, book and learning system that is conventional. By because it is, with increasingly growing progress in the field of science knowledge and technology Institutions especially college high that competence in the field of vocational already preparing the source power of man that is the students who are competent in the field of expertise of each one of them in the field of expertise order beauty or cosmetology.

Universitas Negeri Medan is one of the Institutions of Education State which has a program expertise competence vocational in the field of governance of beauty. Program Study of Educational Makeup Department of Education Welfare and Family Faculty of Engineering is a program of study that opened since the teachings of 2007/2008 was one of the efforts to meet the needs in the community will be the teachers professional and skilled in the fields of cosmetology in the future will come. Improved quality of teaching in universities high, especially in institutes of Education personnel education is and must continue to be improved. Based on the results of interviews with faculty supporting lecturer of college nursing agency implemented on the date of 17 January 2019 can be concluded that during these lectures carried out only with the methods of lecture and demonstration. Practices are simulated first advance by the lecturers can spend time almost 2 credits and subsequent student practice it together. While the result of learning of students associated with the eyes of college nursing agency, the data obtained from the results of learning of students in the eyes of college nursing agency in the teachings of 2016/2017 is said to be good. This can be seen from there are 22.85% who get very good grades and 77.15% who get good grades. Although the result of learning of students in the eyes of college nursing agency pertaining to say good, but still need to be improved so that the results of study a student may be retained or more improved again so that the purpose of the process of learning can be achieved in accordance with the expected.

The role of lecturers as educators is needed to motivate student enthusiasm for learning. Lecturer is seen as a person who knows a lot of things about the conditions of learning and also the problems of learning that faced by students. Lecturers are creative are always innovating and looking for ways how to make the process of learning to teach achieve the result of learning in accordance with the objectives that are planned. Based on the results of observations are made on the date of 25 January 2019 with the lecturer eyes of college nursing agency can be concluded that the reactions of students during the process of learning care agency is a student looks very enthusiastic both from the terms of the deepening of the material as well as the current treatment practice. Although there are some students who look less active in the learning in the classroom, but the lecturer eyes of college trying to provide approach both in apperception, appreciation and motivates him to improve his spirits in process activities of learning care agency.

The use of media and learning resources is part of the components that influence learning. Materials teaching need to be adapted to the conditions of the students and strategies of learning that is used lecturer. Utilization and empowerment of modules to support learning is an advancement, not only to improve the effectiveness and quality of learning, but what is more important is to improve the mastery of the material both faculty and students.

To increase the activity of the participant students in the class in the process of learning, things that can be addressed by applying the model of learning, the success of a participant students in the process of learning is not only determined by the force instructor that good or curriculum that is steady, but is also determined by the method of learning the use of teachers. Models or methods of teaching that require activeness of students in accordance with the progress of students. Activeness learning students can be seen from the activities of learning students, among others: visual activities, oral activities, listening activities, writing activities, drawing activities, the motor activities, mental activities, and emotional activities [2].
To provide the material teaching in accordance with the development of the times, it can be assisted by the provision of a module teaching, a module teaching would be meaningless, if the student can with easy to use. The teaching modules that are currently in accordance with technological developments are electronic based. Teaching module electronics that when it popular is the Modular Object-Oriented Dynamic Learning Environment (Moodle), i.e. the module electronics are based on the web. Moodle is a name for a Program is an application that can transform a medium of learning into the form of a web [3].

In connection with this the author would like to develop an e-module that is by applying one of the models of learning in e-modules, namely discovery learning. Research that will writer to develop these, entitled "Development of E-Module Learning Care Agency -Based Discovery Learning on Student Program Study of Educational Makeup Universitas Negeri Medan".

Learning that effectively marked by the ongoing process of learning from the self-student. A person is said to have experienced a process of learning if in itself occurred change behavior of do not know be out, and not to be able to and so on. In the learning outcomes of learning can be seen directly, by because it was so that the ability of the students can be controlled and evolve as much as possible in the process of learning in the classroom then the program of learning that should be designed first advance by the teachers / lecturers with attention to various principles of learning that has been tested superiority wrong which is the source material of learning for participants learners.

Body means a science to learn how to take care body parts, so that the parts are not experiencing the changes were fatal or damaging the appearance. In order to implement the knowledge that the results are good then it must follow the instructions and perform the exercise, discipline themselves, and so on.

**E- Learning Module**

Electronic module or E-Module is an ICT-based module that has an interactive nature, makes it easy to navigate, allows displaying or loading images, audio, video and animation and it is equipped with tests or formative quizzes that allow feedback behind automatically with immediately [4].

Module electronics is a version of the electronics of a module that is already printed that can be read on the computer and is designed with the software that is needed [5]. E-module is a tool or a means of learning which contains the materials, methods, limits and how to evaluate which is designed as a systematic and attractive to achieve competence are expected in accordance with the level of complexity in electronics.

Some opinions regarding the understanding E-module can be concluded that the essentially e-module is a media electronic that can be accessed by students to have the benefits and characteristics are different. If the terms of the benefits of media electronics alone can make the process of learning more interesting, interactive, can be done when and where any and can improve the quality of learning.

**Sea Digital Learning (SIGIL)**

Sea digital learning is one of the learning virtual learning. Where learning that can be used for learning that do not require face-to-face, or can occur process of learning is not direct. Sea digital learning emphasizes the technology of using the internet to send learning materials to improve knowledge and skills.
Discovery Learning

In the book Encyclopedia of the sciences of learning is learning Discovery learning is learning the invention is to learn from the study of contemporary in psychology cognitive to encourage the development of a method that is more specific, which defined its characteristics is that the participant students must produce units and structures of knowledge abstract like concept and groove by reasoning inductively their own about the case that is not abstract in a matter of learning [6].

The method of discovery (discovery learning) is a teaching method that regulates teaching in such a way that the child obtains knowledge that he did not know before, not through notification but partially or found himself [7]. By thus, in learning by discovery, students can gain knowledge from experience resolve the problem instead of through the transmission of a teacher.

Some opinions regarding the understanding of learning discovery learning it can be concluded that Discovery learning is a model of solving a problem that will beneficial for the children of students in the face of life in later days. The application of the model of discovery learning is intended that the student is able to understand the material change in the form of objects with as best as possible and learning more feels meaningful, so that the result of learning students also will increase. Because the discovery model of learning is in the process using the activities and experiences directly so that will be more attractive the attention of children of students and allow the formation of concepts abstract that has meaning, and its activity was more realistic.

2. Research Method

This research was conducted to produce an electronic module for learning body care. This research was conducted at Medan State University, Faculty of Engineering, Department of Family Welfare Education, makeup Study Program.

Subjects in the study this is a matter of learning the eyes of college nursing agency. While the object of the research it is the students Program Study of Educational Makeup who were studying the matter of learning the eyes of college nursing agency.

To find out the result of learning of students with the application of e-module learning care agency based discovery learning, the researchers did the collection of data research by using the instrument of research that tests and pieces of observation. Research was carried out in the form of observation of the entire activities of the process of learning to teach and aims to determine the changes that occur when do the action. Before sheet observation is used as an instrument of research, especially first sheet of observation is in validated by a team of expert validation.

To test the research instrument test, use a validity test, reliability tests, test the level of difficulty test, and different power test. Analysis of the data in the study is using stage test for normality, test of homogeneity, and t test.
3. Results and Discussion

Results of the study showed; (1) the learning material expert test is in very good qualification (93.75%), (2) the learning design expert test is in good qualification (80.08%), (3) the learning video media expert test is in a very good qualification (89.99%).

The result of the filing of hypotheses prove that: (1) the media e-modules of learning worthy of use in learning care agency on the program of study education that a dressing university land terrain, (2) there is a difference that is significant between the results of learning of students who be taught to use the e-module learning care agency with the result of learning of students who be taught to use the media to learn the book text. This is indicated by the results of data processing $t_{arithmetic} = 3.285$ at a significance level $\alpha = 0.05$ with $dk = 40$ obtained $t_{table} = 1.67$, so $t_{arithmetic} > t_{table}$, the effectiveness of using e-module body care learning = 80.46%. Results from study groups of students who be taught without the use of e-module learning care agency by 71.72%. From the data have proved that the use of e-module learning care agencies more effective in improving the competence and knowledge of students on study treatment weight of a without using the medium of e-modules of learning care.

4. Conclusion

Based on the formula, objectives, results and discussion of research development of the e-module learning care agency that stated earlier, it can be summed up as follows:

1. After passing through several phases of test try, either test try of expert material, test try expert design learning, and test try from expert video and design graphics and test try to students, the product e-module learning dressing characters have the result already decent into the product end of the can be disseminated and implemented to the user. It is clarified with the acquisition of the average ratings almost all stages, i.e. in a test try expert materials on the table a scale of five, value that included the category "very good", the test try expert design learning in the tables scale of five, the value of the included category of "Good", In the trials of the experts in the five scale table, the value is included in the category of "very good", in the one-on-one trial in the five scale table, the value is included in the "very good" category, in the small group trials in the five scale table, the value is included in the category of "very good", in the field trials in the five scale table, the value is included in the "very good" category.

2. To see the effectiveness of the product, an analysis of student learning outcomes was carried out. Based on the analysis of student participants test try to group a large result of use of e-module learning care agency on the test results of learning of students showed that the result of learning of students who be taught to use the e-module learning.

5. Implication

The implications in question are as follows:

1. By using the e-module learning-based discovery learning will facilitate the students in the process of learning care agency, where media e-module learning care agency is equipped with theories, video implementation, and is equipped with test selection multiple that
simplify, improve power remembered and power student reasoning in the learning process so that learning does not become normal anymore.

2. E-module learning care agency is very giving donations positive and practical, especially in the implementation of the process of learning for faculty where media learning this provides ease in organizing learning so that an impact on the effectiveness of the process of learning and can improve the outcomes of learning of students. With such media can be used as a material consideration for lecturers in the delivery of the material of lectures and in the field of science more with consideration where students have an interest in the process of learning will improve the results of their study.

Based on the conclusions above, it is suggested as follows:
1. During this process of learning to teach are implemented on the eyes lecture practice generally still use materials instructional media print, so it often happen refraction of learning. It is caused not achieve the ability to capture and apply knowledge that is acquired.
2. Media e-modules of learning in the eyes of college nursing agencies require their facilities room practices are adequate, so that at the time of the lecture took place not to be corrugated can do activities to learn together which will be more efficient in using the time to learn and have the time that is sufficiently long.
3. E-modules media of learning is just as a tool to assist in the delivery of learning, then the lecturers are still greatly needed as facilitators and students remain engaged actively in the process of learning the eyes of university.

6. References

Fiber Optic Sensor Array for Perfume Detection Using Neural Network

Bakti Dwi Waluyo¹, Arwadi Sinuraya², Salman Bintang³
{bakti_dw@unimed.ac.id¹, arwadisinuraya@unimed.ac.id², salmanbintang@unimed.ac.id³}

Universitas Negeri Medan, Indonesia¹,²,³

Abstract. Optical fiber sensors with a polymer coating instead of the original layer have many advantages to be used as sensors. The advantages of fiber optic sensors are that they have the flexibility of the environment and are free of electromagnetic waves. The working principle of the optical fiber sensor is based on changes in the evanescent field in the boundary area of the core - cladding due to changes in the refractive index when interacting with perfume vapor. Fiber optic sensor testing is done by exposing perfume vapor and letting it interact. During the interaction with perfume vapors, the fiber optic sensor is given a light source from a blue light emitting diode with a wavelength of 450nm and as a light sensor is a photodiode that converts light intensity into changes in voltage. The voltage change data is then processed using the artificial neural network method to identify perfume. The experimental results show that the optical fiber sensor array with different polymer cladding and pattern recognition of artificial neural networks can identify perfume.

Keywords: fiber optic sensor array, polymer cladding, neural network.

1. Introduction

The chemical industry for making cosmetics and perfume products today is growing rapidly. This development resulted in perfume that sold in the market is very vulnerable to falsification. So testing is needed to distinguish the authenticity of perfumes on the market. The tests generally use the sense of smell, this tends to be inaccurate. Because testing using the sense of smell depends on the health condition and mood of the examiner or inspector [1]. Therefore, we need a tool that can detect and distinguish the quality of the scent of perfume. So far there have been developed sensors based on electronics and optics with chemical sensitive coatings. However light-based sensors are more beneficial because they are not affected by electromagnetic waves, low noise, and can be used for long distances using optical fibers [2].

Optical fiber was originally used as data transmission with the principle of reflection and propagation of light. The reflection and propagation of light in an optical fiber depends on the refractive index between the core and the cladding. Changing or modifying the cladding layer causes a change in the refractive index, causing evanescent waves in the boundary area of the core and cladding [3]. Evanescent waves originating from changes in the refractive index are the main parameters of optical fibers that can be used as sensors [4].

In this study polymer materials have been used as a substitute for original cladding, because polymers are sensitive to chemical vaporized so that they can increase sensitivity when interacting with chemical vaporized. In principle, polymer cladding will change the refractive
index in optical fibers when interacting with chemical vaporized, resulting in changes in the evanescent field in the core-cladding boundary plane.

Changes in evanescent fields will affect the pattern of light intensity received by the photodiode as a light sensor. Furthermore, the photodiode changes the intensity of light into voltage. The voltage data for each polymer layer will be different when interacting with the gas, so that each type of gas will show different patterns and characteristics. Voltage data from several types of gas are then processed using the Artificial Neural Network (ANN) method, so the results of data processing with ANN are able to identify the types of gas [5].

**Optical Fibers**

Optical fibers consist of a core with a refractive index \( n_1 \) surrounded by a cladding with a lower refractive index \( n_2 \). For the conventional fiber (except the photonic crystal fiber), the light transmission in optical fiber is based on the principle of total internal reflection (TIR), which requires the refractive index of the core \( n_1 \) to be higher than that of the cladding \( n_2 \) that is, \( n_1 > n_2 \) [4][6]. As illustrated in Figure 1, important fiber parameters include (a) critical angle \( \Phi_c \), which is defined by the ratio between the cladding and the core refractive indices, as given by

\[
\sin \Phi_c = \frac{n_2}{n_1}
\]  

(b) The acceptance cone angle, \( \theta_{i,max} \), which depends on the refractive indices of the core, the clad, and the ambient refractive index, \( n_0 \),

\[
\sin \theta_{i,max} = \frac{(n_1^2 - n_2^2)}{n_0}
\]

And (c) the numerical aperture (NA), which defines the fiber’s light collection efficiency and is related to the acceptance cone’s angle as:

\[
NA = n_0 \sin \theta_{i,max}
\]

All these parameters are critically important when designing the fiber chemical sensors.

---

**Fig 1.** An illustration of light guiding in optical fiber.
Evanescent Wave

When the incident light is reflected from an interface at an angle greater than the critical angle, the total internal reflection occurs. However, its intensity does not abruptly decay to zero at the interface and a small portion of light penetrates into the reflecting medium. This penetrated electromagnetic field is called the evanescent wave, as illustrated in Figure 2 [7]. Since the amplitude of evanescent wave decays exponentially with the distance, the penetration depth ($d_p$) is defined as the distance required for the electric field amplitude to fall to $1/e$ (0.37) of its value at the interface, which is a function of both the wavelength of the light and the angle of incidence, as mathematically given by

$$d_p = \frac{\lambda}{4\pi[n_1^2 \sin^2 \theta - n_2^2]^{1/2}}$$

where $\lambda$ is the wavelength of the transmitted light, $\theta$ is the incident angle at the core/cladding interface, and $n_1$, $n_2$ are the refractive indices (RI) of the core and cladding, respectively.

![Fig 2. Illustration of exponential decay from evanescent field.](image)

Artificial Neural Network

ANN is a computational model for pattern recognition like a biological neural in the human brain. One of the training methods in ANN is a backpropagation neural network with a multilayer perceptron which is a method of learning with high accuracy. This system must first obtain a training pattern of each type of perfume vapor, and then the training pattern is used as an identification of the type of gas [8]. The backpropagation model will compare the expected outputs and targets, if there are any differences, it will change the (weight) that will be repeated continuously until the target is the same as the output. The model of the backpropagation method can be seen in Figure 3.

![Fig 3. Backpropagation training model.](image)
2. Research Method

The materials used include: acetone as the original cladding peeler, alcohol is used to clean the core surface after the cladding is peeled, and the polymer is used as a substitute for the original cladding. The perfumes that used are Signature Zoom, Ascendant Aqua, and Glacier Rock. The equipment used includes: pliers stripper, Multimode step index plastic optical fiber, Arduino Mega 2560, blue LED with a wavelength of 450nm, photodiodes, and personal computer.

The optical fiber used is made of Multimode step index plastic type which has a jacket diameter of 2.21 mm, core layer diameter of 0.98 mm, and cladding layer thickness of 125 μm. The configuration size of the optical fiber pieces can be seen in Figure 4, where the overall length (Lfo) is 25 cm, the length of the right (R) and left (L) is 11 cm. Right (Rx) and left (Lx) lengths of 0.5 cm each, made by opening the jacket using a stripper. In the middle (C), the original jacket and cladding are removed 2 cm long. In the center of the optical fiber (C), the original jacket and cladding are removed 2 cm long. The removal of the original cladding is done by means of a chemical etching method, which is by smearing the core surface with acetone. When the chemical etching process, cladding will experience thickening and will be released from the core slowly. The chemical etching process is carried out at room temperature for approximately two hours. After the original cladding is peeled off, then it is cleaned with alcohol.

After the optical fiber is cleaned, the next step is to coat the optical fiber core with a polymer. Table 1 is the type of polymer used. The use of different polymers is because each type of polymer has different characteristics, where non-polar polymers tend to interact strongly with non-polar gases and polar polymers tend to interact strongly with polar gases.

<table>
<thead>
<tr>
<th>Coating</th>
<th>Type Polymer</th>
<th>Constant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layer 1</td>
<td>Squalane</td>
<td>Non-polar</td>
</tr>
<tr>
<td>Layer 2</td>
<td>Apiezone M</td>
<td>Non-Polar</td>
</tr>
<tr>
<td>Layer 3</td>
<td>PEG 20M</td>
<td>Polar</td>
</tr>
</tbody>
</table>
Illustration of optical fiber testing according to Figure 5, where an air pump with a flow rate of 0.1 Liter Per Minute (LPM) enters silica gel as clean or dry air flowed into the test container. Clean air from silica gel flows into the test container by opening valve 1 and closing valve 2 and valve 3. After the test container is clean, then drained the gas sample by opening valve 2 and valve 3, and closing valve 1.

3. Result and Discussion

Data collected for each perfume vapored is carried out four times, where the first test is as learning data on the neural network and three other data are used as an introduction to perfume vapored. The process of data retrieval is done by first flowing clean air into the test container for 30 seconds then perfume vapored is flowed for 140 seconds, then drain clean air again for 330 seconds.

Changes in voltage data for each response of the optical fiber sensor in 160 seconds to 170 seconds can be seen in Table 2. The data analyzed came from the optical fiber response to perfume vapored, which is from 160 to 170 seconds. If the intensity of the light received by the photodiode gets brighter than the graph goes to a negative value (decreases) and if the intensity gets dimmer then the graph tends to be positive (up).

<table>
<thead>
<tr>
<th>No</th>
<th>Vapor</th>
<th>Testing</th>
<th>Cladding (Volt)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Squalane</td>
</tr>
<tr>
<td>1</td>
<td>Signature</td>
<td>1</td>
<td>0.181</td>
</tr>
<tr>
<td>2</td>
<td>Zoom</td>
<td>2</td>
<td>0.170</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>3</td>
<td>0.148</td>
</tr>
<tr>
<td></td>
<td>Voltage Average</td>
<td></td>
<td>0.166</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td>0.175</td>
</tr>
<tr>
<td>5</td>
<td>Ascendent</td>
<td>2</td>
<td>0.181</td>
</tr>
<tr>
<td>6</td>
<td>Aqua</td>
<td>3</td>
<td>0.163</td>
</tr>
<tr>
<td></td>
<td>Voltage Average</td>
<td></td>
<td>0.173</td>
</tr>
<tr>
<td>7</td>
<td>Glacier</td>
<td>1</td>
<td>0.155</td>
</tr>
<tr>
<td>8</td>
<td>Rock</td>
<td>2</td>
<td>0.154</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>3</td>
<td>0.130</td>
</tr>
<tr>
<td></td>
<td>Voltage Average</td>
<td></td>
<td>0.146</td>
</tr>
</tbody>
</table>
The response of the optical fiber sensor to three different perfume vapors can be seen as follows: Figure 6 is the intensity of the light on the optical fiber sensor when interacting with the signature zoom perfume, Figure 7 is the intensity of the light on the optical fiber sensor when interacting with ascendant aqua perfume, and Figure 8 is the intensity of the light on the optical fiber sensor when interacting with glacier rock perfume.

![Fig 6. Intensity of optical fiber sensor light to signature zoom perfume vapor.](image6)

![Fig 7. Intensity of optical fiber sensor light to signature ascendant aqua vapor.](image7)

![Fig 8. Intensity of optical fiber sensor light to signature glacier rock vapor.](image8)

The data in Table 2 are the voltage response of the three polymer layers, so that it can be seen that the polymer layer has a high, medium and low response to the given perfume vapor. Based on the voltage average normalization, it will be seen the response of each polymer layer in each optical fiber, this can be seen in Figure 9.
The normalized data in Table 2 then becomes a parameter to the learning process in neural networks. This parameter will be used as the next type of perfume vapor testing. Neural network learning is done by setting the desired error value, where the error value is 0.0001. After the error value is fulfilled, the final weight value is obtained to identify the type of perfume vapored. Data obtained from testing using artificial neural networks are shown in Table 3, from 9 data that has been tested, it can be identified as a whole, so that the success of testing to recognize perfume vapored is 100%.

![Fig 9. Average voltage normalization of three perfume vapours.](image)

**Table 3. Test results with neural network**

<table>
<thead>
<tr>
<th>No</th>
<th>Perfume</th>
<th>Testing</th>
<th>Status</th>
<th>Result (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Signature</td>
<td>1</td>
<td>match</td>
<td>100%</td>
</tr>
<tr>
<td>2</td>
<td>Zoom</td>
<td>2</td>
<td>match</td>
<td>100%</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>3</td>
<td>match</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Ascendant</td>
<td>1</td>
<td>match</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Aqua</td>
<td>2</td>
<td>match</td>
<td>100%</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>3</td>
<td>match</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Glacier</td>
<td>1</td>
<td>match</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Rock</td>
<td>2</td>
<td>match</td>
<td>100%</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>3</td>
<td>match</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>

4. Conclusions

In this research, optical fiber-based gas sensors have been designed and made. This sensor is based on evanescent field changes in the core-cladding boundary area due to changes in the refractive index when interacting with perfume vapored. The chemicals used as polymer cladding are Squalene, Apiezone M, PEG 20M. The test results show that this sensor system is able to distinguish the types of perfume vapored, where there are different responses between perfumes vapored from one another.
5. References


The Ability of Coco Fiber Material in Reducing Heat as An Insulation of Building Walls on Accepted Temperature Level

Kemala Jeumpa¹, Selamat Triono², Rusnardi Rahmat³
Lecturer of Faculty of Engineering, State University of Medan, Indonesia¹,²
Lecturer of Faculty of Engineering, State University of Padang, Indonesia³

Abstract. This paper was purposed to determine the ability of coco fibers in reducing heat as a wall covering solution with different temperature levels. For the fulfillment of thermal comfort in buildings requires engineering, knowledge and skills and innovation. One way to reduce hot air in the room can be done through walls, thereby reducing the use of air conditioning. The walls need protection and solar heat absorbers that can make the room inside the building have thermal comfort. Based on this, research needs to be done on natural ingredients that can function to reduce heat. Tests carried out on coconut fiber and fiber-free materials. Material without fiber and coco fiber is 2 cm thickness of each. This coco fiber material is coated with a mixture of cement that also functions as a fiber adhesive. In this case, testing is conducted by applying heat of 60° Celsius and 40° Celsius to one side of the fiber and measuring the temperature that occurs on the other side of the fiber. The test results found that there was a significant difference between the heat temperature supplied and the heat temperature measured on coco fiber. The higher the temperature is received, the greater the heat that can be absorbed. This shows that coco fiber material has the ability to reduce heat at high enough heat as a wall covering against solar radiation.

Keywords: coco fiber, insulation, building wall, cement, reduce heat

1 Introduction

Sunlight is the main source of heat in the building, the heat of sunlight will mainly enter the room through the media of roof and wall. About 83% of the sun's heat in the form of infrared rays on the roof and building walls are absorbed and emitted into the room by radiation, conduction and convection. In humid tropical climates, the building coating is a building element that must be able to protect the occupants from the sun's heat, also reducing the radiant heat forwarded into the building. Therefore one of the functions of the building coating is to control or reduce the heat load from solar radiation into the building (transmission). The entry of solar radiation into the building can be through a vertical cover that is a wall or a horizontal or sloping cover that is roof. Cooling the space in this way is classified as passive cooling system that relies heavily on air movement as a hot carrier medium in the morning to late afternoon to reduce room’s temperature.

Global warming causes the warming of the earth's temperature so that the use of air conditioner in the room is also increase as the need for comfortable room condition is also higher. This will increase the energy use of the earth and increase the contribution of rising earth temperatures and greenhouse effect. From the research of previous research also revealed the
fact that 50% of the energy absorbed in a building is only consumed by refrigerators only, therefore 30% of the total energy required by a country is usually used in housing. This figure is from conditions in developed countries that are more manageable, for in developing countries this figure will not be smaller even believed otherwise. If this fact not handled strategically, will be a terrible impact on sustainable nation development. Based on these factors, it is need to be balanced with the existence of building innovations that can save energy and environmentally friendly, as has been developed in several countries.

The heat on the wall will propagate into the room so the room becomes hot. Walls need protection and dampening from the sun's heat so that indoor space will not heat up. Therefore one way to inhibit heat from outside the room can be done through the wall. Non-heated rooms can reduce the use of air conditioning. By reducing the use of air conditioner means to save energy and also save the earth and the environment.

Environmental awareness can be realized with the use of materials derived from nature as a form of energy conservation and environmental protection. For example, coconut coir (coco fiber), is one of the wastes that has not been fully utilized in Indonesia. The amount of coco fiber capacity produced from coconut harvest annually in Indonesia is quite large where coconut fiber is a large part of coconut fruit, which is 35% of the total weight of coconut.

Based on this matter, it is necessary to do research on natural materials that can reduce heat. The problem that arises in this study is how is the potential of coconut fiber material based on the character of thick fiber as insulation to reduce heat. This research was conducted with the aim to know the potential of coco fiber that later can serve as a wall covering the building to reduce heat from outside.

2  Research Method

The material in this study consisted of several character for coco fiber material, namely 1 cm, 2 cm and 3 cm coated with a cement mixture. The other materials are mixtures of cement and sand commonly used as wall plaster material. The process of making the material can be shown in Figure 1 below.

![Fig.1 The process of making fiber test material](image)

This research approach is based on experiments to determine the ability of coconut fiber to reduce heat at high temperatures. In this case, test is conducted by comparing the two temperature tests. After the fiber and cement are good enough to bind and harden then be tested. In this case testing by applying heat to one side of the fiber and measuring the temperature that occurs on the other side of the fiber. The same tests and heat treatments are also carried out on fiber-free materials. The heat given is 35°C and 60°C for 120 minutes. Tools to measure the temperature that occurs in the material used sensors that are connected to the computer and can be read on the monitor screen.
3. Results and Discussion

Research on innovations related to environmentally friendly buildings to answer the phenomenon of global warming has been done by some researchers in research on building materials for walls that can reduce heat among them, who conducted research on lightweight concrete panels focus on the pearlite as a mixture of concrete panels that can serve as a heat insulator [1]. Another research on the mortal mix materials focus on the utilization of Pumice Breksia as the main ingredient of instant mortar as a heat reducer. While another research conducts a hot conductivity study between Styrofoam and rice coir and focuses on measuring the comparison between Styrofoam particle board composition with rice coir particle board composition as a good material for heat insulators. Similarly, several studies conducted by foreign researchers on building materials for a wall capable of muffling the heat among them [2], who conducted a study of the wall of the building that focused on the addition of retroreflective material on the wall, which can improve the temperature of the building by reflecting solar radiation back in the opposite direction. Furthermore, another research conducted a study on building walls with a focus on determining the thermal conductivity of cement reinforced by periwinkle shells (sea shells) used as construction materials [3]. Meanwhile, another conducted a study of building walls with a focus on hygrothermal behavior of plant-based insulation products to assess their impact on energy performance in buildings, predict indoor climatic conditions, and prevent unexpected degradation risks [4].

Coconut fruit composed of fibers called fiber that serves to protect the hard part called the shell, serves to protect the seeds that are only protected by the membrane attached to the inner side of the shell, there is a liquid containing many enzymes called coconut water, and solid phase settles on the wall of the shell along with the growing old fruit called coconut meat. It can be concluded that the coconut coir is part of the coconut that protects the inside of the coconut from the outside including from the heat of the sun. Based on this coconut coir is estimated to have the potential for heat insulation, because it is necessary to research the character of coco fiber as a building wall coating to reduce heat.

This study compared the potential character for thick the material of coco fiber with the material without fiber. Test results can be shown in the graph in the following figure.

![Graph showing test results](image-url)

**Fig. 2** The results of the test material without fiber with a temperature of 60 °C

The graph in Figure 2 shows the results of the test material without a coir. The Y axis of the series line 1 shows the amount of heat applied to one side of the material expressed in Celsius, while the series 2 indicates the amount of heat measured on the other side of the material. The x-axis shows the length of time during the test expressed in minutes. The results obtained from the graph show that when given the heat of 60 °C for 120 minutes. Then the measured temperature on the other side of the material without a coat ranges from 38 °C.
Fig. 3 The results of the test material without fiber with a temperature of 35 °C

The graph in figure 3 shows the results of the test material without fiber. The Y-axis of the series 1 line shows the amount of heat applied and measured on one side of the material expressed in Celsius, while series 2 shows the amount of heat absorbed by the material measured on the other side of the material, next the series 3 shows the measured temperature in the environment around the test. The X-axis shows the length of time during the test expressed in minutes. The results obtained from the graph show that when given the heat of 35 Celsius for 120 minutes that the temperature measured on the other side of the material without fiber ranges from 34.5 °C.

Fig. 4 The test results of fiber materials 2 cm with a temperature of 60 °C

The graph in figure 4 shows the test results of the fiber material. The Y-axis of the series line 1 shows the amount of heat applied to one side of the material expressed in Celsius, while the series 2 indicates the amount of heat measured on the other side of the material. The x-axis shows the length of time during the test expressed in minutes. The results obtained from the graph show that when given the heat of 60 °C for 120 minutes. The measured temperature on the other side of the fiber material is 32 °C.
The graph in figure 5 shows the test results of the fiber material. The Y-axis of the series 1 line shows the amount of heat applied and measured on one side of the material expressed in Celsius, while series 2 shows the amount of heat absorbed by the material measured on the other side of the material, next the series 3 shows the measured temperature in the environment around the test. The X-axis shows the length of time during the test expressed in minutes. The results obtained from the graph show that when given the heat of 35 °C for 140 minutes that the temperature measured on the other side of the material of fiber 2 cm ranges from 31.5 °C.

From the results of experiments conducted in this study showed differences in temperature measured between coco fiber and without fiber. A significant difference also occurs between the measured temperature of the coco fiber material when it receives a different temperature level of heat. From the comparison of the temperature level shows that the higher the level of heat received, the greater the heat can be reduced by fiber material. The results of this study may still be far from perfect because the test equipment used is still limited.

4. Conclusions

From the ratio of temperature received and measured on coco fiber material, it can be concluded that coco fiber material has the ability to reduce heat so that it can be used as a wall covering solution to solar heat radiation from outside. Based on the experimental results the higher the heat temperature received the greater the heat that can be reduced.
5. Acknowledgements

I thank to Mr. Prof. Selamat Triono and Mr. Rusnardi Rahmat, Ph.D as promoters and co-promoters. This research will later be presented to those with an interest in buildings and observers of energy-efficient buildings. Thank you countless to those who helped in this research.

6. References


Dry Leaf Litter Extraction as Natural Dye for Dye-Sensitized Solar Cell

Muhammad Aulia Rahman Sembiring¹, Bakti Dwi Waluyo²
{marsembiring@unimed.ac.id¹, bakti_dw@unimed.ac.id²}
Universitas Negeri Medan, (061) 6613365¹,²
marsembiring@unimed.ac.id

Abstract. Currently, many dry leaf litters are still being futile. Dry leaf litters burning is a bad solution for health and environment. One alternative used is for dye. Natural dye from dry leaf litter extraction can be applied in dye-sensitized solar cell (DSSC). Titanium Dioxide (TiO₂) is deposited onto transparent conductive oxide (TCO) glass by the doctor blade method. Meanwhile, natural dyes are dripped into dry TiO₂. Electrolytes and carbon as auxiliaries for electron flow in TCO. The parameter responses of DSSC with dry leaf litter extract dye following: Voc: 52.8 mV, Isc: 6.8 uA, FF: 0.31 and Pmax: 113.30 nW.

Keywords: Dry Leaf Litter, Natural Dye, DSSC.

1 Introduction

Waste is a problem that often occurs in various sectors. The general environment around the house every day produces leaf litter[1]. The large number of trees makes a lot of leaf litter and left alone. Leaf waste management is still not effective. Large and diverse amounts of waste have grown into complex waste management[2].

According to the Energy Outlook of Indonesia, alternative fuels inflict oil and natural gas down to 60% [3]. One of alternative energy is solar cells. Solar cells develop rapidly with the price of energy growing large in seconds [4]. Dye-sensitized solar cell are modern solar cells with low prices.

DSSC has a big problem which is efficiency. Until now, dye from leaf chlorophyll were used at DSSC as photocatalysts. Another parameter is TiO₂ thickness[5]. Characterization needed to see the ability of TiO₂ in producing strength and binding dyes. Now, many DSSC fabrications use leaf chlorophyll, such as from Carica Papaya L. Sp., Ricinus Communis Sp.[6]. The amount of dye, solvent concentration and chlorophyll immersion time affect the rate of light absorption[7]. In this study, the method of coating dyes using dry leaf litter will be discussed to determine its impact on DSSC power. The coating will be used with ultrasonic atomization. This deposition technique is generally used to coat polymeric materials on the surface of the gas sensor[8].
2 Material and Method

This research is based on a problem that is applicable, that is planning and realizing the research so that it can work as planned. The steps that need to be taken to realize the research designed are how to design a dye-sensitized solar cell (DSSC), how to obtain data or measurements, analysis models and conclusions.

A. DSSC Design

In the DSSC manufacturing process, the first step is to prepare the material to be used. The tools that will be used are washed first using distilled water to remove impurities. For the manufacture of dye the dry leaf litter extraction principle is used. Dry leaf litter is weighed first 30 grams for the ratio of the number of leaves compared to the solvent is 30 grams: 50 ml.

In making TiO2 paste, 1.5 gram Polyvinyl Alcohol (PVA) is added to 13.5 ml of distilled water, then the mixture is stirred with a magnetic stirrer at 40 °C for approximately 30 minutes until the solution thickens and is homogeneous. PVA functions as a binder in making TiO2 paste. TiO2 powder weighed 0.5 grams, then the suspension that was made was added to the TiO2 powder slowly until a paste with the desired viscosity was obtained.

After obtaining the desired TiO2 paste, the paste is then coated on a TCO glass on the conductive layer using the doctor blading method. The TCO glass which has been coated with paste is then fired at a temperature of 450 °C for 30 minutes so that the paste is perfectly adhered to the glass. Then the extract of dried leaf litter was coated by ultrasonic onto the TCO glass which was coated with TiO2.

![Fig 1. DSSC Manufacture and Measurement](image-url)
B. DSSC Manufacture

The intended design and manufacture are the methods and stages carried out in the design and manufacturing process of the equipment. DSSC design is carried out using a multi-layered structure between DSSC compiler components. The constituent components referred to include substrate, TiO2 paste, dye, electrolyte and carbon. While the preparation steps are coating TiO2 paste on the substrate, drying the paste, shooting the dye using ultrasonic, applying electrolytes, and finally the joining of the substrate with other substrates that have been coated with carbon. The result of DSSC module is shown in Fig 2.

3 Result and Discussion

A. The Layer of TiO2

Measurements of TiO2 were carried out in the laboratory using a Scanning Electron Microscope (SEM). Thickness measurements were taken at one random point. The measurement results are shown in Fig 3.
B. DSSC Measurement

The module is carried out the Voltage-Current (I-V) characterization. Open circuit voltage (Voc), short circuit current, current and maximum power voltage (Imp and Vmp) are needed to calculate the fill factor (FF) and maximum power output (Pmax) formulated as:

\[ FF = \frac{V_{mp} \times I_{mp}}{V_{oc} \times I_{sc}} \]

\[ P_{max} = V_{oc} \times I_{sc} \times FF \]

After DSSC module done, examination do in sun light. Voc and Isc are shown in Fig 4a and 4b.

Fig 4. Measurement Voc and Isc of DSSC module.
Table 1. Measurement Result of DSSC Module

<table>
<thead>
<tr>
<th>Voc (mV)</th>
<th>Isc (mA)</th>
<th>FF</th>
<th>Pmax (nW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>52.8</td>
<td>6.8</td>
<td>0.31</td>
<td>113.3</td>
</tr>
</tbody>
</table>

C. Discussion
In this research, Module has been designed and characterized. The next research is what method will be used for the design of module. Another idea is which chlorophyll or dye will be used for DSSC.

4 References

Needs Analysis and Implementation Training Management Model Development

Eka Daryanto¹, Darwin²

Educational Administration Department, Universitas Negeri Medan, Indonesia¹,²

ekadaryanto@unimed.ac.id

Abstract. This research aims to determine the design of need analysis and implementation training management model. This research uses descriptive qualitative approach method. The data is collected by interview, observation and documentation. The subjects of this research are lecturers, instructors, students and the stakeholders. The results shows that: 1) training courses at the department is using guided inquiry models, the training schedule has been set, the competence of the students is already fits to department vision and mission, 2) graduates are currently working in factories based on their Department during college term, and 3) Design teaching factory in the development of training management model enabling products paired with the industry, especially in performed by the students through the learning process.

Keywords: needs analysis, training management model.

1. Introduction

Improvement or development of human resources is a thing judged on the quality of education, so that education can play role it must be associated with the world of work, which means that graduates should have the ability and skills relevant to the demands of the working world[1]. Human resources play a big role hand in promoting the development of a nation. Development in the various sectors of human resources required to compete in national and international scale. The increase in employment without an increase in labor productivity can result in the impoverishment of the labor force due to stagnant wage [2]. Learning model is a series of presentation of teaching material that covers all aspects of learning in order to achieve learning objectives[3]. Vocational education and vocational education is a kind of education that specifically prepares students to enter the workforce after completing their studies by providing specific expertise. However, the research results showed that there are number of Unemployment Rate (TPT) is high for graduates of vocational and vocational education as stated in the figure below [4]:

In accordance with Law of Higher Education Article no. 16 Year 2012, the vocational education is education that prepares students to become professionals with skills / high workability [5]. Vocational education curriculum prepared jointly with the professional community and professional organizations are responsible for the quality of service in order to qualify profession professional competence.
There is amount up to 80% of educational quality problems caused by the management [6]. In order to improve the quality of vocational education, one of the solutions is to provide training. That process teach certain knowledge and skills and attitudes in order to obtain better skills and is able to carry out their responsibilities properly in accordance with the standards, the training should be done through careful planning or management model proper training [7].

Training planned to be managed in an organized, ranging from planning, organizing and controlling. The four functions of management affect the success of the organization in realizing the vision that has been formulated, even the failure of one of the management functions will result in failure to achieve the vision [8]. Some performance issues with members of organizations that require training are: (1) lack of ability of members, (2) lack of knowledge of members, (3) lack of motivation, (3) behavioral problems [9].

Training is an activity to improve the performance of current and future performance [10]. The benefits of training as are: to improve the independence, to increase the motivation, to generate a sense, to increase job satisfaction, and to improve corporate profits [11].

Regarding quality is an issue that has grown and received special attention in higher education, that is focus on quality in higher education triggered by a factor of the number of competitors, political oversight to higher education, as well as the growth and changes to the expected number of students [12]. There are dimensions of quality, namely: access to service, acceptance, efficiency, effectiveness, relevance to the needs, as well as equity [13].

Needs analysis is defined as a formal process to determine the distance or the gap between the output and the real impact the output and the desired impact, then placing a row this gap in the priority scale, and then choose what is more important to resolve the problem [14].

Training needs analysis is a systematic analysis that determines whether an employee need training or not. Training needs arise if there is a gap between the standards of performance with the work achieves. The process of training needs analysis is very important because it can provide information to organizations about the kind of training and development is needed by workers to improve the effectiveness and efficiency of the organization [15]. The process of training need analysis can be analyzed in several aspects, namely: organizational analysis, task analysis and individual analysis [16].

The terms of management or management training is describing, which covers the activities a) planning, b) implementation, c) evaluation [17]. Of the three components can be developed into a multiple step activity depend on the approach used. The focus of this research
is the need analysis and implementation of the Teaching Factory in Training Management Model Development

2. Research Method

This study is a descriptive study with qualitative approach. Qualitative descriptive research type used in this research is intended to obtain in-depth information about the actual condition of management training, as well as factors that affect training. Subjects in the study is that lecturers, Chairman Prodi Diploma in mechanical engineering, Head of Production Unit, the business world Students and business / industry. Object of study in this research is the need analysis and implementation management model in the development of training management mechanical engineering state university school of engineering fields. The procedure of this research consists of four stages: Stage Pre Fields namely looking for a subject as a resource. Researchers conducted a field assessment (field study) against the background of research, looking for information and data from other studies about need analysis and implementation management model management training. It is intended to undertake the drafting of the study. The second phase: Field Work is to enter and understand the background of research in data collection. Third, the data analysis stage is conducted by performing a series of processes of qualitative data analysis and interpretation of the data that have been obtained previously. Then the process of triangulation of data is done as compared with the theory of literature. Fourth: Stage Evaluation and Reporting. This research instrument in the form of interviews, the instrument in the form of interview, observation, the instrument is a checklist and Documentation.

3. Results And Discussion

Training is one way to improve students' skills in mastering certain skills. The approach used in analyzing the needs of management training is to look at three components of a need analysis, i.e. organizational analysis, task analysis and individual analysis. Then the third aspect of the quality seen by Tovey quality theory, namely the quality of service access, acceptance, efficiency, effectiveness, relevance to the needs and equality. The training model used is guided inquiry. It is guided inquiry learning process with the guidance and direction of the instructor / trainer on an ongoing basis in accordance with the clock face in the classroom and in the practice room.

a) Actual Condition of Competence Development

Organizational Analysis, the training is done to improve the competence of students, especially in psychomotor. Facilities and infrastructure are used in the training Workshop / Workshop on Mechanical Engineering, with various laboratories in it among others: CNC Lab, Lab Machines, and so on. Lab Practical activities carried out in accordance with his courses. Basic machining tools are supplied complete, but still need a variety of machine tools that fit the needs of the industry.
Task Analysis, each lecturer/instructor has job description, respectively, as set forth in Semester Lesson Plan. Each lecturer will get an assessment questionnaire distributed to student assessment, including an assessment based on student competency during the training process.

The training modules owned by the instructor is still very limited in number, there is even less likely. Lecturers that administer refer to instructional material, thus making the module or manual have not been realized.

Individual Analysis, The analysis focuses on the individual itself. This analysis deals with people who are in organizations that require training and development in a particular field. Individual work performance or results may be based on data and assessment of performance compared to the expected level of performance standards specified or organization.

b. Needs Map

The researchers have found the quality of several aspects in training management, which listed as follows:

<table>
<thead>
<tr>
<th>No</th>
<th>Quality</th>
<th>Aspect</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Access to Service</td>
<td>Organizational</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Task</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Individual</td>
<td>93.75</td>
</tr>
<tr>
<td>2</td>
<td>Acceptability</td>
<td>Organizational</td>
<td>58.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Task</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Individual</td>
<td>75</td>
</tr>
<tr>
<td>3</td>
<td>Efficiency</td>
<td>Organizational</td>
<td>79.16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Task</td>
<td>87.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Individual</td>
<td>83.3</td>
</tr>
<tr>
<td>4</td>
<td>Effectiveness</td>
<td>Organizational</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Task</td>
<td>91.67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Individual</td>
<td>62.5</td>
</tr>
<tr>
<td>5</td>
<td>Relevance to Needs</td>
<td>Organizational</td>
<td>62.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Task</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Individual</td>
<td>75</td>
</tr>
<tr>
<td>6</td>
<td>Equity</td>
<td>Organizational</td>
<td>68.75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Task</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Individual</td>
<td>87.5</td>
</tr>
</tbody>
</table>

Based on table analysis obtained by researchers, it is found that priority needs in the development of training management model are:

a) Training model development

Training management model currently in force in guided inquiry, the student gets assistance from the lecturer (instructor) during the training process. The problem appears when the students cannot find the appropriate solution to overcome the problems in the society. The students are lack of literature reviews so that they couldn’t specify the needs of the society. Moreover, a training model which differs from the theory teaching model, since the training model has a lot of practices. Furthermore, the needs of integrated module are needed to guide the students in designing the machinery product.

One of obstacle in the training process is the lack of a Standard Operating Procedure (SOP) in ongoing training. Implementation of SOP training depends only on the existing courses, with
b) Competence Test Centre

The students’ competence is currently marked by the work evaluation. The evaluation sheet does not have proper criterion, which compound the instructor to define students as competent enough or not.

This is because there is no place Competency Test should require Competency Test place as a tool to test their competency and give the certificate as reward, which can be used in applying for work after they graduate.

c) Improved infrastructure

Currently, focused in designing machine-based production with heavy equipment, such as iron, steel and aluminum also leads to the manufacture of basic materials of iron, steel and aluminum, while many industrialized world that does not use it anymore. The department needs to pay attention to the needs of infrastructure for light-based tools, such as polymers, etc. The aim is that the process of learning and training undertaken by students is suitable with the industrial world.

Design teaching factory formed in the development of training management model can be explained by the concept of management training. Training Management consists of planning, implementation and evaluation. The designs are grouped based learning, competence of graduates, the curriculum has been adopted, industry cooperation in the production process, the works carried out in the industry, and infrastructure. The design of the existing teaching factory is established in a design manual. Manual teaching factory design is user practical teaching factory used by students of three engineering diploma as a reference to do a job in accordance with the demand of the business / industrial world. Manual design formed in the management of this program: through the groove identify the problems that exist in society, analyze order, presented the results of orders, work orders, perform quality inspections, and receive presented the results obtained as well as get feedback (feedback) from the lecturer / instructor.

Aspects of the evaluation process and the evaluation show the measure of success of the implementation of the teaching factory. Evaluation is required to see the achievement obtained from the product, both qualitatively and quantitatively. The evaluation is conducted by the coordinator. It is to conduct assessment work on each part of the production execution. Starting from the content, input, process and product. The evaluation results per section are then reviewed again in the overall assessment and the results used as the basis for continuous improvement. Measure of the success could be seen by the achievement of targets, the time completion of products, and consumer satisfaction. Evaluation is done in a sustainable manner is merely a subjective assessment. No indicators and instruments as a reference to determine the target.

In the learning process carried out also allows third parties can order special order products can also be made or produced by students in the school facilities through prior analysis. This design is expected to be one of the trimmers bridge the distance between the competence of graduates with the competence needs of the industry, especially industrial partner. Manual design teaching factory in the development of training management model consists of ways of working that can be used by a student to do a job in the learning process. Quality control and follow-up teaching factory in the development of training management model used to improvement needs of the workforce. Readiness of students to enter the working world can be
done by strengthening and improving the efficiency and academic competence, both financial incentives to encourage industry in the provision of internships and develop a curriculum aligned with the employment needs based on input from the business / industrial world. The success of teaching factory

4. Conclusion

1. The actual condition of the implementation of the increase in student competence namely:
   (1) The training is done with a model of guided inquiry such as mentoring by faculty as an instructor for one semester, (2) The training activities together with existing courses as a form of practice of the theory taught in the lecture, and (3) Workshop has had a fairly complete Laboratory, such as Smart Lab and CNC Lab. The machining tools are used to concentrate the iron, steel and aluminum.
2. Map design development needs training to improve competency management model student priority to: Competency Test Centre, Improved infrastructure and Management training is focused on SOP in accordance with the models of existing training.
3. Design teaching factory in the development of training management model enabling products paired with the industry, especially in performed by the students through the learning process. In planning the educational institutions and industry negotiations to determine which products do students with existing facilities, but these products have a sale value that can be accepted by consumers and the industry itself.

5. References


Effectiveness of Fieldwork Practice Implementation at Engineering Faculty of Unimed in RI 4.0

Harun Sitompul¹, Rosnelli², Eka Daryanto³, Nathanael Sitanggang⁴, Zulkifli Matondang⁵
{prof_runsit@yahoo.co.id¹, zulkiflimato@gmail.com²}

FT Universitas Negeri Medan, Medan Indonesia¹,²,³,⁴,⁵
prof_runsit@yahoo.co.id

Abstract. This study aims to determine the effectiveness of the implementation of fieldwork practices (FWP) at the Engineering Faculty (EF) of Unimed, by technological developments and facing RI 4.0. The effectiveness of the implementation FWP, in terms of the process FWP activities, is while students practice in the business and industrial world (BIW). The subjects of this study were EF Unimed students who consisted of several study programs at EF Unimed. Purposive sampling is done for students who have implemented FWP for each study program. The aspects examined in this paper include students' understanding of the world of work, competencies, student professional attitudes, and the role of lecturers and FWP supervisors. Data collection techniques were carried out using questionnaires and interviews. The data analysis technique was done descriptively. The results showed that after FWP, EF Unimed students experienced, namely: 1) increasing students' understanding of the world of work, 2) increasing professional skills of FWP students, 3) increasing awareness of EF Unimed student attitudes, and 4) the role of FWP supervisors and lecturers in assessing quite optimal in forming professional students. These results indicate that the implementation of street vendors at EF Unimed still needs attention to prepare graduates who are more competent in facing RI 4.0.

Keywords: vocational education, FWP, the world of work, competence.

1. Preliminary

Vocational education has a mission of preparing a generation that is ready to work and professionally. Based on Law of the National Education System, there are two levels of vocational education, namely senior vocational education and higher vocational education. One of the higher vocational education institutions in Medan is the Faculty of Engineering Unimed. The mission of vocational education is to produce human resources with certain competencies and the appropriate amount needed. Vocational education graduates are expected to have: (1) knowledge and skills according to their profession (2) social competence to carry out professional practice, (3) ability to work effectively, and (4) enthusiasm to continue learning to improve their professional skills and knowledge[1].

In order to prepare vocational education graduates who are ready to work, one of the compulsory courses in every study program at EF Unimed is the Fieldwork Practice (FWP). FWP aim at bridge the theoretical material obtained on the lecture bench with the practice carried out in the field. The purpose of the FWP is an effort to equip students of field experience
as a form of practical learning outside the classroom and laboratory. Through the implementation of FWP, students are expected to understand the ins and outs of problems in the field and be able to provide alternative solutions to solve them. Furthermore through FWP students have real experience with all types of work and obstacles in employment.

The reality that is often found in employment is that workers are fired because they are less skilled at work, lazy, careless, dishonest, lacking in discipline, and so on. FWP is given by students to anticipate that prospective graduates understand various problems in the workforce and anticipate dismissal at work. One of the goals of street vendors is to improve their skills according to their area of expertise so they become professional. A profession is a position or occupation that demands special expertise and ethics and service standards. Professional is the nature of something relating to the profession, appearance in carrying out the position in accordance with the demands of the profession or people who have the ability in accordance with the demands of the profession.

Implementation of FWP at EF Unimed, involved companies where the practice taken at business and industrial world (BIW). The implementation of FWP needs to be evaluated whether it is effective or not. This is done because street vendors are activities that aim to improve knowledge, skills, and attitudes. FWP assessment given by FWP field supervisors and FWP supervisors, but it has not been revealed about the achievement of competencies in terms of the perceptions of students who implement FWP. This assessment is important for students who will pursue their next career, for FWP supervisors to find out whether or not optimal in carrying out their role as supervisors. For institutions, it will be very important because it is used to take policies in the implementation of FWP that include the preparation stage on campus, and the implementation in FWP, supervisor of FWP.

Dika Ayu A and Ali Wafa (2016), found that the obstacles in the implementation of street vendors are: lack of supplies or orientation, administrative constraints, difficulty in finding agencies, and inaccurate reasons for choosing agencies[2]. Problems faced by students in the implementation of street vendors are there is no clear work schedule, the work is not as expected, the lack of the role of the supervisor. Problems after the implementation of street vendors are guidelines for the preparation of the final report are unclear, students do not prepare a synthesis of the problem, and no performance/competency test is carried out.

The main problem in this research is that FWP is very important to improve the quality of graduates, but the effectiveness of the implementation has never been seen which includes preparation and implementation. Besides, because FWP is a program that will always be implemented it is necessary to review the level of achievement. Through this paper, it will be revealed how the effectiveness of FWP implementation in EF Unimed is based on students' understanding of the world of work, skills and professional attitudes, the role of FWP supervisors in the field or the role of FWP supervisors.

Catur A and Bambang S (2016) stated that fieldwork activities are quality control of students, whether they have met the competencies required for employment, whether they have met the principle of linkage and accuracy (link and match) of their programs with industry[3].

To find out the effectiveness of FWP, it can be done through evaluation. Demands for evaluating are needed, especially in vocational education. So it is not only student activities that are evaluated but also the activities of educators and educational institutions. One important component in planning a program is to state in advance its objectives, both general goals and desired specific goals[4].

Effectiveness related to the achievement of objectives, in this case, the objectives expected by the implementation of FWP. FWP are said to be effective if they can achieve the goals set out in the curriculum. The purposes of FWP are: 1) to provide students with a real understanding
of the world of work, 2) improve student skills, 3) grow and increase awareness of professional attitudes of students as prospective professional workers, and 4) Carry out work assignments following their profession/field.

To achieve this goal is influenced by internal factors originating from students and external factors that exist outside of students. Factors originating from within students include intelligence, talents, interests, attitudes and so on. Factors originating from outside students are the support of street vendors, supervisors, supervisors in the field, employees in the street vendors, work environment, and fellow FWP[5].

Information about the world of work is an illustration that must be understood by FWP students in their fields. The world of work is a description of the form/type of work that workers do to produce a product. For FWP students, it is necessary to understand the world of work including (1) Types of jobs in their environment, (2) Types of jobs that graduates can enter according to their fields, (3) Benefits derived from each job, (4) Knowledge, skills, and skills needed for each job, (5) Conditions and future in an occupation, and (6) Specific requirements for an occupation.

Students who carry out street vendors understand better the work, so they have more adequate information about the work environment. Students who have information about the world of work will be able to make more appropriate choices in choosing the type of work. When students implement street vendors interact a lot of students with employees to obtain information about the types and various motivations of people working. Thus students will have knowledge and understanding of the world of work. This fosters students' professional attitudes in search of knowledge and work attitudes.

Professional is the appearance of workers in carrying out something following the demands of the profession/job. Students who carry out FWP will have the ability following the demands of the profession according to their fields. Student professional competence shows mastery of knowledge, attitudes, and skills that are in accordance with what is needed in the workforce. Personal competence/personality is the most important factor in the personal formation of a student being a professional. Personal competence needs attention because it requires a relatively long time to form these personal competencies.

Skills are a follow-up of understanding and attitude. To improve skills in their fields, students need to be given the material in the form of self-understanding, values, environmental understanding, and future planning. Some characteristics of skilled students include: 1) immediately carry out the work, 2) carry out the work carefully, 3) polite and friendly with other parties, 4) always looking for work-related information, and 5) self-training. In general student, skills will improve if allowed to practice. FWP will be said to be successful if students experience an increase in understanding of the world of work, skills, and awareness of professional attitudes[6].

2. Research Method

This research was conducted at FT Unimed and the BIW. This research was conducted in May - October 2019. This type of research is including evaluative descriptive research[7]. The data to be obtained in this study are in the form of qualitative and quantitative data. Qualitative data in the form of information about the understanding of the world of work according to their fields, skills or competencies obtained students' professional attitude in practice, the role of lecturers and FWP supervisors in shaping students in the implementation of street vendors.
Quantitative data in the form of descriptive information is about the administration system and assessment of students’ competencies in the implementation of street vendors.

The subjects and sources of data in this study were FWP, lecturers, and street vendors. To obtain data from research subjects, data collection tools such as questionnaires and interview sheets were used. Interviews were conducted with lecturers and PKL supervisors while questionnaires were given to students. The data analysis model in this study follows the concept given[8] by Lodico, Spaulding, & Voegtle. Based on the data analysis model, this research uses the following stages of data analysis: 1) organizing the data and examining the data carefully, 2) re-checking the data, 3) carrying out further data processing. Researchers describe, summarize, and organize coding that contains categories that are more specific and differentiated from other categories, 4) conduct a final analysis, make interpretations and conclusions containing the results of research findings.

3. Results and Discussion

The source of data in this study is students who carry out street vendors in every study program at FT Unimed. Student data obtained as many as 55 people from 6 study programs with the proportions as presented in the following figure.

Data obtained from instruments filled in by students about EF Unimed students’ understanding of the world of work as shown in Figure 2. Based on the questions presented about the understanding of the world of work after FWP, the lowest average score occurred in the Fashion Design study program and the highest occurred in the study program Building Engineering Education. But overall the average score of students' understanding of the world of work after FWP at EF Unimed was 3.24. This shows that the implementation of street vendors conducted in various businesses and industrial world brings increased understanding for EF Unimed students about the world of work that will be entered after the completion of street vendors. But quantitatively, it is still necessary to increase the understanding of FWP students about the real world of work through FWP. This can be done through locations and fields where street vendors are more tailored to the fields of each study program.
If further observed aspects of student understanding of the world of work that still need to be improved are: 1) Information about work following their fields, 2) Information on future work, and 3) Work skills that must be possessed by students. These three aspects still need to be improved so that in choosing the type of work that will carry more choices. Several alternatives can improve students’ understanding of the world of work, for example by organizing career guidance, so students can understand the types of jobs that exist in the community and the types of work entered after graduation. Besides, it can also increase the frequency of meeting practitioners so they can inform matters relating to the world of work information and skills that students must possess before entering the workforce.

Based on data from students about the skills possessed after implementing street vendors are presented in the following Table 1.

<table>
<thead>
<tr>
<th>No</th>
<th>Prodi</th>
<th>Total Score</th>
<th>Average Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PTB</td>
<td>263</td>
<td>3.13</td>
</tr>
<tr>
<td>2</td>
<td>PTE</td>
<td>186</td>
<td>2.95</td>
</tr>
<tr>
<td>3</td>
<td>PTM</td>
<td>160</td>
<td>3.27</td>
</tr>
<tr>
<td>4</td>
<td>PTO</td>
<td>175</td>
<td>3.13</td>
</tr>
<tr>
<td>5</td>
<td>T Boga</td>
<td>213</td>
<td>3.04</td>
</tr>
<tr>
<td>6</td>
<td>T Busana</td>
<td>202</td>
<td>3.21</td>
</tr>
<tr>
<td>7</td>
<td>FT Unimed</td>
<td>1199</td>
<td>3.11</td>
</tr>
</tbody>
</table>

Table 1 shows that the average score of skills possessed by students after FWP based on the type of work performed or observed, EF Unimed students obtained a score of 3.11. The results showed that EF Unimed students had skills after implementing FWP. When reviewed for each study program at EF Unimed, the highest score of skills after FWP namely Mechanical Engineering Education study program and the lowest average score is stated by the Electrical Engineering Education study program.

Skills scores that already show high scores occur in aspects of 1) consulting others who know better, 2) Finding information about the world of work, 3) trying to improve skills. While skills scores that need attention occur in aspects of 1) Achieve results by standards and 2)
Achieve quality following standards. This can be done through creative activities and problem solving with various cases according to their respective fields. This is done so students have the skills before graduating.

The results showed that the professional attitude of FWP students at EF Unimed had not shown good results. Based on Table 2, shows that FWP students of the Automotive Engineering Study Program have the highest average professional scores with a score of 3.19. The lowest average score obtained by student of Building Engineering Education with score of 2.78. In general, EF Unimed students have a professional attitude with a score of 2.94. This shows that the professional attitude of EF Unimed students still needs to get good attention so that EF graduate students can easily work through professional attitude.

Table 2. The Average Professional Attitudes Scores of FWP Students by Study Program

<table>
<thead>
<tr>
<th>No</th>
<th>Prodi</th>
<th>Jumlah Resp</th>
<th>Jumlah Skor</th>
<th>Rerata Skor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PTB</td>
<td>12</td>
<td>200</td>
<td>2.78</td>
</tr>
<tr>
<td>2</td>
<td>PTE</td>
<td>9</td>
<td>151</td>
<td>2.80</td>
</tr>
<tr>
<td>3</td>
<td>PTM</td>
<td>7</td>
<td>129</td>
<td>3.07</td>
</tr>
<tr>
<td>4</td>
<td>PTO</td>
<td>8</td>
<td>153</td>
<td>3.19</td>
</tr>
<tr>
<td>5</td>
<td>T Boga</td>
<td>10</td>
<td>180</td>
<td>3.00</td>
</tr>
<tr>
<td>6</td>
<td>T Busana</td>
<td>9</td>
<td>158</td>
<td>2.93</td>
</tr>
<tr>
<td>7</td>
<td>FT Unimed</td>
<td>55</td>
<td>971</td>
<td>2.94</td>
</tr>
</tbody>
</table>

Qualitatively, EF Unimed students after joining FWP stated that awareness about professional attitudes tended to increase. This is a result of students having experienced conditions and conditions of employment. Based on the results of the analysis shows that professional attitudes that still need to be improved for EF Unimed students, namely: 1) Difficulties to explore the fields of study related to the profession, and 2) attitude of devotion. One effort that can be used to improve this attitude is through cooperation with career guidance. So in learning on campus, it is necessary to develop cooperation between students and provide career guidance according to their respective fields.

In the implementation of street vendors conducted by EF Unimed students, it shows that the role of field supervisors and report supervisors has not yet maximally contributed to improving students' competencies and attitudes. Quantitatively, the average score of the role of supervisors and lecturers of FWP students in each study program is presented in Figure 3.
The implementation of the FWP guidance process at EF Unimed has not taken place maximally. From the data in Figure 3, the average score of the guidance process by FWP supervisors and lecturers is at the BEE study program with a score of 2.94 and the highest is on the Fashion study program with a score of 3.67. When seen the average process of guiding the implementation of FWP conducted field supervisors and lecturers FWP at EF Unimed with a score of 3.32. The aspects measured in the process of mentoring FWP include: 1) compilation of activity schedules, 2) compiling a description of the task or focus of the report, 3) the process of writing report guidance, 4) monitoring / reviewing the implementation of FWP in the world of work, 5) checking and writing daily notes in the FWP process, and 6) the process of assigning FWP values.

From the aspect of FWP guidance, the maximum score occurs in the process of giving FWP scores. Grading of FWP has a standardized format consisting of evaluation of reports and assessment of mastery implementation of FWP. Components assessed in FWP reports include title and theory, report content, systematic writing, and FWP administration. While the display component (mastery) assessed includes: presentation (presentation material), mastery of the contents of the report and attitude in the exam. For other aspects of FWP guidance, they still need improvement and improvement. If this guidance aspect is not heeded, it is possible to achieve the goals of street vendors less than the maximum. While the improvement process carried out by the supervisors before the implementation of FWP is on aspects of: 1) briefing before FWP, 2) submission of students to the FWP, 3) coming to the field and guiding when field, 4) withdrawal of FWP students, and 5) field supervisors participate in guiding FWP reports.

From various aspects carried out in the implementation of FWP, the role of a supervisor is very large to achieve the goals of FWP. Various reasons have resulted in the supervisor not playing an optimal role in the guidance of FWP, namely: busyness on campus, the implementation of FWP outside the city, the time of submission and withdrawal of FWPs students together with other activities. From the results of the study, it shows that the implementation of FWP at EF Unimed can improve: 1) Student awareness of the world of work in the form of an overall understanding of the world of work and its benefits, as well as their meaning for life. 2) Self-awareness of personal needs, strengths and weaknesses, and other potential. 3) Appreciation and attitude, in the form of a value system towards work and how it plays a role. This appreciation and attitude are developed through education that will result in self and social satisfaction. This self and social satisfaction occur as a result of the internalization of values and the role of work that can simultaneously lead to activities and satisfaction in working in the community. 4) Decision-making ability, towards the decision-making, including covering alternative identification, choosing alternatives and implementing alternatives. 5) Awareness of work skills and initial competence, in the form of cognitive skills required in identifying the objectives of a task, task procedures, carrying out tasks and conducting evaluations, 6) Work skills are various forms of skills required to be able to directly perform various tasks appropriately, and 7) education awareness, a form of introduction from students about the meaning of the development of basic skills and mastery of knowledge in achieving goals through education.
4. Conclusion

Based on the results and discussion in this research, several conclusions can be drawn as follows: 1) students' understanding of the world of work after implementing FWP is quite good. Students who carry out street vendors stated that FWP greatly enhance understanding of the world of work, 2) Student skills improved by following FWP, skills gained in the field of employment when FWP in accordance with their respective fields, 3) Increased student professional attitude after implementing FWP, professional attitudes this includes discipline, collaboration, and creative in solving problems in work, 4) FWP advisors in the field show a positive role in improving students' professional skills, because most FWP supervisors in the field guide the preparation of FWP activity schedules, guide student activities during FWP, oversee implementation FWP, and check the daily FWP records of students.

5. References

The Effectiveness of The Use of Statistics Textbooks in Improving The Statistical Reasoning of Building Engineering Education Students

Zulkifli Matondang¹, Enny Keristiana Sinaga², Harun Sitompul³

¹,²,³Universitas Negeri Medan, Medan, Indonesia
zulkiflimato@gmail.com

Abstract. The research aims to develop statistics textbooks and measure their effectiveness in improving the statistical reasoning abilities of students in building engineering education. This study is based on the results of learning statistics courses that are still low. In general, studying statistical material requires the ability to reason in solving problems in the context of everyday life. To help understanding concepts, statistics textbooks need to be developed with SPSS software-assisted analysis that can be used in learning. This research was conducted on students majoring in PTB FT Unimed. This type of research is research and development. This research procedure was modified from the 4-D learning device development model which consisted of 4 stages namely define, design, develop, and disseminate. Data analysis was performed covering the validity, practicality, and effectiveness of the textbooks that were developed. The results showed that: 1) expert validation on the feasibility of statistics textbooks obtained very good categories with details of material experts with an average score of 79.29, media experts with an average score of 85.33 and linguists with an average score 77.78, 2) lecturers' responses about the practicality of statistics textbooks were obtained in a very practical category with an average score of 85.37 and 3) the use of statistics textbooks was quite effective in increasing student reasoning with a count of 11.44 and significance 0.00. Based on the data analysis and effectiveness test, it can be concluded that the developed statistical textbook can improve students' reasoning abilities.

Keywords: development, textbooks, reasoning ability, effectiveness.

1. Introduction

One of the compulsory courses in the Building Engineering Education Study Program (BEE) of the Faculty of Engineering, State University of Medan (FT Unimed) is a statistics course. Statistics courses are prerequisite courses before preparing the final project/thesis. Competence of statistics courses is the mastery of statistical concepts in research, presentation of research data, data processing, test requirements analysis and test hypotheses of the research. Statistics courses equip students to be able to dig up information and process quantitative and qualitative research data. Statistics are specifically used to describe and predict phenomena that occur based on data collection results from measurements [1]. For that, we need a statistical ability to be able to interpret, understand, and make good decisions based on data obtained from research. To be able to use statistics optimally, statistical capabilities are needed, namely in understanding statistical concepts, graphical representations, and interpretation of data and opportunities [2]. This is in line with the opinion that said that the purpose of statistical learning is that students understand statistics well so that they can get information from existing data,
criticize and make decisions based on that information and aim to develop research skills. One of the statistical abilities is statistical reasoning [3].

Statistical reasoning (statistical reasoning) is a way of thinking statistics in producing statistical information [4]. This includes the ability to interpret a set of data, graphics and some statistical information. The ability of statistical reasoning is the ability to understand information in daily life based on data or ideas, which means the ability to understand how to choose, present, reduce, and present data used in existing problems [5]. Therefore, students' statistical reasoning abilities need to be trained in statistical lectures.

Based on the observations and experiences of the authors of statistical learning activities in the FT Unimed BEE study program, it was found that the statistical learning outcomes of the 2018/2019 academic year students from 60 people obtained an A grade of 9 people (15%), a B grade of 23 people (38.33%), and a C grade of 28 people (46.67%). This shows that there are still many students who get a C value. Students who get a C grade have reasoning abilities that need to be developed or improved.

In the learning process of statistics courses, BEE study program students are active in analyzing the material being studied. Some students have difficulty in interpreting the data from the research analysis. For example, students have difficulty in recognizing and classifying types of research data, resulting in errors in data processing. Another difficulty is that the students are confused and are not even able to interpret the results of research data processing, so it is difficult to conclude.

Based on the results of the analysis of student difficulties in learning statistics, it is necessary to assist with the preparation of teaching materials. Students will understand the material well if students learn the material independently. One alternative is the use of teaching books (lecture notes) that can be developed to direct the student's mindset and build student independence. Textbooks are intended as completeness of the learning process with a limited scope of curriculum and syllabus characteristics. Textbooks contain information, discussion, and evaluation. The role of the lecturer as a facilitator can be maximized. Textbooks are one of the suggestions for the success of the teaching and learning process [6].

Then to improve the ability of statistical reasoning students in statistical learning can use SPSS software. Fey and Heid [7] explained that the use of computer software for learning activities is very unlimited. Through the use of SPSS software students can apply the concepts provided in data processing by using computer media to solve real problems. Computers as learning media can empower lecturers and students because by using computers, students can learn a textbook in new, more interactive ways. Every student can study textbooks in different ways and whenever they will, not only when there are lecturers. This is in line with the opinion of Hannafin & Peck [8] the potential of computer media that can streamline the learning process, among others: (1) Enabling direct interaction between students and subject matter; (2) The learning process can take place individually according to students' learning abilities; (3) Able to display audio-visual elements to increase learning interest (multimedia); (4) Can provide feedback on student responses immediately; (5) Being able to create a continuous learning process. For this reason, this research was conducted to develop statistical textbooks assisted by SPSS software in statistics courses at the BEE FT Unimed study program.

Based on the description above, the formulation of the problems in this paper are: 1) What is the process of developing statistics textbooks assisted by SPSS software; 2) How is the quality of textbooks developed based on validity and practicality; and 3) how the effectiveness of statistics textbooks in improving the reasoning ability of BEE FT Unimed study program students.
Statistics Textbooks

Textbooks are student handbooks in a course written and arranged by an expert/person according to their field. Textbooks are arranged according to the rules of the textbook and are officially published and distributed. Important elements in textbooks are: (1) is a textbook that is shown to students/students, (2) always associated with certain subjects/subjects, (3) book that conforms to the standard, (4) is written for certain instructional purposes, and (5) is written to support a particular learning activity. So textbooks are a collection of materials arranged according to standards or competencies intended for students to support learning activities in certain subjects.

Statistics are a collection of material that aims to obtain data, process data, draw conclusions, and make decisions based on the analysis of data collected. Statistics are scientific ways to collect, organize, present, and analyze data, and draw valid conclusions and make appropriate decisions based on the analysis conducted. Thus statistics are a method or way to collect, present, analyze data, and draw conclusions and make decisions based on analyzes conducted by scientific steps or procedures.

So a statistical textbook is a book or collection of material that is a guide for students to follow lessons that contain data collection, presentation and analysis, and can draw conclusions and make decisions based on these data.

To be able to draw conclusions and make decisions based on the analyzed data is reasoning ability. Reasoning ability is the ability to analyze research data and make conclusions by the facts in the field. Chervaney, Benson, and Iyer [2] define statistical reasoning as a way of working with statistical content (remembering, acknowledging, and distinguishing between statistical concepts) and the skill of using statistical concepts in specific problem-solving stages. Statistical reasoning is the ability to draw conclusions and provide an explanation based on data orientation by paying attention to structured procedures, unstructured procedures, and statistical concepts as well as providing critical comments on a statistical process or outcome. Statistical reasoning has five levels, namely: 1) Idiosyncratic Reasoning, 2) Verbal Reasoning, 3) Transitional Reasoning, 4) Procedural Reasoning, and 5) Integrated Process Reasoning. In learning statistics courses, the ability of the five levels is needed to make conclusions that are right and right. Reasoning ability is very needed in statistics, moreover, data analysis uses SPSS software [2].

Development of Statistics Textbooks

Textbooks were developed in the form of print media equipped with SPSS applications. The SPSS application in textbooks is presented to facilitate students in calculating and analyzing data according to the problem at hand. The use of SPSS-assisted statistics textbooks helps students improve their ability to reason inferring problems in statistics.

Textbooks are learning tools that can be developed with several models by the objectives. One model of development of learning tools or textbooks is the 4-D model (Define, Design, Develop and Disseminate). The development model of learning tools in the form of textbooks with 4-D was developed by S.Thiagarajan, Dorothy S.Semmel, and Melvyn I. Semmel. Broadly speaking, the four stages are presented in Table 1 below:
Table 1 Stages of the 4-D Device Development Model [9]

<table>
<thead>
<tr>
<th>Stages</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Define</strong></td>
<td>Define learning requirements. This stage begins with an analysis of the objectives of the boundaries of the material developed by the textbook, which includes several main steps, namely: (a) front end analysis, (b) student analysis, (c) task analysis, (d) concept analysis, and (e) formulation of learning objectives.</td>
</tr>
<tr>
<td><strong>Design</strong></td>
<td>Design Preparing a prototype of learning devices, namely the preparation of benchmark reference tests, the selection of media according to the objectives, to convey subject matter, and the selection of formats.</td>
</tr>
<tr>
<td><strong>Develop</strong></td>
<td>Develop produces learning tools that have been revised based on expert input.</td>
</tr>
<tr>
<td><strong>Disseminate</strong></td>
<td>The use of tools that have been developed on a broader scale, for example in other classes, in other study programs, by other lecturers. Another aim is to test the effectiveness of the use of devices in teaching and learning activities.</td>
</tr>
</tbody>
</table>

**Use of Textbooks in Improving Reasoning Capabilities**

Statistics textbooks are a collection of statistical materials that are developed based on competency courses and become a student handbook in participating in learning. The textbooks are presented systematically and interesting so that students easily understand them. With the textbook, students can learn and repeat the material that has been presented in lectures. With the use of textbooks, each student will try to understand each material and if necessary do the assignments or questions contained in the button. With the use of textbooks, aka can learn independently according to the willingness and availability of time they have. The use of textbooks will be able to improve the ability or competence of students according to the contents of the book. So the use of textbooks will be able to improve students’ reasoning abilities in studying statistical subjects.

**2. Research Method**

The study was conducted on BEE FT Unimed study program students who took statistics courses in odd semester 2019/2020 Academic Year. The study was conducted in the BEE study program lecture room during the lecture.

The procedure for developing a statistical textbook is based on the 4-D learning device development model developed by S. Thiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel, which consists of 4 stages: define, design, develop, and disseminate [9]. In this study three stages were carried out, namely define, design and develop. The procedures for developing a statistical textbook are presented in Figure 1 below.
Fig 1. Research Implementation Procedure
To collect data in this study, several instruments were used in the form of assessment sheets to assess the validity of content and the paternity test as well as a test of statistical reasoning ability to test the effectiveness of the textbooks compiled. Data obtained from experts (material, media, and language) and practicality data (from lecturers) are used to revise textbooks that are developed to obtain appropriate textbooks according to criteria. The validity and practicality criteria for the textbooks developed were based on the following table.

### Table 2. Conversion of Quantitative Data into Qualitative Data with 5 Criteria

<table>
<thead>
<tr>
<th>Quantitative Score Range</th>
<th>Qualitative Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\bar{x} &gt; \bar{x}_l + 1.8Sb$</td>
<td>Very good</td>
</tr>
<tr>
<td>$\bar{x}_l + 0.6Sb &lt; \bar{x} \leq \bar{x}_l + 1.8Sb$</td>
<td>Well</td>
</tr>
<tr>
<td>$\bar{x}_l - 0.6Sb &lt; \bar{x} \leq \bar{x}_l + 0.6Sb$</td>
<td>Pretty good</td>
</tr>
<tr>
<td>$\bar{x} &lt; \bar{x}_l - 1.8Sb$</td>
<td>Not good</td>
</tr>
<tr>
<td>$\bar{x} \leq \bar{x}_l - 1.8Sb$</td>
<td>Very Poor</td>
</tr>
</tbody>
</table>

Adopted from Widoyoko (2009)

The result shows the effectiveness of using pretest and posttest data from the ability to understand statistical concepts with the use of textbooks. According to Matondang [10] to test the effectiveness of textbooks can be done using the paired t-test 95% significance level.

### 3. Results and Discussion

The research process starts with the development of statistics textbooks with a 4-D approach (define, design, develop, and disseminate). In this study carried out until the third stage of development. In the initial stage, a needs analysis is conducted on the development of textbooks, furthermore, the preparation of material and assignments is carried out to improve students’ understanding of reasoning. The concepts and description of the material and other components are further developed in developing the textbook. All materials compiled are designed systematically to produce a draft of a textbook. Furthermore, expert validation and practicality of the use of the textbooks were carried out.

Based on the results of the validation by the material expert on the appropriateness of the contents of the material presented in the statistical textbooks are presented in Table 3.

### Table 3. Expert Material Validation Results About the Feasibility of Book Content

<table>
<thead>
<tr>
<th>No</th>
<th>Assessment Aspects</th>
<th>Average Score (0-100)</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The suitability of the material with the learning objectives</td>
<td>4.17</td>
<td>83.33</td>
</tr>
<tr>
<td>2</td>
<td>Material Accuracy</td>
<td>4.14</td>
<td>82.86</td>
</tr>
<tr>
<td>3</td>
<td>Material updates</td>
<td>3.58</td>
<td>71.67</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>3.96</td>
<td>79.29</td>
</tr>
</tbody>
</table>

Table 3, shows that the teaching scores arranged in a straight line have an average score of 3.96 with a value of 79.29 and are categorized as valid. When viewed from every aspect judged by material experts, the highest average score is given in the aspect of suitability of the material with the achievement of learning subjects with a score of 4.17. The lowest average score is focused on aspects of material expertise with a score of 3.58. This shows that the expertise of the material presented in the statistics textbook needs to be improved.
Figure 2 shows the results of the validation of the media/book expert on the statistics textbook display made. Overall the textbooks arranged have a valid category. Based on the appearance of the book, the aspect of presenting learning has the highest average score of 4.67, while the lowest average score is on the completeness aspect of the score presentation of 3.73. This shows that some aspects that must be in the textbooks must be added again so that the statistics textbooks are better.

The results of the validation of linguists on the presentation of the contents of the developed statistical textbooks are presented in Table 4.

Table 4. Results of Language Expert Validation of Book Content

<table>
<thead>
<tr>
<th>No</th>
<th>Assessment Aspects</th>
<th>Average</th>
<th>Score (0-100)</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Straightforward</td>
<td>4.00</td>
<td>80.00</td>
<td>Valid</td>
</tr>
<tr>
<td>2</td>
<td>Communicative</td>
<td>4.00</td>
<td>80.00</td>
<td>Valid</td>
</tr>
<tr>
<td>3</td>
<td>Dialogical and Instructive</td>
<td>3.83</td>
<td>76.67</td>
<td>Valid</td>
</tr>
<tr>
<td>4</td>
<td>Compliance with the level of student development</td>
<td>3.83</td>
<td>76.67</td>
<td>Valid</td>
</tr>
<tr>
<td>5</td>
<td>Corruption and Alignment of the mind path</td>
<td>3.67</td>
<td>73.33</td>
<td>Valid</td>
</tr>
<tr>
<td>6</td>
<td>Use of the terms symbols and icons</td>
<td>3.89</td>
<td>77.78</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>3.87</td>
<td>77.41</td>
<td>Valid</td>
</tr>
</tbody>
</table>

Table 4, shows that the overall teaching scores compiled when viewed from the language used have an average score of 3.89 with a value of 77.78 and are considered valid. When viewed from each aspect judged by experts, the highest average score was obtained in the aspects of miscarriage, communicative and dialogic and instructive with a score of 4.00. The lowest average score is found in the aspect of using symbols and icons with a score of 3.67. This shows that the language used in writing statistical textbooks needs improvement. Overall, there are still languages that are used in textbooks with long sentences and use vocabulary that has a double meaning. This is a concern for the improvement or revision of the textbook.

Based on input from the material, media and language experts, the statistical textbooks were improved. Furthermore, before the book is used, first the opinions of the statistical lecturers are asked to assess the practicality of the textbook. From 5 statistics teachers gave responses to the textbooks with a summary of the results of the validation as in the following picture.
Figure 3 shows that in general statistics textbooks are quite practical in learning. Based on the scores given by the lecturers, the aspect of textbook functioning in learning has the highest average score of 4.44 while the lowest average score is found in the aspect of the textbook display with a score of 4.08. This shows that the textbooks that are prepared are quite practical to be used in learning activities for students.

Furthermore, to determine the effectiveness of the use of statistical textbooks in learning is measured based on student reasoning in attending statistics courses. To measure reasoning ability, using a test that amounted to 25 questions. In general, the question items are arranged to be able to measure the reasoning ability with statistical material, especially in presenting data and calculating the size of data concentration. The test is conducted on students before and after using the textbooks that are prepared. The mean pretest and posttest results of 29 students who took statistics courses are presented in Table 5 below.

**Table 5. Average Test Results of Students Reasoning Capabilities**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>N</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>97.1345</td>
<td>26</td>
<td>5.51047</td>
<td>1.02327</td>
</tr>
<tr>
<td>Pair 1</td>
<td>71.6324</td>
<td>26</td>
<td>12.09627</td>
<td>2.24622</td>
</tr>
</tbody>
</table>

Table 5 shows that there are differences in students' reasoning abilities before and after using statistical textbooks. The average pretest score of students is 71.63 with a standard deviation of 2.25. While the average posttest score of students was 97.13 with a standard deviation of 1.02. This shows that there is an average difference in students' reasoning abilities after using statistics textbooks.

To test the difference in the average reasoning ability of students with the use of statistical textbooks in learning is done by paired t-test. The average difference test results using SPSS software, obtained results as presented in Table 6 below.
Table 6. Results of Textbook Effectiveness Tests with SPSS

<table>
<thead>
<tr>
<th>Paired Samples Test</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td>Pair 1: Pretest - Posttest</td>
<td>35.0207</td>
</tr>
</tbody>
</table>

The calculation results show that the calculated value of t is 11.44 with a significance of 0.000. The results indicate that the average difference in students' reasoning abilities is quite significant with the use of statistical textbooks provided in learning. So it can be argued that statistics textbooks given in learning are effective for improving students' reasoning abilities in statistics courses.

4. Conclusion

The results of the study can be concluded that: 1) the process carried out in compiling statistical textbooks that starts the process of definition, design and developing, 2) the feasibility level of the developed textbooks is categorized well, with the results of expert validation test on the feasibility of statistical textbooks obtained on average an average score of 79.29, media experts with an average score of 85.33 and linguists with an average score of 77.78. Lecturer responses about the practicality of statistics textbooks were obtained in a very practical category with an average score of 85.37 and 3) the use of statistics textbooks was quite effective in improving student reasoning with at count of 11.44 and significance 0.00.

5. Acknowledgements

Thanks to the Department of Building Engineering, at the Medan State University for competitiveness research at the faculty level (KDBK) in 2019.

6. References


Need Assessment of Video Learning Media as The Supporting Media for Nutrients Analysis Practice

Esi Emilia¹, Rasita Purba¹, Iis Siti Jahro², Risti Rosmiati¹
{esi.emilia@gmail.com¹, rasita_purba@yahoo.com, jahroist@gmail.com², ristirosmiati@unimed.ac.id}

Department of Family Welfare Education, Universitas Negeri Medan, Medan, Indonesia¹, Department of Chemistry, Universitas Negeri Medan, Indonesia²

Abstract. Nutrition Study Program of Universitas Negeri Medan, as a newly formed study program, still has limited laboratory facilities for Nutrient Analysis Course, especially expensive instruments. The video containing the nutrition analysis process can be used as a learning media. The objective of the study was to assess the needs for a video as supporting learning media for nutrients analysis practice. The study used the research and development (R&D) method and Four-D model (define, design, develop, and disseminate). This study only presents the results of the need assessment for the define stage. Needs assessment of video learning media as a define stage results showed that an alternative teaching material was needed to complete the textbook and other learning media. Video learning media that feature contextual problems are excellent alternative teaching materials used. Therefore, the students can repeat the material independently.

Keywords: Learning media, nutrients analysis, teaching materials, video.

1. Introduction

Nutrition Study Program of Universitas Negeri Medan (Unimed) as a newly formed study program still has limited laboratory facilities for Nutrient Analysis Course, especially expensive instruments. Meanwhile, it has much interest from prospective students. Therefore, Unimed always tries to optimize the available facilities to provide the best service for students. The method used to support practice activities by presenting the nutrition analysis process in video learning media.

In the last few decades, the use of instructional videos in education has increased massively. They are considered to be the most popular ways of conveying instruction. Students from all education levels watch instructional videos such as brief knowledge clips, web lectures, and video demonstrations for informal learning purposes on websites such as YouTube and Vimeo [1][2]. Instructional videos are also increasingly used in formal learning environments. For example, instructional videos are often used both in conventional learning and blended learning (conventional and online learning) as well as the main tools of presenting information in massive online open courses (MOOCs), flipped classrooms [3], and Google Classroom. Research on the effectiveness of video as a learning media has been carried out since the 1960s with the main focus on video modeling examples to investigate the extent to which model behavior and characteristics influence learning and self-efficacy [4]. The use of instructional video is increasing with the development of better computer technology and new tools for
recording and playing videos. Since then, the popularity of instructional videos, including instructional animation in education, has grown rapidly. Rapid technological advances in hardware (such as computers, video cameras, smartphones) and software (such as video recording and video editing applications) and increased access to fast Internet, allowing learning videos to be made relatively easily and at a low cost, and shared with others on online learning environment with minimal effort [5]. So far, most teaching videos are still based on the intuition of the writer or designer instead of relying on documented principles that originate from scientific research [6] or theoretical considerations from instructional design theories, such as Cognitive Load Theory [7] and Cognitive Theory of Multimedia Learning [8], as well as observational learning theories such as Social Learning Theory and basic cognitive processing theories such as the theory of embodied cognition [9]. More research is needed to design learning videos based on scientific research. Therefore, the study was to assess the needs for a video as supporting learning media for nutrients analysis practice.

2. Research Method

The study used the research and development (R&D) method and Four-D model (define, design, develop, and disseminate). The define stage is focused on the need assessment, while the next stage is focused on development and implementation. This study only presents the results of the need assessment. It is conducting a needs analysis to determine problems and solutions that are appropriate to improve student competence in nutrition analysis courses. Data collection methods are interview by questionnaire. The research instrument was a questionnaire consisting of 10 statements in which students answered each statement by Likert scale of Strongly Disagree, Disagree, Undecided, Agree, and Strongly Agree. The subjects were third and 5th-semester students who had taken nutrition analysis courses, a total of 80 subjects. Data analysis was performed with how to calculate the percentage of student answers on each item and describe it.

3. Results and discussion

The define stage is carried out to assess the potential problems and the needs for developing nutrient analysis teaching materials. It is done through observation of the ongoing nutrient analysis learning activities, standard analysis of curriculum content used in the KKN (Kerangka Kualifikasi Nasional Indonesia) orientation, and analysis of nutrient analysis learning media needs. Nutrients analysis courses are divided into two semesters based on nutrient type, namely macronutrient and micronutrient analysis courses as much as two credits per semester (1 credit is theory and another is a practice).

Nutrients analysis learning activities in the Nutrition Study Program of Unimed, which are currently taking place, still have more theories compared to practice. The material practiced is about 20% of the total material. It is due to the limited facilities and infrastructure of the nutrient analysis laboratory. The rest of the practice material is carried out with the help of practical manuals and videos containing the stages of nutrient analysis. However, nutrient analysis videos available online are mostly in English or other foreign languages, and some content is not following the learning outcomes of the courses that have been prepared.
The next stage is the analysis of curriculum content standards to determine the framework of the development of video learning media that are tailored to the learning outcomes of graduates that must be achieved by students according to the KKNI levels (level 6). The preparation of learning outcomes of Nutrients Analysis Course refers to the curriculum of nutrition undergraduate programs compiled by AIPGI (Association of Indonesian Nutrition Higher Education Institutions) through Decree Number 003/SK/AIPGI/V/2016 concerning the Determination of Nutrition Undergraduate Curriculum and National Higher Education Standards (SN Dikti) through Republic of Indonesia Minister of Research and Technology Regulation No. 44 of 2015 and Amendment to Ministry of Research and Technology Republic of Indonesia Number 50 of 2018.

Course Learning Outcomes (CPMK) of Nutrient Analysis Course is the student who can analyze the content of carbohydrates, fats, proteins, ash, water, vitamins, minerals, phytochemicals, and food additives in the food according to their characteristics. To achieve its goal, the course discusses the structure and chemical properties of various macro and micronutrients in food. It includes the basic principles of chemical analysis of macronutrients such as carbohydrate, fat, protein, ashes and water analysis as well as micronutrient analysis that including vitamins, minerals, and other chemical components such as phytochemicals, nutritional components, and food additives.

The video learning media for nutrients analysis course is designed to complement practice activities. It was a supporting media for material that cannot be implemented directly in the laboratory. A needs assessment can be a reference in developing video learning media for nutrients analysis following the needs and characteristics of students. This stage aims to analyze what components are contained in the video learning media and to find out the weaknesses and strengths of the textbooks used in nutrient analysis material. The statement items in this study were compiled to obtain a description of the need for teaching materials for nutrient analysis video presented in Table 1.

<table>
<thead>
<tr>
<th>No</th>
<th>Statements</th>
<th>Strongly agree (%)</th>
<th>Agree (%)</th>
<th>Undecided (%)</th>
<th>Disagree (%)</th>
<th>Strongly disagree (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nutrients analysis courses are important subjects</td>
<td>37.50</td>
<td>61.25</td>
<td>1.25</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>2</td>
<td>Nutrients analysis courses are difficult subjects</td>
<td>2.50</td>
<td>5.00</td>
<td>37.50</td>
<td>48.75</td>
<td>6.25</td>
</tr>
<tr>
<td>3</td>
<td>Nutrients analysis courses can be studied using books / teaching modules only</td>
<td>0.00</td>
<td>0.00</td>
<td>2.50</td>
<td>62.50</td>
<td>35.00</td>
</tr>
<tr>
<td>4</td>
<td>Learning activities of nutrients analysis courses requires a practicum</td>
<td>47.50</td>
<td>45.00</td>
<td>7.50</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>5</td>
<td>Learning activities of nutrients analysis courses should use technology</td>
<td>15.00</td>
<td>42.50</td>
<td>38.75</td>
<td>3.75</td>
<td>0.00</td>
</tr>
<tr>
<td>6</td>
<td>Learning activities of nutrients analysis courses using videos learning media is more interesting than other learning media</td>
<td>65.00</td>
<td>28.80</td>
<td>6.25</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>No</td>
<td>Statements</td>
<td>Strongly agree (%)</td>
<td>Agree (%)</td>
<td>Undecided (%)</td>
<td>Disagree (%)</td>
<td>Strongly disagree (%)</td>
</tr>
<tr>
<td>----</td>
<td>---------------------------------------------------------------------------</td>
<td>--------------------</td>
<td>----------</td>
<td>---------------</td>
<td>--------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>7</td>
<td>Another learning resource that can be used by students is the internet</td>
<td>30.00</td>
<td>41.30</td>
<td>25.00</td>
<td>3.75</td>
<td>0.00</td>
</tr>
<tr>
<td>8</td>
<td>Video learning media should present a contextual problem</td>
<td>17.50</td>
<td>58.80</td>
<td>23.75</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>9</td>
<td>Video learning media display should focus on the material to be conveyed rather than highlighting the tutor</td>
<td>61.25</td>
<td>38.80</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>10</td>
<td>Video learning media are an effective learning resource</td>
<td>55.00</td>
<td>42.50</td>
<td>2.50</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>11</td>
<td>Video learning media should be accessible via the internet</td>
<td>15.00</td>
<td>46.30</td>
<td>26.25</td>
<td>6.25</td>
<td>6.25</td>
</tr>
</tbody>
</table>

In the first statement, students are asked to respond to the statement that nutrient analysis is an important subject, while the second statement item is asked for a response that nutrient analysis is a difficult subject. Almost all respondents agreed that the nutrient analysis course was an important subject, and most disagreed that it was a difficult subject. Subsequent statements were made to identify the learning resources for the nutrient analysis course. As many as 97.5% of students disagree and strongly disagree that nutrient analysis courses can be learned using books or teaching modules only and some students (92.5%) feel the need for practice in this course. It shows that another alternative is needed as a learning resource that can be used to support the learning of the nutrient analysis course. Problem-solving efforts in learning can be made by utilizing various learning resources and the form is not only limited to printed forms such as textbooks or modules. Other learning resources use technology, such as teaching videos, interactive presentation, teaching materials in the form of softcopy and so on. Also, one of the characteristics of educational technology is the use of all the potential that can be used as a source of learning in order to obtain maximum learning outcomes [10].

Alternative learning resources should be integrated with technology. It is reflected in point five, as many as 57.5% of students agreed and strongly agreed that learning the analysis of nutrients should use technology. One of the integrated learning technologies is learning to use video learning media. Furthermore, a statement was prepared to analyze whether the teaching material of the video was interesting for students. As many as 93.75% of students agreed and strongly agreed with the statement that learning to analyze nutrients using video learning media was more interesting. It shows that video learning media can be used as an alternative to learning nutrient analysis. Responses to further statements relate to other learning resources that can be used by students. Most students agree that learning nutrient analysis can be done sourced from the internet. It shows that the internet is a very basic requirement for students.

In the next statement, students are asked to respond if the teaching material is in the form of video, it is better to present contextual problems. The result was 86.25% of students agreed and strongly agreed with the statement, and as many as 90% of students agreed and strongly agreed that the learning video display should focus more on what the tutor wants to convey rather than the video that highlights the tutor. Display teaching materials also determine the response of users of teaching materials. The more attractive it looks, the more people want to watch it. In instructional videos, there are instructional videos that always feature the instructor or tutor, but some are only displaying something written or explained by the instructor.
Video learning media are an effective source of learning and there are 92.5% of students agreeing with the statement. It shows that the potential of teaching videos to be an effective alternative source of learning. Learning using video can saving time up to 40% and can increase retention from 14% to 38% [11]. In the digital era, learning should be accessible anywhere, both in the form of written material and video. Easy access and broad coverage can be obtained by using the internet. The last statement was made to identify it. The results obtained that 71.25% of students agreed with the statement. Nowadays, the internet is a primary need for many people. Learning resources when presented via the internet, will make it easier for learners to access them. They can access anywhere and anytime, unlimited time and place.

4. Conclusion

The Nutrition’s Analysis Course requires alternative teaching materials besides books or learning modules that should be integrated with technology. Video learning media that feature contextual problems are excellent alternative teaching materials used. Therefore, the students can repeat the material independently.

Acknowledgments. This study was supported by grants from the Research and Community Services Institute of Universitas Negeri Medan (LPPM UNIMED).

5. References

The Concept of Bloom Taxonomic Revision and Critical Thinking in Fashion Design Learning

Nining Tristantie¹, Syahril², Armaini Rambe³, Juliarti⁴
{n1n4tristan@gmail.com¹, syahril@gmail.com², ijuliarti@gmail.com³, armaini@gmail.com⁴}

Universitas Negeri Medan, Indonesia¹,²,³,⁴

Abstract. Bloom Taxonomy is manipulated as a practical way to perform the learning and evaluating. The existing tiers of the revised Bloom Taxonomy by Krathwol are a changing of noun to a verb form. The tiers are applied into the fashion design test questions to gage the frame of thinking in the low and high category (high order thinking skill) in fashion design learning. Based on this category we may find out the tier of students thinking skill to analyze and to interpret the fashion design learning. Questions are compiled using the category emphasizes on high thinking at C4, C5 and C6. This effort is employed to get the learning goals in order to balance the aspect of cognitive and psychomotor.

Keyword: Taxonomic revision, critical thinking, fashion design learning

1. Introduction

Education is expected to be anticipative and adaptive to every global changing. It is an absolute as education and industry are two mutual influence relations. It is said so as industry needs human resources who are ready to work, whereas education is charged to be adaptive to response the industry demands which are implemented in learning.

Clothing Education Department in the description of one of its vision as a university that prepares its graduates to be professionals. It is related to its role in the creative industry that is currently developed by strengthening the terms emphasizing on creative skills and innovative activities. The term Creative industry has been used throughout the world to enhance the creativity and innovation activities of its people to support the economic sector [1]. Therefore, the Indonesian creative agency through the ministry of trade revitalizes creative activities and seriously provides full support for the creation of skill-based creative product. The concept of performance usually refers to three pillars namely economic, environmental and social [1]. Creative industries are industries that come from individual creativity, skills, and talents that are potentially create wealth and employment through the exploitation and generation of individual intellectual property and creativity.

Creative people by Kanematsu and Berry are described as people who pursue their goals with intensity, exploratory, optimistic and tolerant in uncertainty. Creative people become reactive to stimuli, are elaborate in the amount of response, flexibility. [2].

The implementation of creativity in pursuing the teaching and learning process in class begins with the preparation of lesson plan. Lectures compile lessons plans based on KKNI that emphasizes independent learning and critical thinking. The final goal is to achieve the
competencies that have been established in learning fashion design. This Lesson Plan is equipped with an assessment that serves to determine students learning improvement by using evaluation test that can measure the mastery of the given material.

The use of these tests is determined based on critical success indicators in the learning process. In fashion learning, Examining the student’s creativity in solving the problem, lectures usually focus on operational verb word using, it doesn’t examine the creativity effectively which is oriented to critical thinking. As it is seen from revised taxonomy edition, there are real divisions of high thinking skills and low thinking skills.

Bloom Taxonomy is a ranged classification one of which is used for instructional purpose. Bloom Taxonomy has been revised especially the cognitive realm. David Krathwol - a co writer of original Bloom Taxonomy. According to Anderson et al, Revision is used to improve the tiered structure of thinking, the application can be used in more common language and can articulate more examples.[3]

Taxonomy involves some basic dimensions. Firstly, it is a knowledge domain that involves four knowledge; factual, conceptual, procedural and metacognitive. Second, Factual Knowledge involves basic elements that students should familiarize with discipline and problem solving. Third, Procedural knowledge deals with how to perform something, method of investigation, criteria for doing skills, techniques and methods. Fourth, Metacognitive knowledge involves ‘knowledge about cognition in general as well as awareness and knowledge about cognition itself’.

The domain of knowledge includes the ability to restate the concepts or principles that have been learned, relating to thinking skill, competence in gaining knowledge, recognition, understanding, conceptualization, determination and reasoning. Learning objectives in the cognitive (intellectual) domain or according to Bloom are all activities involving the brain divided into 6 levels according to the lowest to highest levels denoted by C, namely Cognitive (In a book titled Taxonomy of Educational Objectives: Cognitive Domain published by McKey New York, Benjamin Bloom in 1956) known as the Six levels. This is what is often used in formulating learning objectives as C1 through C6. Revised Taxonomy uses the dimensions of cognitive processes that are interrelated.

2. Method

The levels contained in the Bloom’s taxonomy revised have been used a basis for educational purposes, test preparation, and curriculum [4] Therefore, fashion design learning uses this taxonomic revision aims to help lectures to understand, organize and implement learning design goals. The concept of fashion learning using the revised Bloom taxonomy is focused on active, cognitive and constructive processes to create meaningful learning. The constructivists understanding, knowledge is the construction (forming) by related something to others (schemata). Knowledge cannot be transferred from the teacher to others, because everyone has their own scheme of what they know. The formation of knowledge is a cognitive process in which the process of assimilation and accommodation occurs to achieve balancing into a new scheme (plural: schemata) where scheme is formed. [5]

Fashion design Learning has stages that are passed by researching methods starting with questions, identification, analyzing, evaluating and creative product creation. These creative processes begin with creative people who produce creative product including every thoughts and actions taken to deliver an original product.
The popular model suggested by Graham Wallas in 2007. He believes that creative thinking implicates four phases: problem defined preparation), incubation (set the problem aside in long period of time), illumination (when new ideas come) and verification (new ideas investigation). Incubation and illumination phase which show creative thinking is the unconscious mental process.

In this case, Students are sued to be active in the learning process. In fashion design learning, students are free to express ideas, include selecting problem raised as a topic to be followed up. [7] Students are hoped to be able to construct the significance based on the accepted information. The impact obtained, such as students’ complicity in solving problem independently is clearly seen through these learning activities. Then, it will change the students’ perspective in solving the problem namely the change from passive to a cognitive and constructive view.

The focus of this learning is to emphasis on what they know in the form of knowledge and how students think (cognitive process) about what they gain during the learning process. Cognitive process dimension contains six categories; memorizing, understanding, applying, analyzing, evaluating and creating. Knowledge dimension contains four categories. They are factual, conceptual, procedural and metacognitive. The existence of these series processes in fashion design need a series of assessments to measure students’ critical thinking by applying revised Bloom Taxonomy [8].

Fig. 1. Creative process of fashion design start from Idea to assessment [6]
The comparison of Bloom Taxonomy tables and its revisions in the cognitive domain is shown below.

<table>
<thead>
<tr>
<th>Bloom Taxonomy (Noun)</th>
<th>Revised Taxonomy (Verb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Separate Dimension</td>
</tr>
<tr>
<td></td>
<td>Memorizing</td>
</tr>
<tr>
<td>Understanding</td>
<td>Understanding</td>
</tr>
<tr>
<td>Applying</td>
<td>Applying</td>
</tr>
<tr>
<td>Analyzing</td>
<td>Analyzing</td>
</tr>
<tr>
<td>Synthesis</td>
<td>Evaluating</td>
</tr>
<tr>
<td>Evaluating</td>
<td>Creating</td>
</tr>
</tbody>
</table>

Fig. 2. Series of changes to the Taxonomy Category from original framework to its revision by Andersen and Krathwohl (2010)

3. Result and Discussion

The Focus in examining questions in fashion learning is by using revision to improve critical thinking namely high order thinking at the stage of applying.

C3 (Application)
At this phase application is interpreted as information application ability to apply the information at the real situation. Students are hoped to be able to apply their concept and principle to a condition that is new and never given before.

Application Questions:
Develop the basis form of clothing based on your fashion research!
Study: students can answer these questions using the basis fashion knowledge and correlate it with the urgency of problem. Then, students try to explore the knowledge and experience as well as imagination they may have to discover the self-potential. These conditions bring new challenges for them to solve learning problem.

C4 (Analysis)
In this phase Analysis is considered as an ability to break down a material into clearer components. These abilities could be:
1. Element analysis (analysis of parts of the material)
2. Relationship analysis (relationship identification)
3. Analysis of organizing principles/organizational principles (organizational identification)

In this phase, learners are asked to decipher information into several sections to find assumptions, distinguish opinions and facts and find causal links. Operational verbs that can be used at this level are analyzing, auditing, solving, emphasizing, detecting, diagnosing, selecting, detailing, nominating, charting, correlating, rationalizing, testing, enlightening, exploring, imagining, concluding, finding, analyzing, maximizing, ordering, editing, linking, choosing, measuring, training and transferring.
Applications questions:

All designs and projects are initiated with identification of needs with research and investigation methods regarding relevant information. It has been related how a fashion product can have a mindset that can meet the criteria of what is called creativity and innovation.

Study: Form of Questions requires students to know not only from identification of problem but also to comprehend the method used by the research method in solving the problem applicative. Finally, students can raise analysis that can be explained descriptively. Departing from this condition, students are expected to be able to practice their cognition by tracing the facts to find connection between the causes and the effect as a result of a relationship.

C5 (Evaluation)

At this level, evaluation is defined as the ability to assess the benefits of one thing for a particular purpose based on clear criteria. This activity deals with the value of an idea, creation, ways or method. At this stage, someone is guided to gain new knowledge, better understanding, new applications and unique new ways of analysis and synthesis. According to Bloom there are at least 2 types of evaluation, namely: 1. Evaluation based on internal evidence 2. Evaluation based on external evidence. At this level, students evaluate information including making decisions and policy. Operational verbs that can be used in this level are: comparing, concluding, evaluating, directing, criticizing, weighing, deciding, separating, predicting, clarifying, assigning, interpreting, defending, detailing, measuring, summarizing, proving, validating, testing, supporting, choosing, and projecting.

Application Questions:

Criticize 3 sources of information with a central issue that can inspire you to be a research theme!

Study: Questions in the form of test questions lead students to examine more deeply about the given topic. Students can answer this question if he can elaborate indicators from questions one by one. Next, do the problem formulation and then find a solution to the problem by finding answers. A much deeper understanding of the situation will be formed, or the problems faced in executing and making decisions. Next, students are expected to use this understanding to perform some applications based on the abilities with various efforts in doing the analysis.

C6 (Create)

At this level, synthesis is interpreted as the ability to produce and combine elements to form a unique structure. This ability can be in the form of producing unique communications, plans or activities that are intact, and a set of abstract relationships. At this level Create emphasizes on cognitive processes, directing students to produce a new product by organizing several elements into a pattern that are different from before. Students need a meaningful learning experience in the learning process they are going through. The activity of creating leads to the process of creative thinking, but that does not mean that students have total ability to create.

At this level, students are required to produce their own hypotheses or theories by combining various sciences and knowledge. Operational verbs that can be used in this level are: abstract, organize, animate, collect, categorize, code, combine, compose, compose, construct, cope, connect, create, create, correct, correct, design, plan, dictate, enhance, clarify, clarify facilitate, form, formulate, generalize, combine, integrate, limit, repair, display, prepare, produce, summarize and reconstruct.
Application Questions:
Create an interesting theme about creative and innovative ideas. Use brainstorming ideas to find themes with information that is relevant to innovation!

Study: The question item in the form of the question above requires students to determine a design theme that starts with research activities. The initial research used was mapping the problem using mind maps (mind mapping) using 'spider diagrams'. The challenge of this problem is that students must describe the innovations they find. At this stage students are required to master broad insights and will face adaptation to cultural, environmental, and lifestyle issues that can be obtained from information from a variety of print and electronic media. Finally, students can find interesting themes that can be interpreted into designs that have innovation value.

5. Conclusion

Application of the revised taxonomy provides benefits for lecturers to cultivate critical thinking. The revised taxonomy categorized learning activities that can be used to achieve learning objectives following assessment to measure abilities mastered by students. Revised Bloom's Taxonomy makes learning goals easier and clearer in its use. Exploration that has been carried out in this revision gives deeper attention to the cognitive knowledge to solve problems.

The readiness of fashion design education is expected to support the creative industries that demand critical thinking to all changes. Implementation of adaptation to the professional environment can be started from classroom learning by implementing exercises that require high-level thinking skills. In addition, the internalization of the revised Bloom Taxonomy into Fashion Design learning can help lecturers to understand the learning objectives, make better decisions about teaching and be able to access students within the goals framework.

The revision table is very helpful to determine the accuracy in adjusting the arrangement between the objectives that have been set so that it is aligned with the assessment used and the desired learning outcomes.

6. References


Job Sheet Development of Electrical Installation in Improving Student Competencies of Electrical Engineering Education Study Program

Dadang Mulyana¹, Arif Rahman², Mustamam³
{dadang@unimed.ac.id¹, arifr81@gmail.com², mustamam1965@gmail.com³}
Universitas Negeri Medan, Medan Indonesia¹,²,³

Abstract. This research aims to develop worksheets to improve student competence in the electrical installation process. The study was conducted at the Department of Electrical Engineering Education, which involved 18 students. The research methodology uses the Dick & Carey development model, at the review and trial stage the research involved 2 experts, 3 lecturers supporting the course, and 18 students of the Electrical Engineering Education Study Program. Based on the results of testing the job sheet, it is known: 1) the job sheet design expert test states it is suitable for use; 2) test material is known to need to add grounding material to add insight into students in installing and submitting grounding for electrical installations, 3) the results of the use of job sheets by students shows the level of ease and effectiveness in using equipment packages prepared as supplemented job sheets that have been prepared.

Keywords: Job sheet, competence, electrical installation practice.

1. Introduction

In an effort to improve the quality competence of graduates of the State University of Medan, particularly the Faculty of Engineering has been working gradually and continuously to align the curriculum and supporting facilities and infrastructure with the needs of students. One important part in the implementation of the Electrical Lighting Installation course is practical activities, which are real competencies in the field of work in accordance with the SKKNI that has been set. Therefore, one component that supports the improvement of student competencies in addition to the six assignments as described above the practice that is carried out directly by students. The main factor in implementing the practice is the availability of tools, materials and job sheets as a guideline for the implementation of the practice to be implemented.

Job sheet as a teaching material used in the practice of electrical lighting installation does not meet the guidelines of the SKKNI-based curriculum in the Design and Installation of Building Electrical Installations, which is used as a guide to the certification process of Design and Installation of Building Electric Installations as stipulated in the Decree of the Ministry of Manpower and Transmigration number 170 of 2007 concerning the Determination of Indonesian National Work Competency Standards in the electricity sector, the electricity power sub-sector in the field of electricity utilization. This is an important part of the formulation of basic competencies and competency standards that must be achieved by students.

As a practical teaching material, Job sheet is a practice learning tool where the learning sheets are arranged into a unified whole. Learning sheets include: information sheets, instruction sheets, operation sheets, self-check sheet, and evaluation sheet tools. Measuring achievement of
competencies in the performance test, these learning sheets are not separated from each other or must be a unified whole to achieve learning objectives [1][2][3]. If this job sheet is developed, it is one of the approaches in organizing learning in the field of electrical engineering, and provides detailed guidance to students to carry out learning activities, determines learning materials appropriately, determines when and how long it will take, so that each student has sufficient opportunity to master the tasks given. Likewise, the implementation of evaluation in the form of tests developed by lecturers emphasizes more understanding of cognitive content, has not been focused on measuring students' attitudes and skills in the form of performance tests. This condition is very potential to produce graduates who are not in accordance with the expected competency standards (SKL).

Referring to the above problems, it is necessary to increase the effectiveness and efficiency of the implementation of electrical installation practice activities carried out through the development of systematization and job sheet structure in accordance with competency requirements. Thus, a practice-oriented worksheet is needed that is effort-oriented to support the improvement of student competency achievement.

The Indonesian National Qualification Framework (KKNI) is an embodiment of the quality and identity of the Indonesian people in relation to the national education and training system owned by Indonesia. The quality of education needs to be adjusted to science and technology and the demands of development. Increasing the ability and skills for prospective workforce students is the responsibility of the education world. Education is an integral part that cannot be separated from the process of preparing qualified, strong, and skilled human resources. Through education, prospective employees are qualified, productive and able to compete. For this reason, students as educational products are required to have eight main competencies, namely: (1) communication skills; (2) critical and creative thinking; (3) inquiry / reasoning skills; (4) interpersonal skills; (5) multicultural / multilingual literacy; (6) problem solving; (7) digital information literacy; and (8) technological skills [4][5][6].

Competence helps companies to describe how a person is performing. This is of course related to one's knowledge, expertise, and work ability. Competence represents an important dimension of work for a person. On that basis, it is very necessary to map work competencies and develop competency profiles based on industry qualifications and classifications, types of work, and job descriptions that must be done in each field of work and expertise.

Mapping of work competency in the field of electricity based on the classification and qualifications of the business world and the world of industry is very important, as an effort to improve the quality of Indonesian workers through the world of education and vocational training. The results of this mapping make a positive contribution to the adjustment and curriculum development in vocational schools and training institutions. In addition, it is also the basis for developing learning materials in the electricity sector in schools and in training institutions. The competency profile in the electricity sector can become a reference for the world of work (business and industry) in developing employee HR, and also as a reference for schools in improving the competence of their graduates.

The need for qualified and competent human resources (HR) by the world of work, encourages researchers to map work potentials in the field of electricity in the form of work competency profiles in the field of electricity based on the classification and qualification of the industry for the development of vocational education and training. The work competency profile in the electricity sector based on the qualifications of the electricity business world consists of competency aspects, namely: (1) occupational health and safety (K3); (2) planning; (3) operation; and (4) maintenance. The four aspects of competency are based on the competence of knowledge, skills and work attitudes that must be possessed by someone who is declared
competent in the electrical installation field. The work competency profile in the electricity sector is based on the classification of large industries, grouped into six basic competencies, namely: (1) basics of electricity; (2) the basics of electronics; (3) maintenance and repair of industrial electrical equipment; (4) electricity operation; (5) electricity management; and (6) occupational safety and health (K3) [7][8][9].

Teaching and learning interactions certainly require clear communication between lecturers and students. Every form of communication requires a certain medium. The form of print media that can be used in practical learning in a laboratory or in a workshop can be; job sheets, information sheets, job sheets, lab sheets, work sheets, reported sheets given to students.

The learning process is a process of communication between educators and students, or between students. In the communication process it can be done verbally, and can also be nonverbally. In learning of course using different media according to what will be learned, a media can be used for the learning process marked by a series of communication activities. So, learning is a process of communication between educators and students or between students to build themselves based on the knowledge and experience gained through interaction with the environment.

Higher education is a continuation of secondary education that is held to prepare students to become members of the community who have academic and/or professional skills who can apply, develop, and or create science, technology and art. Learning in higher education is slightly different from learning in high school or elementary school. Learning in higher education is more focused on students or often referred to as student centered learning. It is assumed that students are already adults. Therefore, lecturers need to make a plan for each meeting in delivering a course. The Department of Electrical Engineering Education as one of the majors in the Faculty of Engineering, Medan State University has the task of educating students to have skills in teaching Electrical Lighting Installation. These skills are obtained through practical activities in workshops/laboratories that require guiding media such as Job sheets. Output expected by students must be able to carry out practice correctly and correctly. In carrying out practical activities each student must have a reference/guideline, so that the practical activities run smoothly. One of the references/guidelines in the implementation of practice is a worksheet. A job sheet is a systematically compiled guideline or practice manual containing objectives, sequence of work instructions, component drawings, size specifications, inspection results, and conclusions about the practice that has been implemented. Job sheet is a printed educational media (a printed type of teaching aid) that supports instructors in teaching skills, whose contents are a set of directions and pictures of how to create or complete a job. So Job sheet is one form of instruction sheet. One of the most dominant aspects in the learning process of electrical installation practice is the existence of a job sheet, because the job sheet is used to guide or handle students in learning and mastering one of the competencies of practical skills taught by the Lecturer. The use of job sheets will reduce the verbalization of the material presented and be able to increase the active role of students in learning, which ultimately is expected to improve student learning outcomes. Existing worksheets in the Department of Electrical Engineering Education Faculty of Engineering (FT) Medan State University need to be reviewed in terms of the use of job sheets when students carry out practice in the laboratory, to overcome these problems research is needed specifically related to learning in the practice of electrical installation practice which uses teaching materials in the form of job sheets.

The teaching method is a method used by the teacher in establishing relationships with students during the course of teaching [10]. Demonstration of learning tools carried out by the instructor is intended to strengthen the content of the material delivered while also being able to show the process of something happening [11]. After a teacher implements a demonstration
of learning tools, the next activity is to give students practical opportunities. It is intended that students know the working principle of something that is exhibited, know the process of something happening after the demonstration and know the process of using something that is exhibited [12]. If the availability of practical tools to be used is limited, practical activities can be carried out with a group teaching method. So that problems in practice can also be solved as a group. Implementation instructions in practice are: (1) Preparation and planning, including (a) Establishing the objectives to be achieved, (b) Establishing the steps that must be carried out in the demonstration, and (c) Preparing the necessary tools, (2) Implementation, including (a) Making the demonstration of learning tools can be followed by students, (b) Giving each student the opportunity to try so that students feel confident about the truth of a process, (c) Making an assessment of students. Assessment is an effort made to determine whether educational goals and teaching objectives have been achieved or not. Educational assessment is the process of obtaining information about student achievement or performance. The results of the assessment are used to evaluate the mastery learning of students and the effectiveness of the learning process [13].

Practice tests, also commonly called performance tests, are assessment techniques that require students to demonstrate their skills. Practice tests can be written skills tests, identification tests, simulation tests, and work quotation tests. Writing skills tests are used to measure the skills of students expressed on paper, for example students are asked to make designs or sketch images. The ability to design experiments includes how to design the set of equipment used, including examples of written test skills. Simulation tests are used to measure the ability to simulate demonstrating an action without using actual equipment/objects. Job quotation tests are used to measure proficiency in demonstrating real work such as demonstrating how to cook, how to start a machine, or how to use a microscope.

Lighting electrical installations installed in a residential house are electrical installations for generation, distribution, service and use of electric power using a simple construction with a voltage that is used that is low voltage with a power of up to 900 Watts in the use of electricity for residential homes (housing) which is used for lighting needs (lamps) and household appliances. Some simple electrical installations which are the basis for competency in electrical installation include: (1) Single-Incandescent Light Installation, this installation is planned to be installed in a pipe. For the installation of a single incandescent lamp is very simple. For phase cable goes directly to the switch which is continued to incandescent lamp, while for zero cable goes to lamp. (2) Two Incandescent Installation with a Single Switch, Installation of two lamps with a switch, meaning that both lights are sufficiently serviced by a single switch. So in installation, the delivery of the two lights is obtained through a switch. If the two lights are to be served with two switches, there are two ways the chart can be used, namely: (a) the two switches are installed far apart, (b) the two switches are installed in one place. (3) Installation of Two Warehouse Relations Incandescent Lights. In this case one single switch and one exchange switch are installed. The principle is that the switch (switch) near the door has been replaced by a single-pole connector (1), and at the point of lighting 2 an exchange link (2) is installed which acts as a modifying connector. With a single pole connector, it can eliminate the voltage on the exchange connector and lights that can be put out in the blink of an eye. (4) Installation of Incandescent Hallway or Multi-store Home Lighting. The way this installation works is when someone in the hall turns on the lamp using the swap switch 1 then when going to turn off the lights just press the switch exchange 2 only and vice versa. This also applies to terraced houses. In a terraced house this series is installed near the stairs [14].
2. Research Method

This study applies a survey method, so that the implementation of data collection is done through observation, document recording, and content analysis related to the implementation of electrical installation practice courses. As for the development of the Electrical Installation practice manual and Job sheet, the Research and Development (R&D) approach is carried out. In the initial stage of the study materials have been developed in accordance with KKNI teaching materials in the KDBK Network and electrical installations related to Electrical Lighting Installation subjects. In the current research, there will be a development of guidelines for the implementation of practice and job sheets of electrical installation practice. The results of the research are expected to be able to find the materials for the practice of electrical installation courses in the form of a Job sheet for student practical activities to support the competence of electrical installations. Systematic research that will be carried out in this study are as follows
(1) Analysis of the basic competencies of electrical lighting installations in accordance with the SKKNI and KDBK Electrical installation networks, (2) Preparation of the material framework for electrical installation practices according to the competencies required for the electrical installation scheme, (3) Development of practice sheet work on Electrical Lighting Installation courses for Electrical Engineering education study program students.

The population in this study is supporting documents for the preparation of learning materials and Job Sheets for the Electrical Lighting Installation course, and students of the Electrical Engineering Education study program in the odd semester of the academic year 2018/2019 who took the Electrical Lighting Installation Practice course. The sampling technique uses purposive random sampling. In this study, sampling aims to pay attention to the subject of students who are subjected to the Learning of Electrical Lighting Installation Practices, as well as to pay attention to the competence of Electrical Lighting Installation courses in the Electrical Engineering Education Study Program. The number of sample students is planned as many as 18 people. In developing job sheets, design, material and feasibility tests are used by students majoring in electrical engineering education.

3. Result and Discussion

Electrical lighting installation is a compulsory subject in the Department of Electrical Engineering Education. This is because electric lighting installation is very useful in everyday life. Therefore, it is necessary to improve the quality of learning. In this study will develop study guides and practical job sheets complete with packages for the installation of installations that will be carried out during the practice of electrical lighting installation by students both individually and in groups. The use of job sheets and installation practice packages is expected to increase student understanding and increase the competency of installing electrical installations for students.

Basically, practical learning is a direct work process carried out by students with instructor instructions and job sheet guides. The practice process does not always run smoothly, sometimes even the implementation process can cause confusion, misunderstanding, or even wrong concepts. Errors in practical activities can occur because of instructors, students, and learning media used. To avoid or reduce the possibility of miscommunication, media is needed as an intermediary or information distribution process from instructors to students or vice versa. With
the media job sheet the process of implementing the practice is expected to run faster and in accordance with the objectives. Therefore, it is necessary to have a media that can improve student understanding so that the results of practice and improvement in competence of installation practices can be increased and successful. The media was developed in the form of a practical guide and Job sheet for electrical information installation. This job sheet is used for the competence of installing electrical lighting installations. Through the use of this job sheet, it is assumed to be able to increase student understanding so that the results of student practice can be improved and in accordance with the expected competencies.

4. Conclusions

Based on data analysis and research discussion, several conclusions can be drawn, namely: (1) The results of the analysis of design experts, materials, and language show that the integration of theory and the developed job sheets are appropriate for use in the implementation of learning and practice of electrical installations, (2) In general job sheets of electrical installation practice developed to improve student competencies in carrying out electrical installation, (3) Electrical installation theory learning guide becomes a supplement in the implementation of learning electrical installation courses, (4) The results of the implementation of the installation practice by using an electrical installation job sheet can assist students in carrying out the practice and improve competence in the installation of electrical installations, (5) The theory guide and the electrical installation job sheet are developed in accordance with the rules of the learning guide and are able to improve student competency in carrying out electrical installation, (6) The implementation of learning and practice of electrical installations can be carried out effectively and provide convenience to students in completing practice.

5. Acknowledgements

Our thanks go to Univeristas Negeri Medan Chancellor, Dean of FT, and Head of Research Institute for their financial assistance and guidance so that this research can be carried out.

6. References

Development of Occupational Safety, Health (K3) Courses for Makeup Students in the Engineering Faculty of the State University of Medan

Siti Wahidah¹, Nur Basuki², Lina Pangaribuan³
{sitiwahidahrias@gmail.com¹, nurbasuki@unimed.ac.id², linapangaribuan@unimed.ac.id³}

Faculty of Engineering, Medan State University, Indonesia¹,²,³

sitiwahidahrias@gmail.com

Abstract. This study aims to (1) develop appropriate learning modules in the Safety, Occupational and Environmental Health subjects for students of Makeup Education at the Faculty of Engineering, State University of Medan, and (2) determine the feasibility of the Safety, Occupational Health and Environmental learning modules for students Make-Up Education Faculty of Engineering, State University of Medan. This research is development research in the form of developing learning materials for safety, occupational health and the environment using the 4D Models method, namely (1) Define, (2) Design, (3) Development, (4) Disseminate which contains 14 learning activities. Data collection methods involve a material expert and media expert. Field test of the product was carried out on makeup students of the Faculty of Engineering, State University of Medan, Odd Semester. Data analysis techniques used the Likert-4 scale using quantitative descriptive analysis. The results of the development show that the learning media products in the form of Learning Module for Safety, Occupational Health, and the Environment get a value of 141 out of a total of 169 with the category Very Eligible from Material Experts and have an average percentage of 85.20%. The assessment from media experts got a score of 150 out of a total of 161 in the Very Eligible category and had an average percentage of 94.83%. While for the product field test, respondents gave a value of 109.3 out of a total of 136 in the Eligible category and had an average percentage of 80%. In the field test is the aspects.

Keywords: K3L, Modules, Makeup Education.

1. Introduction

The makeup study program at the Faculty of Engineering, Medan State University (Unimed) is one of the study programs in the PKK Department. The makeup study program at the Faculty of Engineering Unimed makes the K3 course one of the mandatory courses taken in the first semester by new students. The goal is that students have more preparation in terms of safety, personal health and the environment when entering the workforce amidst the changing times of the increasingly modern era of industrialization. Work accidents (work accident) will result in a loss effect (loss) no matter how much. Therefore as much as possible work accidents should be prevented, if possible can be eliminated, or at least reduced the impact.

K3 as one of the compulsory subjects considered very important encountered several obstacles in the delivery process. From the results of interviews conducted with the Occupational Health Safety Lecturer (K3) Lecturer on Unimed Makeup Cosmetics and
a number of students who have taken the course, information is obtained that the obstacle is the unavailability of complete learning media that contains material in accordance with the RPS for K3 Courses Cosmetology Education. Students who have taken the K3 Course have complained about the lack of practical learning resources that can be used as a reference for independent learning. While the results of observations of students during the K3 lecture process found that students seemed less enthusiastic about lectures due to lack of learning resources.

With this learning module can be used as a guide by students in conducting K3 lectures, which so far have not used specific print learning media. The development of instructional media through this module is also expected to be able to increase the activity and independence as well as student responses. K3 material is one of the courses that not only contains understanding material but also requires a strong character planting so that K3 culture will automatically be created. Based on the description, the researcher wants to develop learning media in the form of K3 course modules for Students of Make Up Education, Faculty of Engineering, State University of Medan.

2. Research Method

This research is a development research. The purpose of this study is to determine the development and feasibility of the Occupational Health Safety course module for students in Makeup Education. The development model that is used as a reference in the development of Work Health Safety course modules for Students of Faculty Engineering in Makeup Education is the 4-D development model. The reason for using this development model is because the development process is simpler and more coherent.

This 4-D development model includes the following stages: (1) Define contains the initial analysis stage (front-end-analysis), learner analysis, task analysis, concept analysis, and formulating learning objectives. (2) Design includes the stage of preparing a benchmark reference test (constructing criterion-referenced test), the stage of media selection, selection of format, and making the initial design. (3) The development stage includes the stage of expert appraisal and developmental testing. (4) Disseminate is the product distribution stage.

This development research procedure refers to the 4-D research and development steps (Referring to the literature review that has been discussed, development steps are made as shown in Figure.)
3. Results and Discussion

The results of the validation of material experts, media experts and validation of development trials to see the feasibility of OSH courses can be seen as follows.

a. Material Expert and Media Expert Validation

This validation was carried out by material experts using an assessment questionnaire that included aspects of self instruction, self contained, stand alone, adaptive and user friendly. The results of validation tests that have been carried out on the aspect of self instruction by material experts get a value of 86 with a minimum assessment interval of 26 and a maximum value of 104, with a very decent interval assessment category and have a percentage of assessment of 88.49%. Judging from the aspects of self contained by the material experts get a value of 16 with an assessment interval of a minimum value of 4 and a maximum value of 16, with a very decent interval evaluation category and has a percentage rating of 100%. Judging from the stand alone aspect by the material experts get a value of 12 with an assessment interval of a minimum value of 4 and a maximum value of 16, with a very decent interval assessment category and has a percentage rating of 75%. Judging from the adaptive aspects by the material experts get a value of 12 with a minimum assessment interval of 4 and a maximum value of 16, with a very decent interval evaluation category and has a percentage rating of 75%. Judging from the user friendly aspects by the material experts get a value of 14 with a minimum assessment interval of 4 and a maximum value of 16, with a very decent interval assessment category and has an assessment percentage of 88%. Overall, from the assessment conducted on aspects of self instruction, self
Validation testing is carried out by media experts using an assessment questionnaire that including aspects of format, organization, attractiveness, shape and size of letters, space (blank-spaces) and consistency. The results of validation tests that have been carried out on the aspect of formatting by media experts get a value of 22 with an assessment interval of a minimum value of 6 and a maximum value of 24, with a very decent interval assessment category and have a percentage rating of 92%. Judging from the aspect of organization by media experts get a value of 29 with a minimum assessment interval of 8 and a maximum value of 32, with a very decent interval evaluation category and has a percentage rating of 91%. Judging from the aspect of attractiveness by the media experts get a value of 27 with a minimum assessment interval of 8 and a maximum value of 32, with a very decent interval assessment category and has an assessment percentage of 84%. Judging from the aspect of the shape and size of the letters by media experts get a value of 24 with a minimum value of 6 intervals and a maximum value of 24, with a very decent interval evaluation category and has a percentage rating of 100%. Judging from the aspect of space (blank space) by media experts get a value of 23 with a minimum assessment interval of 6 and a maximum value of 24, with a very decent interval assessment category and has a percentage rating of 96%.

Judging from the aspect of consistency by media experts get a value of 24 with an assessment interval of at least 6 and a maximum value of 24, with a very decent interval assessment category and has a percentage rating of 100%. Overall from the assessments that have been carried out on aspects of format, organization, attractiveness, shape and size of letters, and consistency, the overall value of validity obtained from media experts is 149 from a maximum score of 160 with a percentage of 94.83%.

b. Media Expert Validation

The results of the material expert evaluation are based on the average number of aspects of format, organization, attractiveness, shape and size of letters, blank space and consistency of 149 from a maximum score of 160 with a percentage of 93.83%. In accordance with Table 35 it can be classified that the total score of material experts is included in the Very Eligible
category. In addition there are of course some input and suggestions from the validator to make some improvements to the media before being used as a learning medium. The results of the expert material evaluation in the form of a bar diagram are illustrated as follows:

![Bar Diagram of Media Expert Validation Results](image)

2) **Field Test Result**

Instruments that have been declared valid and reliable can be used as material for evaluating learning media to get the data results accordingly.

![Field Diagram of Field Test Results](image)
4. Conclusion

The results of this research show that the learning media products as Learning Module for Safety, Occupational Health, and the Environment get a value of 141 out of a total 169 with the category Very Eligible from Material Experts and have an average percentage of 85.20%. The assessment of media experts got a score of 150 out of a total 161 in the Very Eligible category and had an average 94.83%. The product field test, respondents gave a value of 109.3 out of a total of 136 in the Eligible category and average of 80%.

4. References

Development of Machining Technology Material by Using Teaching Factory Based on Metacognitive Skill Model

Selamat Riadi¹, Selamat Triono², Muslim³ and Syahril⁴
{selamatriadi.unimed@gmail.com}
Universitas Negeri Medan, Jurusan Pendidikan Teknik Mesin, Medan¹,²,³, Universitas Negeri Padang, Jurusan Pendidikan Teknik Mesin⁴

Abstract. This research is to develop learning material of machining technology with Teaching Factory Model approach based on metacognitive skill on Mechanical Engineering Education in Universitas Negeri Medan. The method used in research and development is development design of ADDIE. The results show that machinery technology lecture with Teaching Factory Model approach based on metacognitive skill is proper to be used with practicability level reach to 80.39%, and it is effective because resulting significant differentiation of study result value between experimental class and control class based on result of t experimental with value of $t_{\text{arithmetic}} = 2.72$ and $t_{\text{table}} = 2.021$. Thus, Machining Technology Textbook by using Teaching Factory Based on Metacognitive Skill Model can be used practically and effectively in the learning process.

Keywords: Learning Lecture, Machining Technology, TEFA-BMS.

1. Introduction

In industry revolution era 4.0, disruption is keyword that always be prioritized and watch out for, because it contains indictment purpose that education task and coaching is to prepare human who has capability to think, creatively in attitude and doing for facing unpredictable alteration as planning annoyance. There is seven of survival skill needed in education for facing the changing of “Old World” of classrooms in the “New World” of work. However from the skill, critical thinking and problem solving skill with reinforcement on adaptability power is fundamental competency as way of life in 21s. It is caused of the new world arrangement with characteristic economy knowledge-based indicate that every activities always expressed in; tasks, or problem, or final goal should be finished. Nevertheless, critical thinking and problem solving is important skill for all workers in industry society. Thus, implementation of learning model for graduation should have the competency as a basic of self-development.

Teaching Factory Based on Metacognitive Skill=TEFA-BMS [1] as one of learning model development with some purposes; Outputing professional graduation in their filed, develop modern curriculum, effectively solution of demonstration in facing industry challenges, transfer of technology from industry by being education institution partner [2]. The development of teaching factory in Penn State University, The University of Puerto Rico-Mayaguez, The University of Washington, and Sandia National Labs is to give real experience in design, manufacture, and realization product designed, then curriculum development balance between theory skill and manufacture analysis, design, business activity, and professional skill [3].

ACEIVE 2019, November 16, Medan, Indonesia
Copyright © 2020 EAI
DOI 10.4108/eai.16-11-2019.2293151
image of ideal cooperation between education institutes with industry institute ideal that concern and benefit one each other can be shown as fig. 1 [4]:

Fig. 1. Education cooperation and industry model

The implementation is in the education institute, a concept that converse education mode becomes a challenge place for student in attaining experience, development of responsibility, accountability, attitude, knowledge and skill for their contribution to society one day [5]. Schematically, the concept of learning Teaching Factory shown in fig. 2:

Fig. 2. Scheme of Teaching Factory Concept

In learning model implementation, the utilization of learning lecture is a urgent completeness because candidate of student SMK teacher candidate who will become main education doer in the future should be supplied by learning lecture approach model that appropriate with their skill characteristic, because if it is not, then their expectation for being able to teach student effectively and efficiently will not be true.
2. Method

This research is a development research with the objective to produce a product like learning lecture of machinery technology by using design and development of ADDIE [7], the steps shown as fig. 3:

![Fig. 3. Scheme of research steps](image)

3. Result and Discussion

The results of engine development technology with TEFA-BMS Model are validated by five validators as their expertise. Result of review or validation concerned by machinery technology analyzed by using Aiken’s V formula and the recapitulation can be shown in Table 1.

<table>
<thead>
<tr>
<th>Added Value Aspect</th>
<th>Σ Validator (1-5)</th>
<th>ΣS</th>
<th>Distance of calculation result (Aiken’s V Formula)</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 1-31</td>
<td>631</td>
<td>476</td>
<td>0.65 - 0.90</td>
<td>Valid</td>
</tr>
<tr>
<td>Average</td>
<td>20.35</td>
<td>15.35</td>
<td>0.77</td>
<td>Valid</td>
</tr>
</tbody>
</table>

Based on data analysis on Table 1 shows that validation from book contain of machinery technology with TEFA-BMS model include some aspects and indicator; (a) organization
lecture, (b) Process of writing, (c) contain, and (d) language. Result of statistic data shows Aikens ’V average value 0.77 with interval Aikens ’V range 0 to 1. An assessment will be valid with Aikens’V criteria value above 0.60 then it is valid [1]. That is why, validation result from expert team about lecturing got 0.77 means more than >0.60, thus it is valid category. Nevertheless, in lecture note contains some suggestion can be used to enhance the contain quality.

**Practicality Test from Machinery Technology Lecture note by Lecturer**

In measuring practicability from machinery technology lecture note with TEFA-BMS model from its praktikalitas side implicate some aspect; (a) presentation, (b) compatibility, (c) expediency, and (d) language with total 19 indicators. Assessment done by giving number between 1 (not represent or not relevant) until 5 (represent or very relevant). Aiken’s V statistic can be expressed by [1]:

\[ V = \frac{\Sigma}{n(c-1)} \]

given:

- \( S \) = \( r - l_0 \)
- \( l_0 \) = Number of low validity (in this case = 1)
- \( c \) = Number of high validity (in this case = 5)

The resume of practicality test from lecture note of TEFA-BMS Model shown in Table 2:

<table>
<thead>
<tr>
<th>Assessment Value</th>
<th>Assessment Range</th>
<th>% Practicality</th>
<th>Desc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicator 1 - 19</td>
<td>3.5 – 4.75</td>
<td>70 – 95</td>
<td></td>
</tr>
<tr>
<td><strong>Average Value</strong></td>
<td>4.02</td>
<td><strong>80.39</strong></td>
<td>Very Practical</td>
</tr>
</tbody>
</table>

In practicability instrument model and product, the data got from observation assessment from lecturer respond although students. The questionnaire assessment based on model or products from experimental. Rejoinder score from each criterion done by descriptive analysis. Based on practicality test by lecturer about lecture note of machinery technology with TEFA-BMS model generally expressed by “Very Practical” with P range value (mean) from 3.50 to 4.75 or 70%-95% (Mean 80.39%)

**Affectivity test from lecture note of machinery technology to students**

The affectivity level of lecture note developed from student learning output as experimental and control class. Differentiation analysis done by using t-test formula as shown; Arithmetic formula:

\[ t_{count} = \frac{MY_1 - MY_2}{\sqrt{SS_1 + SS_2 - 2 \left( \frac{1}{n_1} + \frac{1}{n_2} \right)}} \]

Where:
In this experimental using significance degree \( \alpha = 0.05 \) with degree of freedom (df) = \((n_1 + n_2 - 2) = 40\), then from Statistic Table got \( t_{table} = 2.021 \). From accounting comparison can be expressed that \( t_{arithmetic} = 2.72 > t_{table} = 2.021 \), It means that the average value of experimental and control class is different significantly.

### Table 3. Resume of Affectivity Test of Machinery Technology Lecture Note on TEFA-BMS Learning Model

<table>
<thead>
<tr>
<th>No.</th>
<th>Total of Students</th>
<th>X1</th>
<th>X2</th>
<th>Y1</th>
<th>Y2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N1=20</td>
<td>1288</td>
<td>83188</td>
<td>1423</td>
<td>92259</td>
</tr>
<tr>
<td>2</td>
<td>N2=22</td>
<td>Mean X1</td>
<td>Mean X2</td>
<td>Mean Y1</td>
<td>Mean Y2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>64,4</td>
<td>64,68</td>
<td>84,75</td>
<td>79,91</td>
</tr>
</tbody>
</table>

Comparison of assessment result \( t_{arithmetic} = 2.72 > t_{table} = 2.021 \), means that average value of experiment and control class is significantly different.

### Research Discussion

The findings of the research development in this learning material show that teaching materials developed are included in the Valid, Very Practical, and Effective categories. It can be interpreted that the developed teaching material has been able to be a differentiating factor in the effort to achieve learning outcomes in Machining Technology with the TEFA-BMS learning model approach so that the teaching material products developed can be used for learning of Machining Technology well. Many research results about lecture note recommend that the use of lecture note in the learning process is very important and one of the factors determine learning outcomes including in Jakarta, [10] [11] in Palembang. The result of a research that student learning outcomes using printed textbooks were higher in learning outcomes compared to using digital textbooks [13]. Student learning outcomes for those who use printed books (hardcopy) were significantly higher than students who used textbook based on web (e-textbook) [14].

Based on the results of the research above, it is highly recommended that each learning instructor be able to develop and use textbooks in designing and conducting learning. Specifically for learning Machining Technology, because the specifications require that learning outcomes not only be skilled in the psychomotor field but also based on a fundamental cognitive foundation, strong, wide and visceral, the provision of lecture note is a prerequisite in the
learning process. Even though open teaching material in cyberspace is widely available, the research results reveal that students prefer and appear better when reading on screen, but their actual performance disposed to suffer [14]. In addition, other findings suggest that students can better understand information for textbook is more than one page in printed form than in digital/screen form. Learning in taking note is important skill that will be needed by students who will continue their study at university while with the advancement of digital material fewer students learn to take notes [15]. Besides learning in textbooks will be better to remember the title of the book even students can remember every page and diagram in the text.

4. Conclusion

Based on the result of experimental and discussion, the conclusion is as follows:
1. Learning material of machinery technology developed is reasonable to be used in learning process with teaching factory model approach based on Metacognitive Skill.
2. Learning material of machinery technology developed is effective to be used in learning process with teaching factory model approach based on Metacognitive Skill.

Afterward, the implication of research conclusion can be suggested as follows:
1. Every lecturer advisable completing learning process in order to prepare lecture note to reach maximal learning process
2. Lecture note of machining technology with Teaching Factory model approach based on Metacognitive Skill is needed to be developed as machinery technology development and developing lecture.

5. References

The Development of Fantasy Make Up Instructional Dictate for Students in the Cosmetology Study Program of the Faculty of Engineering, State University of Medan

Marnala Tobing¹, Irmiah Nurul Rangkuti², Dian Maya Sari¹, Desy Afyanty Lubis⁴
FT Universitas Negeri Medan¹,²,³,⁴
missirmiahnurul@gmail.com

Abstract: This study aimed to: (1) produce instructional dictate which decent to be used, easy to learn by students and be used for individual learning. (2) to discover the effectiveness of instructional dictate media for character make up that developed on fantasy make up. This type of research is development of research that use the product model Borg and Gall combined by a learning development model of Dick and Carey. The collected data were analyzed by qualitative descriptive analysis technique. The hypothesis results proves that: (1) the instructional dictate is worthy to use for fantasy make up on cosmetology course State University of Medan, (2) there is significantly difference between student learning outcomes who applied by instructional dictate media for fantasy make up and student learning outcomes who not applied. This is shown by data result processing and concluded that use of instructional dictate media is more effective to improving the competency and knowledge of students in learning fantasy makeup than without applied.

Keywords: Development of instructional dictate, fantasy make up

1. Introduction

The Unimed Faculty of Engineering (FT) Cosmetology Study Program, which was opened since the 2007/2008 year, is one of the efforts to meet the needs of the community for teachers who are professional and skilled in the field of makeup in the future. Improving the quality of learning in higher education, especially in educational personnel education institutions still and must be continuously improved.

Based on the constraints that exist in the cosmetology education study program, the researchers feel that the development of Instructional in the form of learning dictate is the most urgent problem, because considering the difficulty of getting learning dictate that suits the needs of students and lecturers in fantasy makeup while supporting facilities for applying is well available in Unimed cosmetology education study programs. With the existence of good learning media the other obstacles encountered by the majority can be overcome such as the lack of teaching materials and learning support books because learning media can be an alternative as a learning media. Through
good learning media, the lecturers' time to explain the learning material will be more concise, and students can immediately practice the learning material presented by the lecturers so that students and lecturers need a media that can assist in the learning process of fantasy makeup courses. In fact, fantasy makeup courses are knowledge that must be understood and applied, not just in the form of memorization. Fantasy makeup material itself is an ongoing material from one unit and complex. The theories in the book or module are able to become a means of forming creativity and independence of students, because students do not see directly the technique of fantasy makeup applications in stages. In addition, the absorption of students is certainly not the same for everyone, you will be very lacking in understanding the techniques or fantasy makeup applications intended, because there are examples with colors. This results in students not being able to imagine to be able to foster maximum creativity. Instructional dictate will also enable learners to provide feedback, feedback and also encourage learners to practice correctly.

Seeing this reality, it is necessary to develop learning instructional dictate in fantasy makeup courses. The use of information technology in the form of instructional dictate that are equipped with attractive animated drawing features can make learning take place interesting and create a learning process that is not monotonous and boring, and easy to understand. In addition, it can also help students capture the material to be delivered, and of course it can be applied directly without having to wait for lectures delivered or supervised by lecturers. Thus, students can learn independently and can be creative according to their talents and interests.

Instructional dictate is a medium that is suitable for various learning such as classes, small groups, even for independent learning. From that, instructional dictate with a duration of only a few minutes can provide more flexibility for lecturers and can direct learning directly to the needs of students. In addition, according to Smaldino [1], learning with multi-voice instructional dictate can be aimed at various types of students.

The use of learning instructional dictate will add a broader dimension to students and can motivate learning and broaden the horizons of students and lecturers not only as users or users of instructional dictate but guided as designers so it is necessary to know practical knowledge on how to make learning instructional dictate and recognize various instructional dictate formats and skills use it. Things that cannot be ignored are must understand visual principles and how to design visual messages properly and effectively.

2. Research Method

This research was conducted in the Cosmetology Study Program of the Family Welfare Education Department (PKK) of the Faculty of Engineering, Medan State University, for the fourth semester / even students of the Beauty Management Program 2016/2017 academic year. In this research and development the model that will be developed refers to the Research and Development (R & D) of the Borg & Gall model which has the aim of developing and validating the product by planning learning in the development of Dick & Carey's learning instructional dictate. The development model is a series of procedures in order to produce fantasy makeup learning media for
students from field state cosmetology education study programs. The development model used is in the form of media fantasy makeup learning instructional dictate designed by explaining the stages of dressing old characters with the theme of witches in stages (step by step). The stages of development adopt the stages of development of Borg & Gall models [2] as follows:

1. Conduct preliminary research which includes:
   a. Identify learning needs and determine competency standards in the course
   b. Conduct learning analysis
   c. Identify the characteristics and initial behavior of students
   d. Write basic competencies and indicators
   e. Write a benchmark reference test
   f. Develop learning strategies that are realized in the form of syllabus and learning units
   g. Develop learning materials
   h. Design formative evaluations

2. Design learning instructional dictate:
   a. Re-identify material and summarize it
   b. Making a script / storyboard

3. Collection of materials which include:
   a. Audio recording and collection
   b. Capturing and logging material from shooting on the Adobe Premiere program in AVI format
   c. Editing stage (image, text, sound effect, music instrument, animation)
   d. rendering using the mpeg extension (VCD format)
   e. Develop and create learning instructional dictate
   f. Burning learning media into VCDs

4. Review and test the product:
   The product review and trial phase is carried out to material experts, learning media experts, instructional dictate and graphic design experts. After going through the revision stage then proceed to students with three stages, namely individual trials, small group trials and field trials so that the resulting learning instructional dictate that is appropriate to use in accordance with the characteristics of the field of study and students as users. Through a series of expert trials and trials to students finally the final product of learning instructional dictate is produced by incorporating suggestions and revisions from content / material experts, learning media experts, instructional dictate and graphic design experts, and students.

5. Test the effectiveness of the product
   Product effectiveness testing is done by analyzing student learning outcomes in fantasy makeup courses.
   Data analysis to test the first hypothesis concerning the feasibility of media fantasy makeup learning instructional dictate used non-test techniques used to collect product data, by validating the design of instructional dictate which includes the process of activities to assess the feasibility of media before being used as a learning media. Evaluation was carried out by validators who had been given trust in validating the design of learning instructional dictate who were experts in the fields of media, science, and technology, and several student groups. All data collected was analyzed using statistical techniques.
Qualitative data in the form of statements that are very poor, bad, moderate, good and very good are converted into quantitative data with a value scale of 1 to 5. The population in this study were the students of cosmetology education study program at Medan State University who knew the 2016/2017 academic number of 58 people divided into 2 classes namely class A as the control class and class B as the experimental class. The research hypotheses that will be tested are: (1) Media suitable fantasy makeup learning instructional dictate are used as a medium for student learning, (2) Learning instructional dictate are more effective for improving student learning outcomes in students of the Medan State University education study program compared to students who taught using conventional media.

3. Results and Discussion

The results of the study by material experts, learning design experts, and learning instructional dictate experts and graphic design in each aspect of the overall assessment were determined by the average score in each category. The results of the assessment were then analyzed to determine the media feasibility of fantasy makeup learning instructional dictate that had been developed. The average percentage from the assessment of material experts, learning design experts and graphic and graphic design experts are described as follows:

Data Analysis of Material Evaluation Results

Table 1. shows the responses of material experts to the instructional dictate learning media included in the criteria of "very good"

<table>
<thead>
<tr>
<th>No.</th>
<th>Category</th>
<th>Percentage</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Aspects of Feasibility of Fill</td>
<td>90.00%</td>
<td>Very Good</td>
</tr>
<tr>
<td>2.</td>
<td>Presentation Aspects</td>
<td>95.00%</td>
<td>Very Good</td>
</tr>
<tr>
<td>3.</td>
<td>Language aspect</td>
<td>90.00%</td>
<td>Very Good</td>
</tr>
<tr>
<td>4.</td>
<td>Integrity Aspects</td>
<td>100%</td>
<td>Very Good</td>
</tr>
<tr>
<td></td>
<td>Average Percentage</td>
<td>93.75%</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

Table 2. shows the response of learning design experts to the instructional dictate learning media included in the criteria of "good"

<table>
<thead>
<tr>
<th>No.</th>
<th>Category</th>
<th>Percentage</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Aspects of Feasibility of Fill</td>
<td>87.50 %%</td>
<td>Very Good</td>
</tr>
<tr>
<td>2.</td>
<td>Presentation Aspects of Information Design Quality</td>
<td>80.00%</td>
<td>Good</td>
</tr>
</tbody>
</table>
No. | Category | Percentage | Criteria |
--- | --- | --- | --- |
3. | Aspect of Presenting Interaction Quality | 70.00% | Good |
4. | Integrity Aspect | 82.85% | Very Good |
Average Percentage | 80.08% | Good |

Data Analysis of Media Instructional dictates Expert Evaluation Results and Graphic Design

**Table 3** shows the response of learning instructional dictate experts to the instructional dictate learning media included in the criteria of "very good"

| No. | Category | Percentage | Criteria |
--- | --- | --- | --- |
1. | Programming Aspects | 88.33% | Very Good |
2. | Technical / display aspects | 91.66% | Very Good |
Average Percentage | 89.99% | Very Good |

**Table 4** shows the student responses to individual tests of learning instructional dictate included in the criteria of "very good"

| No. | Category | Percentage | Criteria |
--- | --- | --- | --- |
1. | Aspects of Learning Material Quality | 91.66% | Very Good |
2. | Technical / display aspects | 84.99% | Very good |
Average Percentage | 88.32% | Very Good |

**Table 5** shows the student responses to the small group test of learning instructional dictate included in the criteria of "very good"

| No. | Category | Percentage | Criteria |
--- | --- | --- | --- |
1. | Aspects of Learning Material Quality | 89.16% | Very Good |
2. | Technical / display aspects | 86.10% | Very Good |
Average Percentage | 87.63% | Very Good |
Table 6 shows students’ responses to the small group test of learning instructional dictate included in the criteria of "very good".

<table>
<thead>
<tr>
<th>No.</th>
<th>Category</th>
<th>Percentage</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Aspects of Learning Material Quality</td>
<td>97.48%</td>
<td>Very Good</td>
</tr>
<tr>
<td>2.</td>
<td>Technical / display aspects</td>
<td>98.76%</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

Hypothesis I testing is done by sudden normality test to look for normality of the sample under study. The normality test uses the Liliefors test. After the discussion, the experimental class obtained a value of $L_{(\text{count})} = 0.136$, while $L_{(\text{table})}$ at the level of $\alpha = 0.05$ and $n = 29$ was $0.161$. This shows $L_{(\text{count})} < L_{(\text{table})}$, which means the sample comes from a population that is normally distributed. While the normality test of the pretest value for the control class obtained the value $L_{(\text{count})} = 0.111$, while $L_{(\text{table})}$ at the level of $\alpha = 0.05$ and $n = 29$ is $0.161$. This shows $L_{(\text{count})} < L_{(\text{table})}$, which means the sample comes from a population that is normally distributed. After calculation, the experimental class obtained the value $L_{(\text{count})} = 0.141$, while $L_{(\text{table})}$ at the level of $\alpha = 0.05$ and $n = 29$ is $0.161$. This shows $L_{(\text{count})} < L_{(\text{table})}$ means the sample comes from a population that is normally distributed. While the normality test of the pretest value for the control class is obtained the value $L_{(\text{count})} = 0.126$, while $L_{(\text{table})}$ at the level $\alpha = 0.05$ and $n = 29$ is $0.161$. This shows $L_{(\text{count})} < L_{(\text{table})}$ means the sample comes from a population that is normally distributed. Based on the normality test of the two classes, it can be concluded that the entire population of research data is normally distributed.

Based on the results of the testing phase of the development of fantasy makeup learning media products, it can be concluded that the developed fantasy makeup learning media is suitable for use in fantasy makeup learning in the field state cosmetology education study program and the first research hypothesis statement is the media for makeup learning instructional dictate character worthy of being used in fantasy makeup learning students in field state cosmetology education study program. And prove that hypothesis I is accepted.

Table 7 shows the total percentage score of the average trial hypothesis I.

<table>
<thead>
<tr>
<th>No.</th>
<th>Respondents Percentage</th>
<th>Percentage</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Expert Learning Materials</td>
<td>93.75%</td>
<td>Very Good</td>
</tr>
<tr>
<td>2.</td>
<td>Learning Design Expert</td>
<td>80.08%</td>
<td>Good</td>
</tr>
<tr>
<td>3.</td>
<td>Learning Instructional dictate Expert</td>
<td>89.99%</td>
<td>Very Good</td>
</tr>
<tr>
<td>4.</td>
<td>Individual Trial 88.32% Very Good</td>
<td>88.32%</td>
<td>Very Good</td>
</tr>
<tr>
<td>5.</td>
<td>Trial Small Group</td>
<td>87.63%</td>
<td>Very Good</td>
</tr>
<tr>
<td>6.</td>
<td>Field Trial</td>
<td>98.30%</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

Average 89.67% Very Good
Hypothesis II testing is done by the experimental method. Normality test is made to look for normality of the sample under study. The normality test uses the Liliefors test. After the discussion, the experimental class obtained a value of $L_\text{(count)} = 0.136$, while $L_\text{(table)}$ at the level of $\alpha = 0.05$ and $n = 29$ was 0.161. This shows $L_\text{(count)} < L_\text{(table)}$, which means the sample comes from a population that is normally distributed. While the normality test of the pretest value for the control class obtained the value of $L_\text{(count)} = 0.111$, while $L_\text{(table)}$ at the level of $\alpha = 0.05$ and $n = 29$ is 0.161. This shows $L_\text{(count)} < L_\text{(table)}$, which means the sample comes from a population that is normally distributed.

After calculation, the experimental class obtained the value $L_\text{(count)} = 0.141$, while $L_\text{(table)}$ at the level of $\alpha = 0.05$ and $n = 29$ is 0.161. This shows $L_\text{(count)} < L_\text{(table)}$ means the sample comes from a population that is normally distributed. While the normality test of the pretest value for the control class obtained the value $L_\text{(count)} = 0.126$, while the $L_\text{(table)}$ at the level of $\alpha = 0.05$ and $n = 29$ is 0.161. This shows $L_\text{(count)} < L_\text{(table)}$, which means the sample comes from a population that is normally distributed. Based on the normality test of the two classes, it can be concluded that the entire population of research data is normally distributed.

Table 8 shows the total percentage score of the average hypothesis II that the hypothesis is accepted. Media Testing Information

<table>
<thead>
<tr>
<th>Control Class</th>
<th>Experiment Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>80.46%</td>
<td>71.72%</td>
</tr>
</tbody>
</table>

4. Conclusion

Based on the formulation, objectives, results and discussion of research on the development of the fantasy makeup learning media presented earlier, it can be summarized as follows:

1. After going through several stages of testing, both the trial of material experts, the trial of learning design experts, and trials of instructional dictate and graphic design experts as well as trials for students, fantasy makeup instructional dictate learning products have results that are feasible to be the final product can be disseminated and implemented to users. This is made clear by the acquisition of an average rating of almost all stages, namely in the trial of material experts the overall average is 93.75% in the five-scale table, the value is categorized as "very good", in the trial of total learning design experts the overall average is 89.99% in the five-scale table, the value includes the category "very good", in the total one-on-one trial the overall average was 88.32% in the five-scale table, the value includes the category "good", in the total small group trial the overall average was 87.63% in a scale five table, the value is in the category of "very good", in the total field trial the overall average is 98.30% in the scale table of five, the value includes the category "very good".

2. To see the effectiveness of the product, an analysis of student learning outcomes is carried out. Based on the analysis of 58 students participating in a large group the results of the use of fantasy makeup learning instructional dictate on student learning outcomes tests shows that the learning
outcomes of students who are taught by using fantasy makeup learning instructional dictate are more effective = 12.06. From the student learning outcomes taught using textbook learning media = 10.76. Thus it was concluded that the learning outcomes of students taught using fantasy makeup learning instructional dictate were more effective than with student learning outcomes learned with textbook learning media, where data obtained from the results of fantasy makeup learning instructional dictate had an effectiveness of 80.46% higher than the effectiveness of textbook learning media is 71.72%.

Based on the findings described in the conclusions and implications of the results of the research, the following are some suggestions, namely:

1. During this time the teaching and learning process carried out in practical subjects generally still uses printed media learning materials, so that learning refraction often occurs. This results in not achieving the ability to capture and apply the knowledge obtained.

2. Media fantasy makeup learning instructional dictate on fantasy makeup courses require adequate practice room facilities, so that when the lecture takes place it does not have to be bumpy to be able to do learning activities together which will be more efficient in using study time and having a long enough time.

3. The media for fantasy makeup learning instructional dictate is only a tool to assist in the process of delivering learning, therefore the existence of lecturers is still very much needed as a facilitator and students remain actively involved in the learning process of fantasy makeup courses.

4. In fact, until now the learning process of fantasy makeup courses is still done conventionally using textbook learning media. So it is recommended that the media for fantasy makeup learning instructional dictate can begin to be applied because the media for fantasy makeup learning instructional dictate are able to provide feedback better for students.

5. With limited time and costs, so that there are still some effects that have not been controlled, thus further research can be carried out in a more representative sample.
5. References


Development of Job sheet-Aided Module in Children Clothing Courses Fashion Study Program off Universitas Negeri Medan

Hotmaria Tampubolon¹, Surniati Chalid², Ermidawati³, Eka Rahma Dewi⁴
{ tampubolonmaria0@gmail.com, ekarahma0107@gmail.com }

Department of Family Welfare Education, Faculty of Engineering, Universitas Negeri Medan¹,²,³,⁴

Abstract. Children's Clothing courses encountered several obstacles in the learning process, among others namely, the material of children's clothing is an important part to understand. Learning with the use of media including the use of job sheets will make it easier in the learning process to be more effective. The results of the development of a jobsheet-assisted module both state the module and the job sheet are suitable for learning, but with some improvements. Student's limited test results state that modules and job sheets are acceptable for learning. Job sheet-assisted module field test results are also feasible to use, then the hypothesis shows that there is a difference in learning from applying a job sheet-assisted module as a learning medium having a better success rate than those not using.

Keywords: Module, job sheet, Children's Clothing

1. Introduction

The use of learning modules will greatly help the effectiveness of the learning process and the delivery of information. The presence of media in learning can also help increase student understanding, the presentation of data or information is more interesting and reliable, as well as facilitate the interpretation of data to obtain information. Lecturers or teachers are required to be able to understand, use the tools available in an effort to achieve the expected goals. For this reason, teachers must have sufficient knowledge and understanding of learning media. The learning media of this module is also compiled with the help of a children's clothing course job sheet.

In the children's clothing course there is still a module with the appropriate worksheet assisted, so that the learning process is carried out following the teaching to support the learning process. Therefore, the researchers tried to conduct research on the development of Worksheet-assisted modules in order to facilitate students in the learning process and learning that could run more effectively. The title of the research that was raised was "Development of Worksheet Assisted Assistance Modules in Children's Clothing Subjects in Medan Fashion University Study Program".
2. Research Method

The research was conducted in the Fashion Study Program of the Family Welfare Education Department (PKK), Faculty of Engineering, Medan State University. The population and sample in this study were stambuk 2017, V semester students majoring in Fashion Study Program PKK. The sampling technique in this study was Nonprobability Sampling, namely the type of Purvosive Sampling, so that the sample in this study was all V semester students.

The main instruments used to collect data in this development are as follows:

a. Questionnaire Sheet Validation of Expert Team

The validation sheet is used to obtain assessment data from the validator about the product being developed, namely the module is divided into three, namely:
1. Validation sheet for subject matter experts.
2. Validation sheet for learning design experts.
3. Validation sheet for learning media experts.

b. Questionnaire sheet for student responses to the module. The questionnaire sheet obtained from individual trials, small group trials and limited field trials. Grid of individual trial questionnaires, small group trials, and limited field trials.

The development uses the development model of Borg & Gall combined with the learning design model Dick & Carey. The steps of the stages of development are as follows: (1) conducting preliminary research, which includes: (a) identification of learning needs or objectives and determining core competencies of subjects, (b) conducting learning analysis by determining more specific skills that must be studied, (c) identifying initial characteristics and behavior, and (d) writing core competencies and competency standards along with their indicators; (2) compile a benchmark reference test by developing an assessment item to measure the ability of students expected in the learning objectives; (3) collection of materials which include: (a) collection of learning materials, (b) making and collecting images (illustrations); (5) product validation; (6) product revisions; and (7) product testing.

The data obtained is data about the state of the module with jobsheet. This data is collected through expert validation, questionnaires distributed to students. Assessment instruments for validators and individual trials, small groups and limited field groups.

3. Result and Discussion

Based on product assessment through a series of trials and revisions that have been made, this module with jobsheet is declared valid. The trial was conducted in six stages, namely: (1) material expert validation, (2) validation of learning design experts, (3)
validation of learning media experts, (4) individual trials, (5) small group trials, and (6) limited field trials.

The hypothesis proposed in this study is that produced between student learning outcomes learned with worksheet-assisted use modules and student learning outcomes that do not use worksheet-assisted modules. Testing the hypothesis used is a different test.

From the calculation results obtained because $t_{\text{count}} = 25.08 > t_{\text{table}} = 2.0105$, it was concluded that there were significant differences in student learning using worksheet-assisted modules with those not using worksheet-assisted modules.

<table>
<thead>
<tr>
<th>$t_{\text{hitung}}$</th>
<th>$t_{\text{table}}$</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.08</td>
<td>2.0105</td>
<td>There is a difference</td>
</tr>
</tbody>
</table>

As a suggestion considering that during the learning process in schools still using modules in the form of textbooks only, it is recommended that also use more applicable modules that can help students understand learning material, and link learning obtained with students' real life so as to provide feedback better for students.

Considering that the conclusions in this study are still possible to be influenced by factors that have not been able to be controlled, it is still necessary to do further research on more and broader samples.

4. Acknowledgements

The author would like to thank to Directorate of Research and Community Service for the provision of research funds.

5. References


Development of E-Book Learning Media in Drawing Manswear Sewing Pattern in Fashion Study Program

Halida Hanim 1, Farihah 2, Nurmaya Napitu 3, Surani 4

Prodi Pendidikan Tata Busana, Program Sarjana, Universitas Negeri Medan1,2,3,4

halidahanimp@gmail.com

Abstract. This study aims to develop e-book learning media as a teaching material patterns create in Fashion Education Study Program, Faculty of Engineering, State University of Medan, as a good learning resource and can function properly with effective results and can be used as a learning media. The research design used in this study is R&D. This research is used to develop or validate products that be used in education and learning. The research and development methods are research methods that be used to produce certain products, and to test the effectiveness of the products. The development of educational products in this research is e-book media development. This model has several stages: potential and problems, data collection, product design, product validation, trial use, product revision, product trial, design revision, product revision, mass production. The test subjects consisted of material experts, media experts, and students. The data about the quality of these development products was collected by a questionnaire. Every data that be collected were analyzed using qualitative descriptive analysis techniques.

Keywords: E-Book, Manswear Sewing Pattern, Undergraduate Students of Fashion.

1. Introduction

Developments in the field of science and technology (science and technology) currently affect various aspects of human life, including in the world of education. The development of science and technology encourages efforts to renew the use of technology in the learning process. The fashion study program of the Faculty of Engineering UNIMED is one of the vocational education institutions that prepares graduates who are ready to work according to the area of expertise learned, with a vision and mission to produce professional human resources who have competitiveness, noble character and care for the environment and are accepted by the community. To prepare graduates who are ready to work in the fashion study program, they have many practical subjects, one of which is fundamental is Men's Clothing courses. Men's clothing is a course given to fourth semester students because it is a basic course that must be known and mastered by every student.

One obstacle in the learning process in the classroom, especially in the Men's Clothing course, is learning centered on lecturers, as a result of students become less independent. Another obstacle is its limitations literature/ material/ media used by lecturers about drawing men's clothing patterns.
Some of the problems above are important and must immediately utilize computer or other electronic devices owned by students as a medium for learning itself, because the media can facilitate students in accepting lessons delivered by lecturers.

E-books take advantage of technological advances in learning, e-books created can be stored in devices such as mobile phones, laptops or iPads, so students can carry subject matter everywhere and are no longer burdened with printed books, in other words the use of e-books can more flexible compared to printed books.

Another advantage of e-books can be developed not only in the form of text, but can include pictures, animations, music videos and sounds so that it is more interesting than ordinary textbooks. Moreover, for practical courses, students can be facilitated by e-books because in e-books videos can be included such as work steps for drawing patterns.

2. Research Method

The development model used in this study is a 3D form that is Define, Design and Develop. This model is a research method used to develop or validate products used in education and learning. The 4D research model stands for Define, Design, Development and Dissemination. The development of e-book learning media in the Men's Clothing course is carried out by research and development methods (research and development). Research and development methods are research methods used to produce certain products, and discover the effectiveness of these products [1].

Borg and Gall in Sugiyono [1] stated that, research and development (R&D) is research used to develop or validate products used in education and learning. The development of educational products in this research is in the form of e-book media development.

Development Procedure

In this research and development product that will be produced is an e-book learning media for drawing men's clothing patterns. In designing media products, a step that must be taken beforehand is to outline media programs.

Block diagram of making media
Data Collection Technique

Data collection techniques in this study were conducted using a questionnaire. Questionnaire is a data collection technique that contains questions or statements submitted in writing to a person or group of people to get the answers or responses and information needed by researchers.

Research Instruments

In this study including quantitative research that is collecting data then analyzed quantitatively using descriptive statistics. The instrument used in this study was a closed questionnaire in which the respondent gave a choice of answers by putting a check mark (pada) in the answer column provided. The instrument is a closed questionnaire aimed at experts namely material experts and media experts, and given to students.

Data Analysis Technique

This research focuses more on the effectiveness of products designed as E-Books to create men's clothing patterns, so that the data are analyzed properly to analyze data from the questionnaire, the following steps are carried out:
1. Questionnaire that has been filled in by the respondent, checking the completeness of the answers then arranged according to the respondent's method,
2. Quantitative questions by giving a score according to predetermined weights,
3. Loading data tabulation
4. Calculate the percentage of each sub variable with the following formula:

   \[ P = \frac{F}{N} \times 100 \]

3. Result and Discussion

   The initial process of research and development is the potential seen from the existence of facilities and carrying capacity that can be developed for electronic-based media, internet networks (wifi), so the problem is the deviation between what is expected and what happens.
   Based on the results of the analysis of the needs of lecturers and students, it can be concluded that supporting learning by using E-Book learning media is needed. Then the results of interviews from lecturers who support men's fashion courses, drawing men's clothing patterns are difficult to find learning media that motivates students. Therefore, E-Book learning media is needed to draw male fashion patterns and this media is easily accessed anywhere and anytime by students.
   A series of development results have been carried out, for that the next step is to design and develop E-Book learning media.

Product development

At this stage the learning media developed were included in the category of strongly agree / very good with the percentage of the results of the assessment of each material expert 83% strongly agreed / very good, 87.14% of the media experts strongly agreed / very good, for the results of the first stage test 63 , 3%, the results of the second phase trial 79.25%, and field trials 89.25%.
Product effectiveness
At this stage the multimedia-based E-Book learning media developed effectively are used as learning media. Based on the results of student responses to effectiveness trials conducted at the field trial stage obtained an assessment with very good criteria with an average percentage of 89.25% and lecturer responses were rated very well with an average percentage of 93.33%.

4. Conclusions
That the E-Book media is really needed in men's fashion courses, especially in making men's clothing patterns. As teaching material that supports the learning process, this E-Book learning media is a media product to help the process of delivering learning in particular making patterns so that students are actively involved in the learning process.

5. References
The Syllabus Development of Welding Technology Course SKNNI-Based PTM-FT UNIMED to Support The SMAW Welding Competence Test

Hidir Efendi¹, Izwar Lubis², Firdaus³
Department of Mechanical Engineering Education, FT Unimed, Medan Indonesia¹,²,³
hidirefendi23@gmail.com

Abstract. This study aims to develop the Syllabus of Welding Technology Courses in the FT Unimed Mechanical Engineering Education Study Program (PTM) to Support Competency Test in Certification Institutions (LSP) with Level IV Qualification of Shielded Metal Arc Welding (SMAW). Specifically, this study aims to: (1) find the SKKNI-based Welding Technology Syllabus Draft Syllabus with the Skill Passport evaluation pattern up to level IV to support the competency test according to the demands of the Professional certification body, (2) find the Syllabus Validation of the Welding Technology Courses developed by several learning experts / experts, and 3) discovering the effectiveness of syllabus application developed in learning on a limited and broad scale, and (4) disseminating syllabus developed to lecturers in the Department of Mechanical Engineering Education at FT Unimed. To produce operational products in the form of SKKNI-based Welding Technology Learning Syllabus, a process of research and development phase known as "the R&D cycle" is guided by the ADDIE model and is carried out in a very limited time. In the first phase of the survey, a survey method was used through a needs assessment and literature study. The second stage, designing a draft of the Welding Engineering syllabus. The third stage used the trial method through expert review procedures, one-on-one trials, small group trials, and field trials (real classes). In the next stage is the Implementation and Dissemination and evaluation of products. Data collection techniques used in this study were non-test techniques in the form of questionnaire responses from students and expert lecturers.

Keywords: Syllabus, SKKNI, SMAW Welding.

1. Introduction

Based on data from the Welding Association of Indonesia-Indonesian Welding Society (API-IWS) as reported in Kontan.co.id, 11 November 2017, that the development of the national manufacturing industry still requires 5,000 welding workers per year [1]. In line with this, Indonesia currently has 500 thousand welding workers, but only 10% have certificates that are recognized worldwide (https://media-indonesia.com/read/detail/212116-indonesia-akanpenuhi-kekurangan-ahli-pengelasan-ber tarafinternasional). In fact, he further stated that in 2030, the need for welding experts in the world requires at least 3.2 million people, while in Welding Camp itself as a training center for welding workers, only 2,500 people have been born since its establishment in 2015, so this shortage is a great opportunity for prospective Indonesian welding experts.
Mechanical Engineering Education Study Program (PS-PTM) of FT-Unimed is a form of formal education unit that organizes technical vocational education at the Diploma-3 (D3) and Bachelor (S1) levels. Besides preparing vocational students of Mechanical Engineering, graduates are also prepared to be able to take part in the welding industry services, in addition to other fields. Graduates are expected to take part in their fields both as workers and as job creators.

To be able to produce graduates as expected, quality learning references such as syllabus are needed. In relation to the relevance of welding employment, the structure and content of the syllabus must be aligned with the Indonesian National Work Competency Standards (SKKNI), both based on existing guidelines and the real reality of the real workplace. Likewise, the composition of the Syllabus must be in accordance with the Indonesian National Qualification Framework (KKNI). Thus the importance of the Syllabus of Welding Technology courses in order to meet welding work standards, it is necessary to reorganize the existing syllabus. Specifically, taking into account the needs of the field and the availability of available Fabrication Workshop equipment, the Syllabus was developed in the SMAW (Shielded Metal Arc Welding) by referring to the RI Minister of Manpower and Transmigration Number: KEP. 342 / MEN / X / 2007.

Syllabus is a learning plan for a particular group and / or group of subjects / themes that includes competency standards, basic competencies, subject matter / learning, learning activities, indicators, assessment, time allocation, and learning resources. In other words, the syllabus is a translation of competency standards and basic competencies into subject matter / learning, learning activities, and indicators of competency achievement for assessment (BSNP, 2006). The syllabus is used as a reference in preparing the Semester Program Plan (RPS) and Lecture Event Unit (SAP) which subsequently serves as a guideline for conducting lectures in class, related to Student and Lecturer activities for one semester. Syllabus is a set of plans and arrangements regarding learning activities, classroom management, and assessment of learning outcomes. The syllabus contains the main components that can answer the following questions: competencies that will be instilled to students through a learning activity, activities that must be carried out to instill/shape these competencies, efforts that must be made to know that the competencies are already owned by students, useful as a guide in the development of further learning, ranging from learning planning, learning management, and developing an assessment system.

In developing a syllabus it is necessary to pay attention to eight principles, namely: (1) Scientific, (2) Relevant, (3) Systematic, (4) Consistent, (5) Adequate, (6) Actual and Contextual, (7) Flexible, and (8) Comprehensive (BSNP, 2006) Scientific shows that all material and activities which are content in the syllabus must be correct and scientifically accountable Relevant related to the scope, depth, level of difficulty and sequence of presentation of material in the syllabus according to students' needs. , syllabus components are functionally interrelated in achieving competency Consistent namely the existence of a consistent relationship between basic competencies, indicators, subject matter, learning experiences, learning resources, and assessment systems Adequate, coverage of indicators, subject matter, learning experiences, sources learning, and the assessment system is sufficient to support the achievement of basic competencies, actual and contextual, that the coverage of indicators, subject matter, learning experiences, resources learning, and assessment systems pay attention to the development of science, technology, and events that occur. Flexible, the entire syllabus component can accommodate the diversity of students, educators, and the dynamics of changes that occur in schools and community demands. And Completely interpreted that, the syllabus component covers the whole domain of competence (cognitive, affective, and skills).
Research Development that refers to the ADDIE model is a development model with several stages. The stages of the ADDIE Model are (Gagne, 2015): (a) Analyze (analysis), conducting need assessments, (b) Design (design), relating to learning objects, assessment instruments, exercises and their contents, subject analysis, learning plans, and learning media, (c) Development, the process of making a draft of a design come true or the product that will be used, (d) Implementation (implementation / execution), which is a concrete step to implement the learning system that we are making and (e) Evaluation (evaluation / feedback), is a process to see whether the learning system that is being built can be successful. The ADDIE development model is a learning design model based on an effective and efficient system approach and an interactive process that is the results of the evaluation of each phase can take the development of learning to the next phase. The final result of a phase is the initial product for the next phase.

Welding Technology courses are courses that contain Theory and Practice competencies. This course is held in 2 (two) semesters with the name of the Welding Technology course in the initial semester and Advanced Welding for the following semester. Welding Technology courses are compulsory courses in the Study Program, whereas Advanced Welding courses are elective courses SKKNI is the formulation of work ability that covers aspects of knowledge, skills and / or expertise as well as work attitudes that are relevant to the implementation of the duties and conditions of the position stipulated in accordance with applicable laws and regulations and are arranged based on the needs of the business field [3]. With the competency standard mastered, then someone will be able to: (1) How to do a job, (2) How to organize it, (3) What to do, (4) How to use abilities, (5) How to use the abilities they have.

In the framework of developing the quality of the workforce, KKNI is determined based on the level of work competency qualifications from the lowest (qualification certificate 1) to the highest (qualification certificate 9), however not all levels in the IQF can be filled by certain types of work competencies in the sector or sector [2]. It was further explained that in qualifications competencies could be arranged as tiered qualifications or as non-tiered qualifications. Specifically for this study, it was conducted based on tiered qualifications. This means that the contents of the learning syllabus are arranged according to the SMAW / GMAW Welding competency qualification level starting from Level I up to Level IV [3].

The evaluation (competency test) on SKKNI can be done in two ways, namely a tiered and not tiered competency test. Non-tiered competency tests are carried out for certain professions that only require certain competencies according to those contained at that level (Kepmenakertrans Number: KEP / 342 / X / 2007). After completing learning at a certain level, participants can take competency tests at that level. However, participants cannot take the next level of competency test, if the participant is not yet competent at the previous level. If a participant has been declared competent, he / she can take the next level up to level IV, and a certificate is given after the competitor has been declared competent at all levels. This evaluation method in SKKNI is called the Skill Passport.

2. Research Methods

This research was conducted at the Mechanical Engineering Education Study Program Faculty of Engineering, State University of Medan, for 1 (one) semester in the odd semester 2019/2020. The research targets were students of the 2018 PTM S1 Study Program who were teaching Welding Technology courses.
In developing the syllabus in this research, a research and development (R&D) approach is used, which is guided by the ADDIE model and is carried out in a very limited time. In this case the development of the syllabus of welding technology courses in the first stage, the survey method was used through a needs analysis and literature study. The second stage, designing a draft of the Welding Engineering syllabus. The third stage used the trial method through expert review procedures, one-on-one trials, small group trials, and field trials. In the next stage is the Implementation and Dissemination and evaluation of products. Data collection techniques used in this study were non-test techniques in the form of questionnaire responses from students and expert lecturers. In more detail, the approach and method used is described in the form of a fishbone diagram.

3. Result and Discussion

Analysis (analysis)

At this stage a need assessment (needs analysis) is carried out to determine the learning process of welding technology that has taken place in the Unimed PTM-FT Study Program and existing infrastructure. Besides that, welding competency data is also traced as standardized according to LSP standards up to level IV with the evaluation pattern of passport skills. Learning process data is obtained from previous research conducted by the KDBK Welding Technology Team with the following results [4]: (1) Learning Process (a) Learning objectives and competencies are not based on the needs of students and industry, (b) Do not use evaluation sheet in assessing the learning process, (c) Learning activities no introduction, presentation, and closing, (d) Initial tests of student ability are not carried out, (e) Lecturer manuals and student manuals are absent, (f) Students and lecturers experiencing obstacles in participating in learning and, (g) Need to develop the learning of welding subjects that are oriented to the needs of the world; (2) Facilities and Infrastructure (a) Adequate lecture room measuring 180 m2 for 15 welding lecture participants, (b) Workshop facilities are adequate, (c) The weight of the welding subject is 2 credits, 1 meeting 200 minutes with a duration of 16 meetings in 1 semester, (d)
For students who wish to explore material Welding technology is given elective courses
Advanced welding as much as 2 more credits in the following semester, (e) Supporting
references available in the Library, mostly in foreign languages and. (f) Diktat and modules
available but not yet needs based on du / di Welding competency data up to level IV is obtained
by tracing SKKNI. The formulation of the Welder competency package for each level is as
follows [3]:

**Level I (Certificate 1)**

a. General competency groups: (1) Performing mutual communication, and (2) Identifying
   the principles of Occupational Safety and Health (K3)

b. Core competency groups: (1) Measuring with basic mechanical measuring instruments,
   (2) Reading sketches and / or simple working drawings, (3) Using hand tools and light
   machinery, (4) Carrying out mechanical cutting, (5) Carrying out mechanical cutting gas
   cutting, (6) Carrying out (basic) welding routines with a manual arc welding process, (7)
   welding underhand / flat position plates with a manual arc welding process, and (8)
   welding horizontal / horizontal position plates

c. Specific competency groups: (1) Make a report, and (2) Perform basic technical
   calculations

**Level II (Certificate 2)**

a. General competency groups: (1) Doing work in teams, and (2) Implementing
   Occupational Safety and Health and the Environment (K3L)

b. Core competency group: (1) Measuring with a precision mechanical measuring
   instrument, (2) Reading technical drawings and welding symbols, (3) Welding upright
   /vertical position plates with a manual arc welding process, (4) Welding over head
   position / overhead plates with the manual arc welding process, (5) Weld the horizontal
   axis pipe position can be rotated with the manual arc welding process, and (6) Weld the
   vertical axis position can be rotated

c. Specific competency groups: (1) Interpret English literature, and (2) Operate Computers

**Level III (Certificate 3)**

a. General competency groups: (1) Implement a quality system, (2) Plan routine tasks

b. Core competency group: (1) Welding the horizontal axis position pipe cannot be rotated
   with a manual arc welding process, (2) Welding the oblique axis position pipe cannot be
   rotated by a manual arc welding process, and (3) Welding the plates and / or pipes of all
   positions with a manual arc welding (SMAW) process

c. Specific competency groups: (1) Apply material handling, (2) Get to know the
   characteristics and use of materials, (3) Perform welding machine and equipment
   maintenance, and (4) Apply welding metallurgy

**Level 4 (Certificate 4)**

a. General competency groups with competency units: (1) Carry out workplace preparation,
   (2) Participate in the quality system

b. Core competency groups with competency units: (1) Lead small work teams, (2) Improve
   welding results, (3) Identify Welding Procedure Specifications (WPS), (4) Demonstrate
   welding practices to welder groups / levels below , (5) Making fillet welding connections
   according to WPS for plate-to- plate welding, pipe to pipe, and pipe plate in accordance
   with the welding process used, (6) Making groove connections according to WPS for
plate-to-plate welding and in accordance with welding process used, (7) Making groove weld connections according to WPS for pipe to pipe welding and in accordance with the welding process used.

c. Specific competency groups with competency units: (1) Operate welding machines according to WPS

If observed, the competency package contained in the competency group at each level, it appears that the competencies demanded are closely related to Learning Achievement (CP) in other subjects. Such as measuring competence with basic mechanical measuring instruments, competence in reading sketches and/or simple work drawings, competence in carrying out cutting mechanically, and so on.

**Level I**

<table>
<thead>
<tr>
<th>Competency Sequences To Be Applied To Welding Technology Courses</th>
<th>Prerequisites To follow each level of Welding competency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifying the principles of Occupational Safety and Health</td>
<td>1. Measuring with a basic mechanical measuring instrument</td>
</tr>
<tr>
<td>Carrying out (basic) welding routines with a manual arc welding process</td>
<td>2. Read simple sketches and/or work drawings</td>
</tr>
<tr>
<td>Welding underhand/flat position plates with a manual arc welding process</td>
<td>3. Using hand tools and light machinery</td>
</tr>
<tr>
<td>Welding horizontal/horizontal position plates</td>
<td>4. Carry out mechanical cuts</td>
</tr>
<tr>
<td>Make a report</td>
<td>5. Carry out cuts with Gas</td>
</tr>
<tr>
<td></td>
<td>6. Perform basic technical calculations</td>
</tr>
</tbody>
</table>

**Level II**

<table>
<thead>
<tr>
<th>Competency Sequences To Be Applied To Welding Technology Courses</th>
<th>Prerequisites To follow each level of Welding competency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welding upright/vertical position plates with a manual arc welding process</td>
<td>1. Do work in teams</td>
</tr>
<tr>
<td>Welding over near position/over near plates with the manual arc welding process</td>
<td>2. Measuring with a precision mechanical measuring instrument</td>
</tr>
<tr>
<td>Weld the horizontal axis pipe position can be rotated with manual arc welding process</td>
<td>3. Reading technical drawings and welding symbols</td>
</tr>
<tr>
<td>Weld the vertical axis position can be rotated</td>
<td>4. Interpreting English literature</td>
</tr>
<tr>
<td></td>
<td>5. Operating the Computer</td>
</tr>
</tbody>
</table>

**Level III**

<table>
<thead>
<tr>
<th>Competency Sequences To Be Applied To Welding Technology Courses</th>
<th>Prerequisites To follow each level of Welding competency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welding the horizontal axis position pipe cannot be rotated with a manual arc welding process,</td>
<td>1. Implement a quality system</td>
</tr>
<tr>
<td>Welding the oblique axis position pipe cannot be rotated by a manual arc welding process,</td>
<td>2. Plan routine tasks</td>
</tr>
<tr>
<td>Weld the plates and/or pipes of all positions with a manual arc welding (SMAW) process</td>
<td>3. Implement material handling</td>
</tr>
<tr>
<td>Perform welding machine and equipment maintenance</td>
<td>4. Apply welding metallurgy</td>
</tr>
</tbody>
</table>
Level IV

<table>
<thead>
<tr>
<th>Competency Sequences To Be Applied To Welding Technology Courses</th>
<th>Prerequisites To follow each level of Welding competency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carry out workplace preparation</td>
<td>1. Competent at level I until IV</td>
</tr>
<tr>
<td>Participate in the quality system</td>
<td></td>
</tr>
<tr>
<td>Lead small work teams</td>
<td></td>
</tr>
<tr>
<td>Improve welding results</td>
<td></td>
</tr>
<tr>
<td>Identify Welding Procedure Specifications</td>
<td></td>
</tr>
<tr>
<td>Demonstrate welding practices to welder groups / levels below</td>
<td></td>
</tr>
<tr>
<td>Making fillet welding connections according to WPS for plate-to-plate welding, pipe to pipe, and pipe plate in accordance with the welding process used</td>
<td></td>
</tr>
<tr>
<td>Making groove connections according to WPS for plate-to-plate welding and in accordance with welding process used</td>
<td></td>
</tr>
<tr>
<td>Making groove weld connections according to WPS for pipe to pipe welding and in accordance with the welding process used</td>
<td></td>
</tr>
<tr>
<td>Operate welding machines according to WPS</td>
<td></td>
</tr>
</tbody>
</table>

The competency package as seen in the composition of the order of competence to be applied to the welding technology courses above, students are required to master certain competencies as a prerequisite to follow each level of welding competency found in other courses.

SKKNI-based Welding Technology Syllabus with passport skill evaluation pattern to support the competency test as described above is still a draft that will be submitted through trials and evaluated as a consequence of the ADDIE Model consisting of five steps namely: 1) Analyse (analysis), conduct need assessment (needs analysis), (2) Design (design), relating to the object of learning, assessment instruments, exercises and their contents, subject analysis, learning plans, and learning media, (3) Development (development), the process of making the design draft into a process reality or product that will be used, (4) Implementation (implementation / execution), which is a concrete step to implement the learning system that we are making and (5) Evaluation (evaluation / feedback), is a process to see whether the learning system that is being built can succeed. The discussion of the SKKNI-based welding technology syllabus as previously designed, is an initial product in this study that still needs further testing. However, it can be assumed that this syllabus draft will be more effectively applied in learning in the context of ownership of welding competencies by students that can support the success in taking the competency test at the certification body in the SMAW welding scheme.

4. Conclusion

The Welding Technology Syllabus up to level IV SMAW welding as proposed can be followed by students by first meeting the competency prerequisites as required for each level of competence. To follow the learning at each level, the prerequisites may be in line with the
implementation of the competencies of each level, but to follow the evaluation at each level, it must be completed following the specified prerequisites. Regarding the evaluation items, what is called the Competency Test material (MUK) in the competency test still needs to be developed further in the future as a necessity so that college participants do not experience obstacles when they will take competency tests on the LSP according to the Scheme in the SMAW Welding in accordance with the Level followed.

5. References


The Feasibility and Effectiveness of Interactive Multimedia using Gerlach and Ely Model in Learning Planning Courses

Erma Yulia
{e-mail: ermayulia@unimed.ac.id}
Universitas Negeri Medan, Medan Indonesia

Abstract. This study discusses about utilization of information technology and communication’s equipment as learning activity and teaching effectively. The objective of this research is to get interactive multimedia on learning planning courses such as, textbook of learning planning and e-learning. The method used is research method and development from Borg and Gall. The steps of development of learning material oriented on Gerlach and Ely method which consist of determining material, goal, appraising entry behavior, determining strategy, making group, allocating time and place, choosing study source, evaluation, and feedback. The data aggregation techniques do by observation and questioner. Expedience of learning media obtained by doing expert validation, one to one evaluation, small group evaluation and field trial. The conclusion of this research resulting interactive multimedia courses material which give understanding about corrupting and non-corrupting experiment, and increasing the output of student value from pre-test and post-test.

Keywords: interactive multimedia, Borg and Gall, Gerlach and Ely

1. Introduction

Facing the era of globalization, various challenges related to future demands that arouse public awareness of the role of Higher Education (PT), especially in improving the function of higher education relevant to community development. Conny stated that the development of human capacity or Human Capacity Development (HCD) is the result of interaction between individuals and communities who have chance to participate. HCD refers to the constellation of skills, attitudes and behaviors in carrying out life towards independence, while at the same time having high competitiveness and resilience to the turmoil of the world economy [1].

The efforts to improve student achievement are constantly being carried out by higher education institutions including Medan State University. The learning process is identical to the process of delivering information or the communication process. In connection with that, the learning activities needed a media that functioning as the learning aid for the process of delivering learning material. One important thing that needs attention is that students should not be alienated from learning media, especially computer-based media.
Multimedia or computer based learning has five advantages, namely: (1) effective in improving student mastery in all levels of education; (2) it is very effective in improving student mastery at the elementary school level, which continues at the secondary level through to college; (3) has a positive effect on student attitudes toward subject matter, learning and on computer technology; (4) can save time for learning; (5) Research findings from various studies and with different methods and different student settings have conclusive consistency [2].

To develop multimedia-based learning must use a development model. The development model in this study uses the Gerlach and Ely model as shown in figure 1, which is a systematic way of identifying, developing, and evaluating a set of materials and strategies aimed at achieving certain learning goals.

Based on the advantages possessed by learning by using multimedia, learning needs to be developed by combining some of the latest computer applications that so far have not been available in the Material Testing course. With this multimedia learning, the expected outcome is high technology and is the result of creativity in educational innovation. Especially in providing learning media that can improve student competencies.

The development of multimedia-based learning media must be carried out gradually and thoroughly based on one model. In this study the development of instructional media refers to the Gerlach and Ely models. The advantage of the Gerlach & Ely model lies in the initial ability tests before learning activities. Besides that this model is very thorough in planning and implementing learning. This can be seen from the planning of grouping learning, the division of time for each activity, and the arrangement of the learning space. In accordance with its class-oriented characteristics, this development model is suitable for small-scale learning.

![Fig 1. Steps of Gerlach & Ely Development Model](image-url)
The understanding of the model in this study refers to the definition expressed by Miarso [3] that the model is a representation of a process in free and/or narrative form, by showing the main elements and their structure. In this case it is possible to interpret narrative models in graphic form, or vice versa. Robins define that “model is an abstraction of reality; a simplified representation of some real world phenomenon”. That is, the model is a representation of several phenomena that exist in the real world [4].

According to Miarso there are various kinds of models, three of which are (1) conceptual models, which are in essence an embodiment of a theory in other words a conceptualization of theories; (2) procedural model, which is prescriptive in nature means giving a prescription about how something is. In essence is an embodiment of the stages of the process of forming a model; and (3) physical model, is a model in physical form [5].

Gustafson and Branch said that 'the development of instructional media' consisted of at least five main activities, namely: (1) analyzing the conditions of learning and the needs of learners; (2) designing a series of specifications that are effective, efficient, and relevant to the learning environment; (3) developing all materials for all learners and material management; (4) implementation of the learning design results; and (5) formative and summative evaluation of the results of development [6]. Byrnes said that the constructivist view is not new, but is an amalgamation of various approaches.

Seels dan Richey defines multimedia is a collection of material in a variety of different media (text, graphics, audio, visual, etc.) that is designed to be presented in an integrated manner through the use of a medium (ie computer) [7]. While Schwier and Misanchuk define that Multimedia: An instructional program which includes a variety of integrated sources in the instruction. The program is intentionally designed in segments, and viewer responses to structured opportunities (e.g., menus, problems, simulated crises, questions, virtual environments) influence the sequence, size, content, and shape of the program [8].

This research aims to develop learning media for testing multimedia based on interactive multimedia using Gerlach and Ely models. The feasibility of learning media for interactive multimedia-based material testing using Gerlach and Ely models, and knowing the effectiveness of interactive multimedia-based learning media testing materials using Gerlach and Ely models.
2. Research Methods

2.1. Steps of research assessment

The development of learning media which is used as the basis for this research and development is the Gerlach & Ely development model as shown in Figure 2.

![Gerlach & Ely Development Model](image)

**Fig 2. steps of research**

2.2. Data Collection and Analysis Techniques

The data in this study were analyzed qualitatively, and the data collection instruments developed in this study were related to the data collection techniques carried out at each stage of the study, namely: a list of questions in the form of a questionnaire, used to ask questions and observations in the development and validation stages experts, as well as learning outcomes tests in the form of objective tests and action tests used to measure student competency improvement.

3. Result

3.1. Result of the development

The results of the development of interactive multimedia material testing courses, include three forms, namely 1) conceptual development; 2) procedural development; and 3) physical development as shown in figure 3.
CONCEPTUAL

- BORG & GALL
- KEMP
- BRANC
- SITEPU

Gerlach & Ely Model

Interactive Multi-media Learning

PROCEDURAL

OBSERVASI
- Facilities/infrastructure
- Learning process
FGD Lecturer of Learning Design outside UNIMED.
Needs: Theory, Method, Strategy and evaluation

1. Determine the material
2. Formulate TIU & IC
3. Entry behavior
4. Determine student characteristics
5. Choosing a Strategy
6. Create groups
7. Allocate time
8. Allocate places
9. Choose learning resources
10. Validation:
   - Expert
   - One to one
   - Small group
   - Pretest/Post test
11. Evaluation/Field
12. Feedback analysis
   - Class observation

PHYSICAL

MULTIMEDIA INTERACTIVE LEARNING

CD Presentation

Interactive Learning Multimedia

Fig 3. Result of development
3.1.1. Result of conceptual development

Conceptual development is an embodiment of the conceptualization of the theories and principles underlying the formation of interactive multimedia-based learning in this material testing course. The results of conceptual development can be seen in Figure 4.
### 3.1.2. Results of Procedural Development

The result of procedural development is the realization of the stages in the formation of interactive multimedia-based learning media. This procedural development is a combination of the Gerlach and Ely development model with the Dick and Carey development model, which consists of 10 steps namely: (1) determining the material; (2) formulating learning objectives; (3) Entry Behavior; (4) choosing a learning strategy; (5) creating groups; (6) allocating time; (7) allocating space; (8) choosing learning resources; (9) evaluation; (10) feedback analysis, developed and modified to 12. The complete procedural development scheme can be seen in Figure 5.

![Procedural Development Scheme](image)

**Fig 5. Procedural Development Scheme**

### 3.1.3. Results of Physical Development

Physical development in the form of physical form of Learning Design product courses, in the form of printed textbooks and interactive multimedia in Compact Discs (CD). The appearance of the front and back cover of the printed textbook is shown in Figure 6, 7, 8, 9, 10.
Fig 6. Learning Textbook Design Learning

Fig 7. The main menu Interactive Multimedia Learning

Fig 8. Display of Interactive Multimedia Operating Instructions
3.2. Feasibility of Interactive Multimedia

Furthermore, for the perfection of products resulting from the development of interactive multimedia, a feasibility test is carried out by experts, instructional design experts, material experts and instructional media experts.

3.2.1 Feasibility Learning Expert Design

Inputs and suggestions from learning design experts are divided into 4 (four) aspects namely learning objectives, learning strategies, material preparation and evaluation tools. Comments / inputs for improvement / revision of the question items are given in the Likert scaling score 1 to 5. The assessment of the learning design expert is shown in the diagram in Figure 11.

![Fig 11. Average Learning Design Expertise Feasibility Score](image-url)
The mean score given by the learning design expert for 4 (four) aspects of the assessment is 4.58 or 91.5%, thus the assessment of the feasibility of the learning design expert, including the category is very good.

3.2.2. Feasibility of Expert Material

Material expert assessment consists of 3 (three) aspects as seen in figure 12, namely the preparation of learning materials, presentation of learning materials, and assessment tools. An assessment of the question items is given in the scaling score 1 - 5, and comments / input for improvement / revision.

![Feasibility of Expert Material](image)

**Fig 12. Average Score of Material Expert Eligibility Results**

Of the three aspects judged by the material experts, the average score obtained was 4.48 or 89.6% and included in the excellent category.
3.2.3. Feasibility of Learning Experts

![Feasibility of Learning Experts](image)

From the feasibility of instructional media experts as shown in figure 13 gave a mean score of 4.42 or 88.3% and included in the category of very good. The eligibility of the expert gave an average score of 4.52 with a Likert scale of 5 or 90.4%.

3.3. Effectiveness of Interactive Multimedia

<table>
<thead>
<tr>
<th>No</th>
<th>Test</th>
<th>Average Score</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>One to one test</td>
<td>4.44</td>
<td>88.8%</td>
</tr>
<tr>
<td>2</td>
<td>Small Group Test</td>
<td>4.42</td>
<td>88.4%</td>
</tr>
<tr>
<td>3</td>
<td>Pretest and posttest</td>
<td>36.83</td>
<td>90.95%</td>
</tr>
</tbody>
</table>

Interactive multimedia has been declared effective proven by an increase in student learning outcomes by 90.95% (pre-test and post-test results) as shown in table 1.
4. Conclusion

Procedural development is in line with the Gerlach and Ely models that have been modified with Dick and Carey. The physical form of the development results in the form of interactive textbooks and multimedia learning materials stored on presentation CDs. The mean score given by the learning design expert is 4.58 or 91.5%, the expert judgment of the material average score obtained is 4.48 or 89.6%, the learning media expert assessment gives a mean score of 4.42 or 88.3% and includes very good categories. The effectiveness of the learning material is done at the end of the physical test by carrying out the post-test, based on the calculation of the mean pre-test value is 40.50 and the post-test average is 77.33. Judging from the results of the pre-test and post-test scores an increase of 36.83 or 90.95%. This means that there is an increase in learning outcomes during the learning process of the Material Testing course by using the learning material development results that have been applied.

5. References

Development of Integration Learning Models
Industrial Engineering Courses in Fakultas Teknik
Universitas Negeri Medan

Rosnelli¹, Sarwa², Fahmy Syahputra³
Fakultas Teknik Universitas Negeri Medan¹,²,³
rosnelli@unimed.ac.id

Abstract. This study aims to develop learning tools in Industrial Engineering at the Faculty of Engineering, Medan State University. The specific objectives of this research are to develop: 1) Course Learning Outcomes (CLO), 2) Learning Outcomes (LO), 3) Indicators of Achievement of Learning Objectives, and 4) Study Material on Industrial Engineering learning. The research method used is Research and Development. The research sample is lecturers and students who use the KKNI curriculum. Data collection techniques used were observation and documentation study for analyzing the needs of developing learning devices. Interviews, questionnaires and classroom observation sheets are conducted to see the needs of learning activities in class. The results showed that the implementation of industrial engineering learning began from the design of superior products from areas of expertise of interest to students to produce engineering results of student ideas; The Semester Learning Plan is designed for: 1) Course Learning Outcomes, 2) Learning Outcomes, 3) Indicators of Achievement of Learning Objectives, and 4) Study Materials. The study material developed is the analysis of customer needs, analysis of market competition, identification of equipment and material needs in accordance with the product to be made, the determination of product specifications, determination of minimum equipment requirements in manufacturing products, work steps to manufacture products effective and efficient, producing ideas of engineering works in accordance with the field of expertise, designing product exhibitions of ideas of engineering works, making reports on ideas of engineering works in the form of scientific articles, carrying out exhibitions of engineering products of ideas and making reports on activities of product exhibitions.

Keywords: Development of Learning Devices, Industrial Engineering.

1. Introduction

Indonesian National Qualification Framework (KKNI) contains an equalization mechanism between the quality of graduates against the required qualifications of the workforce. To deal with the problem of unemployment caused by not recognizing one's competence, the mechanism for recognition of past learning outcomes and recognition of current competencies is urgently needed. KKNI can underlie a strategy of equalizing one's qualifications obtained from the world of formal, non-formal, informal education, even from work experience. Referring to KKNI, the Strata 1 level is located at Level 6. To improve the quality of graduates especially in carrying out learning, Unimed implements a policy of conducting Focus Group Discussion on the Development of KKNI Evaluation Model for University, Faculty and Faculty and Study Programs levels.
The efforts made to achieve the educational indicators that have been set by Unimed are conducting studies and developing the quality of learning using various approaches. The purpose of the study is to meet the needs of graduate users and their relevance to the actual condition of existing Unimed courses resources. In addition to the University level in curriculum learning that refers to KKNI there are leadership courses that bind the University. At the Faculty of Engineering level there are Industrial Engineering courses that are binding at the Faculty.

Industrial Engineering courses in the learning process in the classroom, in workshops and in the field, require standardized learning tools, so that anyone who teaches these courses, students will receive the same learning from lecturers supporting the courses. Learning tools for Industrial Engineering courses are documents that contain minimum standards of learning content, depth and breadth of learning material that refers to graduate learning outcomes. The depth and breadth of learning material can be achieved by applying 6 tasks to students namely Routine Tasks (TR), Critical Book Review (CBR), Critical Journal Review (CJR), Mini research (MR) and Project (PR) (Handbook of KKNI Faculty implementation Engineering, 2016). The learning guide for doing 6 student assignments can be used to achieve 8 (eight) graduate competencies, namely: (1) Competent logical and analytical thinking in solving problems; (2) Competently work independently and cooperate with others; (3) Competently communicating ideas and information verbally or in writing; (4) Competently increasing science and expertise independently; (5) Competently mastering and using technology; (6) Competently evaluating, analyzing data, and making effective solutions to overcome problems; (7) Competently plan and organize activities; and (8) Competently adapting to the work environment and society (Engineering Faculty Renstra; 2016). Industrial Engineering learning courses can be used to control learning in order to realize the vision of a superior Engineering Faculty in the fields of engineering and vocational education, industrial engineering and culture that ultimately can also realize the vision of the University that excels in the fields of education, culture, and industrial engineering. The aim of the research is to develop the Industrial Engineering learning device.

The development of KKNI curriculum learning tools, especially Faculty and Department courses in the Faculty of Engineering, State University of Medan is important in efforts to realize the Vision and Mission of the Faculty of Engineering. Industrial Engineering courses are courses that bind all study programs in the Faculty of Engineering. Implementation of the KKNI curriculum learning process in an effort to realize student competencies in order to compete in the world of work at the Faculty of Engineering applying 6 student assignments which include Routine Tasks (TR), Critical Books Report (CBR), Critical Journal Review (CJR), Mini research (MR), Engineering Ideas (RI) and Project (PR). Work on student assignments, especially Mini research (MR), Engineering Idea (RI) and Project (PR) as a demand for subject learning products.

The development of KKNI books at the Fakultas Teknik Universitas Negeri Medan can facilitate lecturers and students in an effort to improve the quality of graduates and accelerate the completion of student studies. In addition, the results of this study will produce: 1) Course Learning Outcomes (CLO), 2) Learning Outcomes (LO), 3) Indicators of Achievement of Learning Objectives, and 4) Study Material on Industrial Engineering learning. The results of this research development product can be used as a guide as well as to control the learning process and assessment of Industrial Engineering learning in the Faculty of Engineering. The product of this development research can be used as a basis for the development of industrial engineering learning devices. Thus the learning process can inspire students to achieve their stated goals [1].
The Education Process in Higher Education is an important element in efforts to produce superior quality human beings. In addition, education is an important aspect of one's life and is a strategic aspect for a country. The nature of education is complex, dynamic and contextual [2]. In the world of modern education, the curriculum is defined as more than a collection of subject matter [3]. The curriculum is seen as a written material that contains a description of the educational program of a school that must be implemented from year to year [4]. The curriculum is a set of plans and arrangements regarding the objectives, content, and learning materials as well as the methods used to guide the implementation of learning activities to achieve certain educational goals (Director General of Islamic Education, 2006). The curriculum as a guide for organizing learning activities gives the meaning that in the curriculum there is a guide for interaction between the teacher and students [5].

The suitability of lecturers' competencies with the courses they teach will be able to inspire and encourage lecturers to conduct research in accordance with their field of science. It also can inspire lecturers in doing community service to do it in accordance with their competencies. In these conditions, the lecturer will be able to function himself as a visionary leader in the learning class [6]. Visionary lecturers will have the ability to lead students to be able to create, formulate, communicate, socialize, transform and implement ideal thoughts originating from themselves, so students can successfully do the 6 tasks given.

Visionary lecturers will be able to carry out learning tasks according to their competencies. If it is supported by the suitability of laboratory staff and technicians for their work, a good work team will be formed to achieve the learning objectives. Good teamwork will expedite the process in an effort to improve the performance that has been set [7]. The effectiveness of the work team will be able to facilitate in achieving the goals set together [8]. The lecturer team along with the laboratory staff and technicians, will be able to help the effectiveness of the learning process carried out by the lecturer when carrying out the practice. The learning atmosphere in workshops and laboratories by making effective laboratory assistants and technicians in accordance with their work will be able to inspire students to be able to train Competent logical and analytical thinking in solving problems that arise in carrying out practicum.

Effective learning and facilitated by visionary lecturers and supported by the suitability of laboratory staff and technicians for their work, will be able to help inspire students to improve their knowledge and expertise in the chosen field of science, can work independently and in groups. This is in accordance with the opinion that if an individual is inspired and motivated to do his work will be able to improve his performance, because the individual maximizes his potential in achieving the goals set [9]. In addition, students who have been inspired and motivated will be able to improve the competence of students in terms of mastering and using technology, both in laboratories and workshops as well as technology equipment used in industry when they take industrial field practice courses.

The Engineering Faculty course to be developed is Industrial Engineering. Industrial Engineering is a Faculty course that is a hallmark of the Faculty of Engineering. The aim of the Industrial Engineering course is that students are competent in designing the mechanism of making products and producing and carrying out exhibitions of engineering products in accordance with the field of expertise / specialization [10][11]. The learning achievements of Industrial Engineering are: 1) designing the mechanism of making products and producing an engineering work of ideas in accordance with the field of expertise / specialization and 2) holding an exhibition of engineering products of the work of engineering ideas according to the field of expertise / specialization.

Indicators of learning achievements in Industrial Engineering show that after completing lecturing students will be able to: 1) Analyze the needs of production customers, 2) Analyze...
market competition and 3) Analyze the needs of materials in accordance with the product to be made (the work of engineering ideas according to the field of expertise/ specialization). In the industrial engineering course students will find that the phenomenon of changing needs and lifestyles caused by the times will spur industrial companies as producers to continue to innovate. Old products will be continually redesigned, and new products are incessantly developed [12]. Industrial companies must develop new products to maintain sales [13]. In the Industrial Engineering course, students are trained to be able to develop one of the products in accordance with their area of expertise. Product development is a series of activities that start from the analysis of perceptions and market opportunities, then end with the production, sales and shipping stages of the product [14].

The learning strategy of industrial engineering courses will train students for product development in terms of: 1) developing existing forms, 2) adding to existing models, 3) imitating competitor strategies, 4) adding products. Consumer desires that might be facilitated from product development in industrial engineering courses such as: 1) fulfilling the desires of consumers who are not satisfied with the old product, 2) to utilize the remnants of materials, 3) to prevent boredom, 4) simplify the product [15]. Learning industrial engineering courses will foster student commitment in product development in accordance with the chosen field of expertise. Commitment to support innovation in product development will be able to motivate students in developing new products.

The research road map is shown in the following figure.

![Flowchart of research](image)

From the flowchart of the picture above, shows the flow of research starting from field survey to capture data as it is according to field conditions. Based on the study of literature, a plan is made for the preparation of the development process of the Faculty (Industrial Engineering) and Department (Product Design) curriculum learning courses in the KKNI curriculum within the Faculty of Engineering consists of Collection of Lecture Contracts, guidance on Monitoring and Evaluation and Internal Quality Assurance for the level of the Faculty of Engineering. Then validation of experts is needed to ensure that the development of industrial engineering and product design courses is feasible.

Based on the expertise of the experts, a revision of the Documents for the Faculty and Department course learning instruments was drafted, as well as a Collection of Lecture Contracts, guidance on Monev and Internal Quality Assurance for the Faculty of Engineering level. Then the validation of experts is needed to ensure that the development of industrial
engineering and product design courses is declared feasible. Then validation of experts is needed to ensure that the development of industrial engineering and product design courses is feasible.

Based on theoretical studies, it can be concluded that the industrial engineering course is a characteristic course at the Faculty of Engineering given to all students in semester 6. Course Learning Outcomes: Industrial engineering courses are after completing the industrial engineering courses competent students determine products, design the mechanism of the process of making products, producing and carrying out exhibition of product engineering ideas in accordance with the field of expertise / specialization.

2. Research Method

The place of research is the Faculty of Engineering, Medan State University. The research design to be used is classified as ex post facto research using Research and Development. Descriptive approach is used to analyze variables (data) or review reviews of the need for learning tools for Industrial Engineering courses, Lecture Contracts, guidance on Monitoring and Evaluation and Internal Quality Assurance for the Faculty of Engineering level. Then validation of experts is needed to ensure that the development of industrial engineering courses is feasible.

3. Results and Discussion

The results of the research development of the standardization of the principles of learning in industrial engineering courses begin with the formulation of the vision, mission, goals, and objectives of the Faculty of Engineering. This is done so that alignment occurs between the mission of the Faculty of Engineering with the achievement of learning in Industrial Engineering courses. The vision of the Unimed Engineering Faculty is to become an excellent Faculty in the fields of engineering and vocational education, industrial engineering and culture. The mission of the Faculty of Engineering is: 1) Providing quality education in the fields of engineering and vocational education; 2) Carrying out research in the context of developing science and technology in the fields of engineering and vocational education; 3) Providing services to the public in the fields of engineering and vocational education; 4) Develop a culture of entrepreneurship and establish cooperation with institutions inside and outside Unimed; 5) Fostering a conducive scientific culture by empowering all its potential; 6) Fostering a healthy academic atmosphere and organizational climate.

The objectives of the Unimed Engineering Faculty are: 1) To produce superior and professional graduates in the fields of engineering and vocational education; 2) Produce and develop innovative and productive work to meet stakeholder needs; 3) Produce, develop, and disseminate knowledge and technology in the fields of engineering and vocational education for the quality of people's lives; 4) Produce graduates who are capable of entrepreneurship and able to collaborate with institutions inside and outside Unimed; 5) Creating a conducive scientific culture by empowering all potentials possessed; 6) Fostering a healthy academic atmosphere and organizational climate.

Competencies and Quality Graduates of the Unimed Faculty of Engineering are: 1) Competently applying the principles of education and teaching in the field of technology and vocational training; 2) Competent academic thinking in technology and vocational fields; 3)
Mastering Technology in an applicative, adaptive and innovative way; 4) Competently communicating ideas of information orally and in writing; 5) Competently applying information technology; 6) Competent to work independently and cooperate with others; 7) Competently adapting to the work environment and society; 8) Have the attitude and interest in entrepreneurship.

Based on the vision, mission, goals, objectives and competencies of the graduate of the Faculty of Engineering, a description of the Industrial Engineering course is compiled in an effort to support the established competency of graduates. Course Learning Outcomes (CLO) in Industrial Engineering courses is a student who is competent in determining the product, designing the mechanism of the product manufacturing process, producing and carrying out an exhibition of product engineering ideas in accordance with the field of expertise / specialization. Industrial Engineering courses examines the analysis of customer production processes, analysis of market competition, production processes and management (materials and means of production, steps of production, production technology) in producing a product / technology, and conducting exhibitions of course products in accordance with the area of expertise / student specialization.

The learning outcomes of the Industrial Engineering course that is after attending lectures that students will be able to: 1) Determine the products to be made based on the engineering of ideas in accordance with the field of expertise / specialization; 2) Designing the mechanism of the process of making products and producing an engineered work of ideas in accordance with the field of expertise / specialization; 3) Carry out exhibitions of engineering products in accordance with the field of expertise / specialization.

The learning objectives of Industrial Engineering courses are goals that must be achieved by students after completing lectures, that is, students will be able to: 1) Determine the products to be made based on the engineering of ideas in accordance with the field of expertise / specialization; 2) Analyzing the need for tools and materials in accordance with the product to be made (the work of engineering ideas in accordance with the field of expertise / specialization); 3) Determine the appropriate equipment and materials in the manufacture of products of engineering ideas in accordance with the field of expertise / specialization; 4) Designing the mechanism of making products of the work of engineered ideas according to the field of expertise / specialization; 5) Producing a work of engineering ideas in accordance with the field of expertise / specialization; 6) Designing exhibits of products of ideas engineered in accordance with the field of expertise / specialization; 7) Carrying out an exhibition of engineering products of ideas created by the idea of engineering in accordance with the field of expertise / specialization.

Indicators of achieving the learning objectives of the Industrial Engineering courses are: 1) Competently determining products to be made based on engineering ideas in accordance with the field of expertise / specialization; 2) Competently analyzing the material requirements in accordance with the product to be made (the work of engineering ideas in accordance with the field of expertise / specialization); 3) Competently consider the selection of materials in the manufacture of products (product specifications of the work of engineering ideas in accordance with the field of expertise / specialization of students; 4) Competently determine the appropriate equipment in making products of the work of engineering ideas in accordance with the field of expertise / specialization; 5) Kopeten designs the mechanism for making products of the work of engineered ideas according to the field of expertise / specialization; 6) Competently producing a work of engineering ideas in accordance with the field of expertise / specialization; 7) Competently design product exhibitions made from engineering ideas according to the field
of expertise / specialization; 8) Competently carrying out exhibitions of engineering products of ideas created by engineering ideas in accordance with the field of expertise / specialization.

The subject matter of Industrial Engineering courses are: 1) Approval of expert staff on the product of engineered ideas in accordance with the field of expertise / specialization (based on analysis of production customer needs and analysis of market competition); 2) Identification of the need for tools and materials in accordance with the product to be made; 3) Determination of suitable materials according to needs (product specifications); 4) Determination of minimum equipment requirements in manufacturing products according to product specifications; 5) The work steps of making products effectively and efficiently; 6) Producing works of engineering ideas in accordance with the field of expertise / specialization; 7) Design an exhibition of product ideas and engineering according to the field of expertise / specialization; 8) Carrying out an exhibition of engineering products of ideas created by the idea of engineering in accordance with the field of expertise / specialization. For complete product development results in the attachment.

The formulation of learning achievement in Industrial Engineering courses still refers to the formulation of learning achievement of the Faculty of Engineering and the formulation of learning achievement of Medan State University. The formulation of learning achievement in Medan State University is derived from the vision and mission of Medan State University that contains the general profile of graduates as competitive and comparative advantage from Medan State University. University learning outcomes display more soft skills than hard skills that must be possessed by Medan State University graduates. The profile of the graduates of the Faculty of Engineering refers to the achievements of university learning, so that a continuation of the process to achieve the vision and mission of the university is formed. However, the uniqueness of graduates of the Faculty of Engineering and study programs is an important part of showing the competitive advantage of each study program in the Faculty of Engineering.

Industrial Engineering is a subject that is characteristic of Engineering Faculty students. Industrial Engineering courses are compulsory courses for students to take in each study program at the Faculty of Engineering. The formulation of graduate study profile is the role expected by study program graduates in the community / work world. This profile is the educational outcome to be addressed. The graduate profile is the answer to the question: what kind of graduates will the study program produce after they complete the entire set of education (outcomes); i.e. "After graduating, what will the graduates of this study program be?" The formulation of the profile writes the professional roles and a series of competencies (learning outcomes) that graduates must have to carry out these roles in a professional, accountable, and noble manner, having knowledge, skills, independence, and attitude to discover, develop, and apply science, technology, and art, which is beneficial to humanity. (PP No. 19 of 2005 Article 26 paragraph (4).

The formulation of graduate competency standards is prepared based on what competencies must be possessed by graduates of the study program as the learning output. Formulation of Learning Outcomes Program (PLO) is a complete description of the profile of graduates with regard to what competencies students must have after graduating from a study program at the Faculty of Engineering. The learning outcomes of the Industrial Engineering course are formulated based on the results of a tracer study (tracking study) and analysis of the needs of the world of work related to the competencies built, as well as the level of qualifications referred to from the Indonesian National Qualification Framework. Students can do at the end of the lecture when they integrate learning from all lectures they get. Each CLO must be in line with one or more study program learning outcomes (PLO).
Conduct FGD with the Dean, department heads, Study Program Heads and Lab heads regarding the implementation of KKNI-based learning tools standardization. The Dean Team compiles the learning outcomes of the Faculty courses derived from the vision, mission, goals and competencies of the graduates of the Medan State University. The Task Post Team of the Faculty decreases the learning outcomes of the Department courses based on the vision, mission, goals and competencies of the Faculty of Engineering graduates. Department courses are based on the vision, mission, goals and competencies of graduates of the Faculty of Engineering.

Performed FGD at the Faculty with participants ranging from the Dean, the faculty task post team and the head of the Department as well as the head of the Study Program within the Faculty of Engineering to align the achievements of the Faculty of Engineering learning with the achievements of the Learning of the Department at the Faculty of Engineering. Performed FGD at the Faculty with participants ranging from the Dean, the faculty task post team and the head of the Department, the head of the Study Program and the head of the Workshop and laboratory within the Faculty of Engineering to align the learning achievements of the Faculty of Engineering with the achievement of the learning of the Department's subject and the availability and tools and materials in the Faculty of Engineering.

Learning planning is the main determinant of what is taught. The curriculum is published, transformed, and adapted in the planning process by adding, deleting, interpreting, and making decisions about the speed, sequence, and emphasis (teaching). In the planning of learning including allocating learning time for individuals and groups of students; arranging student groups; organizing daily, weekly and quarterly schedules; and compensate for time for interruptions outside the classroom and communicate with substitute lecturers.

After completing the preparation of learning tools in the learning device standardization activities by the research team, this draft was taken to the FGD for all Faculty of Engineering functionaries in an effort to monitor and evaluate their suitability and harmony with the competencies of engineering faculty graduates. Then revised again. After the revision, discussions were still being made by the team at the Faculty of Engineering so that there would be conformity and harmony with the competencies of graduates of the Faculty of Engineering. After really in accordance with the competencies of graduates of the Faculty of Engineering to support the competencies of graduates of the Medan State University, the dean was determined that the lecture instruments developed were in accordance with the expected learning outcomes. The final stage then carried out socialization to all lecturers in the engineering faculty regarding the product development of the standardization of learning tools for the Faculty courses.

4. Conclusions

The results of the development of the Faculty course learning tools are the Industrial Engineering 2 SKS courses contained in the Faculty level Engineering curriculum which is in the 6th semester with the following details.

1. Course Learning Outcomes (CLO): Students are competent in determining the product, designing the mechanism of the product manufacturing process, producing and carrying out exhibitions of product engineering ideas in accordance with the field of expertise / specialization

2. Learning Outcomes (Learning Outcomes / LO). After participating in the learning program in this course, students can:
a) Determine the product to be made based on engineering ideas in accordance with the field of expertise / specialization.

b) Designing the mechanism of the process of making products and producing a work of engineering ideas in accordance with the field of expertise / specialization

c) Carrying out exhibitions of engineering products in accordance with the field of expertise / specialization

3. Indicators of Achievement of Learning Objectives

a) Competently determine the product to be made based on engineering ideas in accordance with the field of expertise / specialization.

b) Competently analyzing the material requirements in accordance with the product to be made (the work of engineering ideas in accordance with the field of expertise / specialization).

c) Competently consider the selection of materials in the manufacture of products (product specifications of the work of engineering ideas in accordance with the field of expertise / specialization of students).

d) Competently determine the appropriate equipment in the manufacture of products of engineering ideas in accordance with the field of expertise / specialization.

e) Competent designs the mechanism of making products of the work of engineering ideas in accordance with the field of expertise / specialization.

f) Competently producing a work of engineering ideas in accordance with the field of expertise / specialization

g) Competently design a product exhibition of engineering ideas in accordance with the field of expertise / specialization

h) Competently carrying out exhibitions of engineering products of ideas created by the idea of engineering in accordance with the field of expertise / specialization

4. Study Material; Study material in the Industrial Engineering course is as follows.

a) Expert approval of product engineering ideas according to the field of expertise / specialization (based on analysis of production customer needs and analysis of market competition).

b) Identify the need for tools and materials in accordance with the product to be made.

c) Determination of suitable materials according to needs (product specifications).

d) Determination of minimum equipment requirements in manufacturing products according to product specifications.

e) The work steps of making products effectively and efficiently

f) Producing works of engineering ideas in accordance with the field of expertise / specialization

g) Designing an exhibition of products of engineering ideas in accordance with the field of expertise / specialization

h) Conducting an exhibition of product engineering ideas the work of engineering ideas in accordance with the field of expertise / specialization.
5. References

Development of Teaching Materials Based on Blended Learning on The Special Room Decoration Art Course

Sulistiawikarsih¹, Mastarina Barus², Siti Sutanti³, Mawadda Azizah Sari Waruwu⁴
sulistiawikarsih8@gmail.com

Culinary Education Study Program, State University of Medan¹,²,³,⁴

Abstract. The aim of this research is to develop special room decoration art teaching materials based on blended learning in Culinary Education Study Program, Faculty of Engineering State University of Medan as a good learning resource and be able to function properly and to know the results of the feasibility of teaching materials developed so that it can be useful as a learning media. The design of research used in this study is R&D. This study provides treatment to research respondents who subsequently observed their effects. The treatment given is the use of teaching materials based on blended learning. This model includes six stages namely: literature study, development planning and design, development of citizens, expert validation, trials, revisions, and final products. The test subjects consisted of two learning material experts, two learning design experts, two instructional video media experts, three students for individual trials, nine students for small group tests, and fifty-eight students for field trials. Data about the quality of these development products was collected by a questionnaire. The data collected was analyzed using qualitative descriptive analysis techniques.

Keywords; Blended Learning, Special Room Decoration Art, Undergraduate Students of Culinary Education

1. Introduction

Science Technology in the education world has transformed conventional learning systems into modern learning systems, demanding to innovate in the delivery of learning. Then these challenges make changes in the learning environment and contribute to the movement of the learning process, especially in lectures. Utilization of Science Technology (Science and Technology) in the world of education becomes something that is considered important in changing education. Especially in learning systems, science and technology has changed conventional learning systems into modern learning systems that are based on information and communication technology (ICT). One of them is computer media with internet. The rapid development of ICT (information, communication and technology) has an effect on all fields including education. ICT is able to become a medium and a broad source of learning so as to enable students to learn independently without the presence of a teacher. With this media will stimulate the brain's performance so that it is more optimal and optimal, which in turn leads to E-Learning. The presence of E-Learning which then provides new innovations in the world of education by expanding the use of electronic communication media. For this reason, in the world of education, it is very much needed the help of Science Technology (IPTEK). The atmosphere
of E-Learning learning will force students to play active role in learning process, this is because E-Learning learning requires students to look for material with their own efforts and initiatives.

The context of the use of information and communication technology in the world of education, it has been proven that the narrowing and fusion of the factors "space and time" which has been a determinant of the speed and success of mastering science by humans. More flexible without being bound by space and time, enriching learning material, animating the learning process, making the learning process more open, and supporting students to learn independently. The emergence of E-Learning has led to new learning media such as, commonly referred to as blended learning, Mobile learning, Web-based learning, virtual learning, internet learning, Networked learning, distance learning. The use of E-Learning as a technology also needs to be carried out a plan in order to implement effective learning, as well as improve students’ learning outcomes so that learning objectives are achieved.

In an effort to improve the quality of education, institutions must be able to move all components that become subsystems in an education quality system. "The first and foremost subsystem in improving the quality of education is the teacher factor." From the above opinion, it can be concluded that good or bad quality of education is strongly influenced by educators. Therefore, educators are required to be professional, creative and innovative in improving the quality of education. Educators in this era of globalization are required to master the development of existing technology. Mastery of the development of this technology will be expected so that educators can apply it in the realm of education. By being able to master the development of technology, educators will be able to develop quality teaching and learning processes in order to improve learning outcomes better. Basically education is a process of delivering information to students where in the information there is a message to be conveyed. This information can be conveyed using learning media. In the implementation of learning, media is also one of the success factors. In this era of very rapid technological advances, there have been many media that can be used to support learning, there are print media, electronic media and media that are indeed developed to facilitate learning. With a touch of information and communication technology that has given birth to the concept of E-Learning.

The role of learning media can facilitate the learning process and learning outcomes. Besides learning media are all tools and materials that can be used for educational purposes such as radio, television, books, newspapers, magazines, computers and so forth. In this case the media functions as an intermediary to deliver material. Seeing the needs of students and the demands of the times, a good learning strategy is to combine the best characteristics of learning in the classroom (face to face) and E-Learning to enhance active independent learning by students. The choice of using blended learning model is considered in realizing the learning strategy.

E-Learning is a learning model that has characteristics that can be used by anyone (everyone), anywhere (everywhere), and anytime (everytime). E-Learning is focus on the efficiency of teaching and learning process. The use of E-Learning model will make it easier for students to access lesson material, discuss with friends, and ask questions with the instructor whenever and wherever. Not only that, teachers can also add references to teaching materials that can be uploaded on the internet so that students can also broaden their horizons, and will greatly facilitate teachers to supervise students’ mastery of material. The combination of learning models is often called Blended Learning where face-to-face teaching is combined with the use of information and communication technology. Blended Learning Model has advantages to improve accessibility in learning so that the convenience will have an impact on students’ ease of accessing subject matter and enactment so that it can help students improve their learning outcomes.
Thus, this research intends to develop teaching materials based on blended learning in the Art of Special Room Decoration in the Culinary Education Study Program in the hope that these teaching materials can be utilized for learning. Teaching materials in the form of modules and based on blended learning are designed to support student learning so that it is easier to understand theory, the basics of decorating arts properly, and add learning references so as to improve student learning achievement.

2. Research Method

In this research and development model that will be developed refers to the Research and Development (R&D) of the Borg & Gall model which has the aim to develop and validate the product by planning learning in the development of the learning textbook. Research and Development (R&D) methods are research methods used to produce certain products, and test the effectiveness of those products. Furthermore, to be able to produce certain products used research that is needs analysis and to test the effectiveness of these products in order to function in the wider community, research is needed to test the effectiveness of these products.

The development model used in this study is the 3D form, namely Define, Design and Develop. This model is a research method used to develop or validate products used in education and learning. The 4D research model stands for Define, Design, Development and Dissemination.

Trial Design

The trials in this study were conducted by distributing questionnaires. Questionnaires are given to students to find out students' interest in the learning dictates developed. The questionnaire was made on a scale of 1 to 5. The guidelines and assessment criteria for interpreting (Percentage of Response criteria / scoring criteria guidelines). In this case it is seen in Table 3.1 below:

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Criteria</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>81% ≤ ≤ 100%</td>
<td>Very Good</td>
<td>A</td>
</tr>
<tr>
<td>61% ≤ ≤ 80%</td>
<td>Good</td>
<td>B</td>
</tr>
<tr>
<td>41% ≤ ≤ 60%</td>
<td>Enough</td>
<td>C</td>
</tr>
<tr>
<td>21% ≤ ≤ 40%</td>
<td>Not Good</td>
<td>D</td>
</tr>
<tr>
<td>0% ≤ ≤ 20%</td>
<td>Very Good</td>
<td>E</td>
</tr>
</tbody>
</table>

Table 1. The Guidelines Assessment Criteria
Research Location and Time
This research was conducted at the Catering Study Program Department of Family Welfare Education (PKK) of the Faculty of Engineering, State University of Medan in VII / Odd semester students of the Catering Study Program, Academic Year 2018/2019.

Method of Collecting the Data
The data to be collected is data about the need for teaching materials based on banded learning in a qualitative form. Qualitative data were collected using questionnaire sheets and documentation. Data collection techniques used in this study as follows:

- Questionnaire
  Questionnaire used to capture data on the learning needs of the dictates provided to students, to identify the needs and general objectives of learning, to capture student opinions.

- Documentation
  Documentation used as research evidence. Documentation includes things that can strengthen research statements such as photographs, correspondence and so on.

Technique Analysis the Data
To analyze the data, which is about the feasibility of banded learning based learning materials, non-test techniques are used to collect product data, by validating the module design which includes the process of activities to assess the feasibility of the module before it is used as a learning material. The assessment is conducted by a validator who has been given confidence in validating the design of the teaching and learning dictates who are experts in the field of greafis design, cosmetology science, learning design, and several student groups.

3. Discussion Result
The process of implementing banded learning media development is carried out in stages. The first stage in this development activity was to conduct a needs analysis at the Faculty of Engineering, Department of Family Welfare Education and conduct interviews with lecturers who took courses on August 25, 2019 then continued on September 2, 2019, doing the same thing by distributing questionnaires to 40 lecturers The Department of Family Welfare Education uses the method of defining the definition of banded learning media in a questionnaire so that respondents have an overview of the questions in the questionnaire submitted.

From the results of the questionnaire that has been distributed it shows the data that 100% of students stated that they need banded learning media to be used as a learning facility individually 91% of lecturers stated that they need banded learning media so that the learning process runs more effectively and interestingly. Data on the needs analysis is presented in Table 5.1 below:
**Table 2. Need Analysis the Data**

<table>
<thead>
<tr>
<th>No</th>
<th>Sort of Information</th>
<th>Ans</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Have known or not about blended learning media through the neo LMS website</td>
<td>Yes</td>
<td>Lecture 4</td>
<td>Student 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No</td>
<td>36</td>
<td>53</td>
</tr>
<tr>
<td>2</td>
<td>Use or not use blended learning media through the neo LMS website in the learning process</td>
<td>Yes</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No</td>
<td>35</td>
<td>58</td>
</tr>
<tr>
<td>3</td>
<td>Requires or not require blended learning media through the neo LMS website in the learning process</td>
<td>Yes</td>
<td>36</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

Based on the results of the needs analysis questionnaire distributed to students and lecturers, the following conclusions are obtained:

a. Most of the students and lecturers (89%) stated that they were not familiar with the media of blended learning through the neo LMS website. Only a small proportion (9%) of lecturers and students stated that they knew the learning media.

b. Most (88%) lecturers stated that they did not use blended learning media in the learning process and all students (100%) said they had never used the learning media.

c. Most of the lecturers (91%) stated that they needed blended learning media in the learning process and all students (100%) said they needed it.

Based on the results of the needs analysis it can be concluded that the development of blended learning media through the neo LMS website is indeed very much needed by students and lecturers in the learning process. The results of an oral interview to the lecturers of decorative arts courses, stated that they needed blended learning media through the neo LMS website to support the learning process because they admitted it was difficult to get an effective teaching material media to deliver decorative art lecture material.

**4. Conclusion**

Blended learning media on special room decoration art teaching material is very needed in the learning process. So after that the media production process will proceed to the next stage until it becomes a product that is suitable for use in the learning process.
5. Suggestion

For lectures, the results of this development can be used as an alternative learning media in the introduction of Central and Eastern Indonesian Food Processing to students. This product can stimulate students’ enthusiasm to get involved in learning, especially when lecturers explain the subject. For the next researchers, it is expected that the next researchers can conduct research on training with educators in the development of instructional media using interactive media.

6. References


Learning Media Based on Website Development of Courses in Patisserie Culinary Student of FT Unimed

Adikahriani¹, Ana Rahmi², Riana Friska³

Catering Education Program, Faculty of Engineering, Universitas Negeri Medan¹,²,³

Abstract. This research aims: to develop a website-based patisserie learning as an independent media learning media for UNIMED Culinary Students Study Program. Research located in the Laboratory of Culinary Education, Universitas Negeri Medan. The subjects of this study were two media experts, two materials experts and 20 students. Research was done in July 2019 - October 2019. The method used in this research is the Research and Development. Data collection techniques in this study used a questionnaire. Questionnaire Data collected from material experts, media experts, and students were analyzed using descriptive statistics. Based on the results of this study in the opinion of the experts on the material aspects of the feasibility of the contents including good criteria, on the presentation aspects including good criteria and on the linguistic aspects Including very good criteria. Based on the opinion of the media experts on the aspects including the very good criteria, the aspects of the negatives include the very good criteria. Based on the opinion of users/ students on the material aspects, Including good criteria and the aspects of the display, including very good criteria. Results of this research is based on the website-based learning media includes both criteria as a medium of independent learning for Unimed Students.

Key Words: website, patisserie

1. Introduction

Developments in technology and communications have changed the current of human life. Almost all humans’ work is easier with the help of advanced technology, one of which is a computer technology. Currently this technology is now a staple to help get the job done quickly and accurately. For example, in the case of households, commerce, education entertainment until everything can be solved with a computer. An example of this is the development of computers and mobile phones.

Web-based learning media can incorporate a wide variety of media. The diversity of these media is including text, images, audio, video, animation, and even simulation. The website is one of the platforms that can contain many databases that are useful as containers or facilities that can inform an object is both institutional information, learning, promotion and so forth.

With a huge data base, the website is able to provide better information services such as facility teaching materials, examinations, student database useful for effectiveness and efficiency in learning activities. Media Web-based learning is one form of application of the system of E-Learning (electronic learning).

E-learning is a medium of learning by using electronic tools as a kit, according Daryanto [1], says that e-learning is learning that used electronic media, both online and offline are applied
in conventional education and distance education. E-learning system is one system of learning for students as e-learning can help students add information over the course patisserie.

Based on the results of observations made, there are some things that become problems in the learning process that reduces the level of efficiency of time is the provision of teaching materials are so many conventional distributed in the lecture that makes a lot of time is spent only for the provision of instructional materials. Standardization of materials, equipment, reception and storage means insufficient cause many students who take different references from internet so the results do not correspond with patisserie learning courses.

Therefore, Internet-based media should be able to be an effective solution to overcome the shortcomings of the media conventional learning and easily helps educators to channel all teaching materials available on the course patisserie effectively and efficient, as well as helping the learners to get the material learning relevant.

In accordance with the description above, the problem in this research is: How to develop a web-based learning media in the course patisserie Catering FT Unimed Students?

1. Learning Media

In etymology, media comes from the Latin, the plural form of the word medium, which means the center or intermediary. Intermediary or introductory term is used for the function of the media as an intermediary or an introduction to a message from the sender (seller) to the recipient (receiver) message [2].

In the opinion of Barlo "communication process involves at least three major components, namely the sender or the source of the message (source), intermediaries (media) and receiver (receiver)". Meanwhile, according to Widodo and Jasmani the opinion that "there are four components that must be present in the communication process that is a conduit of information, the information itself, the audience and the media" [2].

From some of the above opinion can be said that the media have a very important role is as a device or tool that serves as an intermediary in the communication process.

Web is a collection of web pages that are usually housed in a domain or sub-domain that it is located within the world wide web (www) on the internet. Each of these web pages is also called web page. The main page of a web commonly called as homepage. "Web is a hypertext medium that provides facilities for displaying data in the form of text, images, sound, animation, and other multimedia data".

Web as a collection of pages which is used to display text information, still or motion picture, animation, sound, and a combination of everything good that is static or dynamic form a suite of interconnected buildings, which each respectively connected to the network page [3]. Meanwhile, the Web is a place on the Internet that consists of a collection of images, video, and other files that are placed on a web server, so it can be accessed online by anyone through the Internet.

"Patisserie" is one of knowledge in the processing and presentation of the food, especially the process and presenting various kinds of cakes [4]. Patisserie derived from the French as "patisserie" meaning pastries. Thus patisserie can be interpreted as the science that studies the ins and outs of a good pie pastry continental, oriental and Indonesian cakes from preparation, processing up to the presentation. Currently, patisserie is studied as a science and art in the process and presenting a wide variety of excellent pastries pastry traditional and modern. The cake can be served in a variety of occasions, in addition to providing a sense of fullness, also serves as a cake decoration or ornament. Now this is the quality and taste of the cake would have been much different.

With the insight that develops, man adding and mixing the various ingredients and aromas, giving rise to variations of patisserie so vast. Patisserie variation can also be formed by a variety...
of techniques and different processing methods. However, these variations could not be separated from art and beauty.

3. Research Methods

The method used is research and development, because this research, including research development that is intended to produce a decent learning product utilized and as needed. Limits on research and development in an effort to develop and validate the products used in the learning process.

Based on the development model used is the ADDIE development model of the research method used, namely: 1) stage of analysis is to identify learning needs and develop learning objectives which refers to the applicable curriculum deprogram culinary education studies Terrain public universities. Identifying the behavior and characteristics of the students. This is done to determine the condition rather than objects or targets developed product is acceptable, 2) In the design phase, the activities carried out are designing a website, 3) At this stage of development, the activities to be carried out are: a) make the initial display media websites during a media opened, b) inserting content, photos and videos. 4) Once the design is developed then the next thing is to implement the product, implementation phase was conducted to look at the conditions when the medium run media website. If media website created already be executed as planned, the next activity is to evaluate media websites. However, if there is no match then carried back stage revision of the media. 5) Evaluation or testing phase of the product to validate the product. The evaluation conducted by expert instructional materials, instructional media experts and users such as students learning media. 5) Evaluation or testing phase of the product to validate the product. The evaluation conducted by expert instructional materials, instructional media experts and users such as students learning media.

4. Data Collection Instruments

Data collection instruments on the development of this form of assessment instrument to assess the products have been developed. Instrument staple used to collect data in this development is to use a questionnaire sheet.

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Indicator</th>
<th>Item number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feasibility of Contents</td>
<td>Quality Learning Materials</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Information Submission System</td>
<td>4</td>
</tr>
<tr>
<td>Presentation</td>
<td>Presentation Quality Learning Materials</td>
<td>5</td>
</tr>
<tr>
<td>Linguistic Amount</td>
<td>Linguistic Quality Learning Materials</td>
<td>3</td>
</tr>
<tr>
<td>Amount</td>
<td></td>
<td>14</td>
</tr>
</tbody>
</table>

Source: Sugiyono 2010
Table 2. Grid Research Instruments About Quality Design Expert Media

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Indicator</th>
<th>Item number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presentation</td>
<td>Media Presentation Design Quality</td>
<td>9</td>
</tr>
<tr>
<td>Graphic</td>
<td>Presentation Quality Learning Materials</td>
<td>7</td>
</tr>
<tr>
<td>Amount</td>
<td></td>
<td>16</td>
</tr>
</tbody>
</table>

Table 3. Grid Research Instruments Technical Quality and Views On Students

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Indicator</th>
<th>Item number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory</td>
<td>Contents Learning Materials</td>
<td>8</td>
</tr>
<tr>
<td>Display</td>
<td>Learning Media Display</td>
<td>6</td>
</tr>
<tr>
<td>Amount</td>
<td></td>
<td>14</td>
</tr>
</tbody>
</table>

Source: Sugiyono 2010

The scale of measurement in this study refers to a Likert scale, where each made using a 1-5 scale response categories were given a score or weight is the amount of a score between 1 and 5, with details as written in Table 4 below:

Table 4. Assessment Criteria [5]

<table>
<thead>
<tr>
<th>Score</th>
<th>Criteria</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Very good</td>
<td>100-90</td>
</tr>
<tr>
<td>B</td>
<td>Well</td>
<td>98-79</td>
</tr>
<tr>
<td>C</td>
<td>Pretty good</td>
<td>69-50</td>
</tr>
<tr>
<td>D</td>
<td>Not good</td>
<td>49-30</td>
</tr>
<tr>
<td>E</td>
<td>Very No Good</td>
<td>29-0</td>
</tr>
</tbody>
</table>

5. Research Result

The quality of learning materials on the web-based media in the course patisserie has three aspects are considered, among others: the content feasibility aspects, aspects of the presentation and evaluation aspects of the language used in teaching media.

The results of the assessment of the development of web-based instructional media on patisserie subjects as media independent study are as follows:

Table 5. Assessment Expert and User-Based Learning Media Website

<table>
<thead>
<tr>
<th>No.</th>
<th>Respondents</th>
<th>Value (%)</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Expert Content</td>
<td>90.00</td>
<td>Very good</td>
</tr>
<tr>
<td>2</td>
<td>Expert Media</td>
<td>91.05</td>
<td>Very good</td>
</tr>
<tr>
<td>3</td>
<td>College student</td>
<td>89.00</td>
<td>Well</td>
</tr>
</tbody>
</table>
The results of the research-based instructional media website in the course patisserie has 3 types of validation such assessment, an assessment based on subject matter experts in the table above can be seen VI-based instructional media development results on the course website patisserie with the achievements of the value of 90.00 is included in the criteria very well. At a media expert with the achievements of the value of 91.05 qualifies as a very good and on the respondent student receives a grade of 89.00 included in both criteria.

6. Outputs Achieved

Some of the uses and benefits of using instructional media based websites are: The material is easy to understand because the concepts presented are planned to facilitate students and systematically, learn faster and attractive so as to avoid boredom because it comes with pictures and video, interactive learning media can also be used as an alternative medium of learning independently.

7. Conclusion

Based on the formula, objectives, results, and discussion of this research can be concluded as follows:
1. Media patisserie learning-based website by including the subject matter expert in the excellent category.
2. Media patisserie according to media experts included in the excellent category.
3. Media patisserie web-based learning by the students included in both categories.

8. Suggestion

Based on these results, the authors suggest:
1. Students can use the website to be self-learning media Another
2. Lecture can develop websites for other subjects in order to be more effective learning process also efficiently

9. References


The Development of Blended Learning Model to Improve Students Learning Outcomes in Drawing Technique and AutoCAD

R. Mursid¹, Yuniarto Mudjiasatyo², Andi Bahar³
Mechanical Engineering Education, Faculty of Engineering, Universitas Negeri Medan, Indonesia¹,²,³
mursid.tp@gmail.com

Abstract. The purpose of this study is to develop a blended learning model to improve students’ learning outcomes in drawing techniques and AutoCAD, to determine the feasibility and effectiveness of a blended learning model. Research and development methods using R & D Borg and Gall, with odd semester students who take the technical drawing courses in mechanical engineering education courses. The results showed that, the blended learning model that was developed was feasible to be used in learning drawing techniques and AutoCAD, the learning model based on blended learning could effectively improve learning outcomes in drawing techniques and AutoCAD and there were differences in learning outcomes in drawing techniques and student AutoCAD, and superior results learn to draw techniques and student AutoCAD using blended learning based learning models developed.

Keywords: learning model, blended learning, drawing technique, AutoCAD.

1. Introduction

Drawing techniques are needed in all fields, especially in the fields of mechanical engineering and engineering. In this field drawing is one of the basic abilities that must be possessed, especially in drawing mechanical engineering. With the development of the times more and more building construction machinery and components are produced, so it takes the ability to draw techniques in the digital era, such as drawing in 3D (three-dimensional) or AutoCAD. Technically the implementation of a complete depiction can still be left to drafter (draftsman) who is more experienced and qualified. Drawing Engineering also needs to be explored for the next life that aims to facilitate work in the field of engineering, especially mechanical engineering.

The image is an appropriate means to convey one's ideas or ideas to others. Sato [1] states "information forwarding is an important function for language or images. The picture is expected to include a description of the information precisely and objectively. The information obtained in the form of visual images, symbols, symbols and image standards. The information is an idea or ideas, abstract concepts which are then realized by the picture ". Drawing technique has a function as a communicative information delivery medium because the image can be understood, measured (has a scale), accurate (precise technical precision), effective (right in use), and aesthetic (its beauty). But technical drawings will not cause different interpretations for people who see them. Therefore, there must be certain signs / standards as a collective
agreement. These standards are usually contained a normalization or the International Standardization for Organization (ISO). This ISO standard is important to be understood by engineering people, especially mechanical engineering or people who will understand/make technical drawings. So, in technical drawing must use standard and uniform picture signs, as complete as possible to provide a complete understanding and understand by others.

Through this Engineering Drawing course, blended learning based learning models are developed. Siregar [2] states that Content Knowledge is scientific knowledge that should be mastered by teachers including facts, concepts, principles, laws, and theories. The development of science and information technology or science and technology becomes a challenge that must be faced by prospective teachers by prioritizing their abilities. By the Law of the Republic of Indonesia Number 14 of 2005 concerned on teachers and lecturers in enhancing what competitiveness if there are graduates of education who become teachers or lecturers. This certainly becomes a challenge for S1 graduates to improve their quality and ability to compete with others in the current MEA Era.

1.1 The Result of Learning Drawing Technique and AutoCAD

Drawing is a tool to express the intentions, the main points of thought or ideas of a technical planner (draftsman) to the machinery operator or consumers who need technical information [3]. The information must be complete, precise, and clear so that the intentions, ideas or ideas conveyed can be read and understood by the image reader. The views in mechanical engineering drawings are mostly visualized using straight projection images. There are two ways to draw a straight projection, namely the projection of the American system (Third Angle Projection) and the projection of the European system (First Angle Projection) [4].

Engineering drawing is the language (communication) of the mechanical engineering profession. Therefore technical drawings and machines are always used throughout the product's life cycle, from ideas to operation and maintenance, to recycling the product. ISO (International Standardization for Organization) and ASME (The American Society of Mechanical Engineers) prepare standards on engineering drawings. ISO technical drawing standards sourced from DIN 6 (Deutsche Industrie Normung).

Rules in a language are defined in grammar and spelling, written in grammar books and dictionaries. As with language, technical drawings must be regulated, which is realized in the standards issued by the organization for standardization. Each country has its organization specifically for standardization. For example, ASME (The American Society of Mechanical Engineers) and ISO (International Standardization for Organization). Engineering drawing is equivalent to language. A language must have a set of rules to be used correctly. The same thing applies to technical drawings. In English, there are two basic rules. The first is 'word order' which provides information about subjects and objects. The second is the spelling and information about the word itself such as nouns, verbs, and others.

Technical drawings need to communicate legally binding information by providing specifications. Therefore technical drawings must meet the following requirements: (1) technical drawings must be clear. (2) Technical drawings must be complete. (3) Technical drawings must be duplicated. (4) Pictures must not depend on a particular language. (5) Technical drawings must be by the standards. 'Highest' standards are ISO standards that apply throughout the world. Or the standards that apply in each country can be used. Company standards are often produced for very specific industries. The ISO technical drawing standard is used by the majority of Western European countries. The ISO technical drawing standard is the adoption of a technical drawing standard published by DIN Germany (DIN 6). DIN 6 was published by Germany in 1922. DIN 6 was later revised by Germany in 1950 and 1968. DIN 6 adopted by
ISO was later named ISO 128. When it was just adopted ISO 128 only consisted of 15 pages. As with other standards, ISO 128 continues to be developed so that ISO 128 in 2013 has 14 sections, of which the first part is about the introduction and index (ISO 128-1: 2003), and 13 other separate sections, which govern the procedure the location and sequence of technical drawings [5]. The technical drawing standards published by ISO and ASME [6] are sufficient to regulate how a technical drawing is made so that it meets the requirements required for a technical drawing [7]. For example, how the following types of images can be made well using the ISO and ASME standards; (1) machine drawings in the form of drawings and components; (2) working drawings (working drawings/shop drawings).

AutoCAD (Computer-Aided Design) or design aided by computers according to Munir and Aswad [8] is a computer application program that is very helpful in the description in the field of engineering and engineering. So that the AutoCAD in question is a moving image media in the form of a series of depictions in the field of engineering and engineering which contains a projection image, namely the American system projections and European system projections. The use of AutoCAD in conveying projection drawing material can provide more understanding and motivation to learn because in AutoCAD contains an audiovisual display or image that is more interesting, clearer and can look like a picture. Besides, the CAD video explains the making of 3-dimensional work pieces, the display of work piece field views and the projection images themselves. AutoCAD consists of an American video projection system image and a European system projection image. For each AutoCAD, the projected image is explained from determining the image view, proportional placement of images, giving an outline of the image and giving the size. In providing views of images, the images described are front views, right side views, and top views. This is by what was stated by Khumaedi [9] that to be able to make a good picture view that is not excessive or insufficient views. If the object being drawn is not complex, it can use three views.

In learning to draw projections students must make a projection image consisting of a front view, a right side view, and a top view. Also, images must be placed proportionally and the accuracy of the placement of numbers and sizes must be considered. The results by seeing in detail the shape of the projected image presented in the AutoCAD, it will be easier for students to draw a projection exactly by the rules of technical drawing in general.

1.2 Instructional Model

The concept models of developed, and the design models in this study. According to Richey, model research should place more emphasis on the design and development of research itself [10]. This definition emphasizes that research related to models should focus more on comparisons with existing models. In the design of learning systems, models usually describe the steps or procedures that need to be taken to create effective, efficient, and interesting learning activities [11]. So a model in the development of learning is a systematic process in the design, construction, utilization, management, and evaluation of learning systems. There are three components in developing learning models, namely: (1) learning conditions; (2) learning methods; and (3) learning outcomes. Learning conditions include learning characteristics in the form of objectives and learning barriers and student characteristics. Learning methods include how to organize learning materials, delivery strategies and management of activities. While learning outcomes include the effectiveness, efficiency, and attractiveness of learning for students [12].
1.3 The Development of Instructional model based on Blended Learning

The development of good learning models must be adapted to certain conditions. This condition is the size or complexity of an educational institution, the scope of duties of educational institutions, as well as the ability of managers. Joyce [13] explains the learning model is a plan that is used as a guide in planning learning in class or learning in tutorials and to determine learning tools and direct us in designing learning to help students in such a way that learning objectives are achieved.

Gunter et al [14] define an instructional model is a step-by-step procedure that leads to specific learning outcomes. Joyce & Weil [15] defines the learning model as a conceptual framework that is used as a guide in conducting learning. Thus, the learning model is a conceptual framework that describes a systematic procedure in organizing learning experiences to achieve learning goals. So the learning model tends to be prescriptive, which is relatively difficult to distinguish from the learning strategy. An instructional strategy is a method for delivering instruction that is intended to help students achieve a learning objective [16].

A relationship is formed in the model between technological and pedagogical competencies, where technological competence influences pedagogical competencies, which are based on the basic competency model determined by [17]. Therefore, a teacher needs to pay attention to the basic consideration of the selection of learning models, including objectives to be achieved, learning materials, students' points of view, and things that are non-technical in the form of effectiveness and efficiency [18].

The implementation of the blended learning model in its application to learning planning combines synchronous and asynchronous learning settings appropriately in order to achieve learning objectives [19]. And combining face to face learning activities and online learning [20]. Mosa further stated in Riyana [21] which includes two main elements of blended learning, namely classroom learning, and online learning, regarding blended learning by a constructive approach containing blended learning and constructive approach.

1.4 Lesson Plan

From the aspect of learning system components that the planning of blended learning model learning is in accordance with the theory. Sanjaya [22] states, that a teacher in designing learning should be able to synchronize the learning components into a unified whole, including objectives, material, methods, media, and evaluation. This is also in accordance with Sudjana's opinion [23] that, the learning process is basically nothing but the process of coordinating a number of components (objectives, materials, methods and tools, and assessment) so that each other is interconnected and influential so as to foster learning activities in students as optimal as possible towards changing behavior according to the goals set. Learning planning is based on key considerations of a blended learning model that is in accordance with Carman's theory [24], including live events, self-paced learning, collaboration, assessment, and performance support materials.

The formulation of the problem of this research are: (1) there is no blended learning based learning model to improve learning outcomes in drawing techniques and AutoCAD; (2) whether the learning model based on blended learning is appropriate to be used to improve the quality of learning drawing techniques and AutoCAD; and (3) whether an effective blended learning based learning model is used to improve the quality of learning drawing techniques and AutoCAD.
2. Method

This research uses research and development methods, carried out directly by collecting descriptive data that is processed and the analysis of inductive data. The implementation of this research follows the steps: (1) preliminary survey, (2) planning; learning models, learning strategies, learning methods, instructional media, (3) model validation, (4) model trials and (5) model revisions.

This research is a research and development that consists of three stages, namely pre-development of the model, development of the model and application of the model where the research refers to the Borg & Gall R&D cycle [25], with the description that has been modified and harmonized with the aims and conditions of the study. In fact, the research framework is broadly organized in the following order: collecting current condition data for needs analysis, analyzing data, developing, choosing alternative actions, testing new models, analyzing and revising, collecting newly revised data, repeating development analysis, and revising the model. The method used in this research is a combination of qualitative and quantitative methods.

Blended learning model learning is a form of online management. Classroom management and online learning through a system is developed by the Learning Management System application, whether developed through PT or LMS arrangements available. With the development of learning modules drawing techniques and AutoCAD with the use of Google-based applications in the Google suite for education package. Books are compiled and use Google classroom and Google form with a Unimed G-suite institutional account. Learning with a blended learning model using the Google classroom application greatly helps students in developing knowledge and can be direct as online learning.

The study was conducted in the Mechanical Engineering Education Study Program, individual trials, small group trials, and main trials. At the development stage of the learning model, the determination of the target, in this case, is lecturers, learning experts, experts in the field of study, and students who assess the learning model that has been developed based on the criteria, as follows: (1) evaluation of learning experts is determined based on their expertise, (2) evaluators who carry out evaluations are determined based on the ability of lecturers with the classification of experts in the field of study.

The data technique analysis in this research and development uses qualitative and quantitative descriptive analysis. All data collected was analyzed using descriptive statistical techniques that were quantitatively separated by categories to sharpen the judgment in concluding, reducing data, displaying decision making data and verifying. Analysis of the data in this research and development is explained in three, namely the preliminary study, development and validation stages. In the validation stage, the significance and effectiveness of the results of the application of the model were analyzed using a quantitative (quasi-experimental) approach, by comparing the results in the experimental (control) group and the control group, under conditions before and after application. Quantitative analysis conducted through trials with the pretest-posttest and t-test analysis.

Posttest t-test

\[ H_0 : \mu_1 = \mu_2 \quad H_a : \mu_1 > \mu_2 \]

Where:

\[ \mu_1 = \text{Average student learning outcomes of drawing techniques and AutoCAD taught by using} \]
e-learning media using Google classroom.

μ² = Average student learning outcomes of drawing techniques and AutoCAD taught by conventional learning.

Ho = There is no difference in the results of learning to draw techniques and AutoCAD taught by using e-learning media using Google classroom from students taught by conventional learning.

Ha = There is a difference in the results of learning to draw techniques and AutoCAD taught by using e-learning media using Google classroom is higher than students taught by conventional learning.

3. Result and Discussion

Based on the results of expert validation; material, graphic design, instructional design for the development of e-learning media using Google classroom on the course drawing techniques and AutoCAD showed very good results. Henceforth, individual and small group trials also show good results.

Table 1. The average percentage of results of an assessment of e-learning media using Google classroom in individual trials

<table>
<thead>
<tr>
<th>No</th>
<th>Category</th>
<th>% Average</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aspects of learning materials</td>
<td>93.33</td>
<td>Very Good</td>
</tr>
<tr>
<td></td>
<td>Quality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Aspects of technical/display</td>
<td>89.52</td>
<td>Very Good</td>
</tr>
<tr>
<td></td>
<td>Quality</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>91.43</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

Table 2. The average percentage of the results of an assessment of e-learning media using Google classroom in small group trials

<table>
<thead>
<tr>
<th>No</th>
<th>Category</th>
<th>% Average</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aspects of learning materials</td>
<td>91.39</td>
<td>Very Good</td>
</tr>
<tr>
<td></td>
<td>Quality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Aspects of technical/display</td>
<td>95.87</td>
<td>Very Good</td>
</tr>
<tr>
<td></td>
<td>Quality</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>93.63</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

The results of the assessment conducted on e-learning media using Google classroom drawing courses in small group trials as a whole are Very Good and after analysis, there is one problem that must be corrected, namely, the test results should be sent to e-mail students. Therefore, improvements will be made by the suggestions submitted.

The Data Analysis of Field Trial Results

Table 3. The average percentage of the results of an assessment of e-learning media using Google classroom in field trials

<table>
<thead>
<tr>
<th>No</th>
<th>Category</th>
<th>% Average</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aspects of learning materials</td>
<td>97.84</td>
<td>Very Good</td>
</tr>
<tr>
<td></td>
<td>Quality</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aspects of technical/display</td>
<td>98.08</td>
<td>Very Good</td>
</tr>
<tr>
<td></td>
<td>Quality</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>97.96</td>
<td>Very Good</td>
</tr>
</tbody>
</table>
Table 4. The e-learning media assessment score uses Google classroom in field trials of the quality aspects of learning material

<table>
<thead>
<tr>
<th>No</th>
<th>Rating Indicator</th>
<th>Score</th>
<th>% Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Clarity of instructions learning</td>
<td>6</td>
<td>97.93</td>
</tr>
<tr>
<td>2</td>
<td>Clarity of study instructions</td>
<td>5</td>
<td>98.97</td>
</tr>
<tr>
<td>3</td>
<td>Ease of understanding the text</td>
<td>13</td>
<td>95.52</td>
</tr>
<tr>
<td>4</td>
<td>Ease of understanding learning</td>
<td>10</td>
<td>96.55</td>
</tr>
<tr>
<td>5</td>
<td>The accuracy of the order of presentation</td>
<td>5</td>
<td>98.28</td>
</tr>
<tr>
<td>6</td>
<td>Adequacy of exercise</td>
<td>13</td>
<td>95.52</td>
</tr>
<tr>
<td>7</td>
<td>Clarity of feedback</td>
<td>58</td>
<td>100</td>
</tr>
<tr>
<td>8</td>
<td>Help students learning with programs</td>
<td>58</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td></td>
<td>97.84</td>
</tr>
</tbody>
</table>

Table 5. The e-learning media assessment score uses computer-based Google classroom in field trials on aspects of technical quality or appearance

<table>
<thead>
<tr>
<th>No</th>
<th>Rating Indicator</th>
<th>Score</th>
<th>% criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The interest of the display</td>
<td>58</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>Text Readability</td>
<td>58</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>Image quality and animation</td>
<td>5</td>
<td>98.28</td>
</tr>
<tr>
<td>4</td>
<td>Color composition</td>
<td>15</td>
<td>94.83</td>
</tr>
<tr>
<td>5</td>
<td>Navigation</td>
<td>9</td>
<td>96.90</td>
</tr>
<tr>
<td>6</td>
<td>Carrying capacity of music</td>
<td>8</td>
<td>97.24</td>
</tr>
<tr>
<td>7</td>
<td>Interaction</td>
<td>2</td>
<td>99.31</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td></td>
<td>98.08</td>
</tr>
</tbody>
</table>

3.1 The Test Results of Product Effectiveness

Students’ learning outcomes is shown on Table 6 that implemented e-learning media such as Google Classroom. Based on research that has been conducted on student learning outcomes that are taught with e-learning media using Google classroom, it was found that the scores of student learning outcomes from 29 respondents were spread in the range of 70-95. The calculation shows that the lowest score is 70 and the highest score is 95, the mean is 12.06, the median is 12 and the standard deviation is 1.30.

Table 6. The frequency of learning outcomes learned by using e-learning media using Google classroom

<table>
<thead>
<tr>
<th>No. Interval Class</th>
<th>Absolute Frequency</th>
<th>Relative Frequency</th>
<th>Cumulative Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 65 – 70</td>
<td>1</td>
<td>3.4</td>
<td>3.4</td>
</tr>
<tr>
<td>2 71 – 75</td>
<td>2</td>
<td>6.9</td>
<td>10.3</td>
</tr>
<tr>
<td>3 76 – 80</td>
<td>7</td>
<td>24.1</td>
<td>34.5</td>
</tr>
<tr>
<td>4 81 – 85</td>
<td>9</td>
<td>31.0</td>
<td>65.5</td>
</tr>
<tr>
<td>5 86 – 90</td>
<td>7</td>
<td>24.1</td>
<td>89.7</td>
</tr>
<tr>
<td>6 91 – 95</td>
<td>3</td>
<td>10.3</td>
<td>100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>29</strong></td>
<td></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
3.2 Hypothesis testing

After testing the data requirements namely normality and homogeneity tests are completed, then t-test is done. This is done to find out whether there are differences in the initial ability of the control class and experimental class using the pretest t-test.

Based on the calculation results, the t-count output is -1.3385 and the t table is 1.67 at a 95% confidence level. Then it is obtained that $t_{count} < t_{table}$ or $-1.385 < 1.67$ or in other words Ha is rejected. This shows that the initial ability of students in both the control class and the experimental class is likely to be the same and not significantly different. After the pretest t-test is completed, then the research hypothesis testing is then performed using the posttest t-test. This is done to find out if there are differences in student learning outcomes after different treatments.

Based on the calculation results in the table above, the output of $t_{count}$ is 3.285 and $t_{table}$ is 1.67 at the 95% confidence level. Then it is obtained that $t_{count} > t_{table}$ or $3.285 > 1.67$ or in other words Ho is rejected and Ha is accepted. Based on the data above, it is concluded that the learning outcomes of students taught by using e-learning media using Google classroom are higher than students taught by conventional learning whose truth is tested. This means that the learning outcomes of students who use e-learning media using Google classroom are higher than the learning outcomes of students who are taught with conventional learning with effective use of interactive media by 80.46%.

The effectiveness of e-learning media using Google classroom is obtained as follows:

$$x = \frac{total \ space \ score \ obtained}{ideal \ number \ of \ score} \times 100\%$$

$$x = \frac{350}{435} \times 100\%$$

$$= 80.46\%$$

The effectiveness value of e-learning media using Google classroom is higher than the value of learning effectiveness without media that is equal to 71.72% which is described as follows:

$$x = \frac{total \ space \ score \ obtained}{ideal \ number \ of \ score} \times 100\%$$

$$x = \frac{312}{435} \times 100\%$$

$$= 71.72\%$$

Aspects that are revised and refined based on data analysis and trials and input from material experts, learning design experts, software foundation experts and students as e-learning media users using Google classroom, aim to explore some aspects that are common in the process of developing a product. Learning media variables have an average value of Very Good. The learning media variables assessed include the goodness of content, presentation, language, programming, and graphics.
### Table 7. Summary of Average Percentage of Assessment Results on E-learning Media using Google classroom

<table>
<thead>
<tr>
<th>No</th>
<th>Respondent</th>
<th>% average</th>
<th>criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Material expert</td>
<td>93.83</td>
<td>Very Good</td>
</tr>
<tr>
<td>2</td>
<td>Learning design expert</td>
<td>88.55</td>
<td>Very Good</td>
</tr>
<tr>
<td>3</td>
<td>Software engineering expert</td>
<td>94.10</td>
<td>Very Good</td>
</tr>
<tr>
<td>4</td>
<td>Students on individual trials</td>
<td>91.43</td>
<td>Very Good</td>
</tr>
<tr>
<td>5</td>
<td>Students on a small group trial</td>
<td>93.63</td>
<td>Very Good</td>
</tr>
<tr>
<td>6</td>
<td>Students on field trials</td>
<td>97.96</td>
<td>Very Good</td>
</tr>
<tr>
<td></td>
<td><strong>Average</strong></td>
<td><strong>93.25</strong></td>
<td><strong>Very Good</strong></td>
</tr>
</tbody>
</table>

#### 3.3 Discussion

The e-learning media development product using Google classroom on the subject of drawing techniques and AutoCAD is a learning material that has been developed by paying attention to aspects of learning and the media as a principle of learning message design. The product development research conducted is directed to produce a product in the form of e-learning media using Google classroom in engineering drawing and AutoCAD courses for students in the first semester of the mechanical engineering education study program used to improve the learning process and student competencies. Therefore this research process is carried out and begins with, (1) a preliminary study, (2) then designing the learning media, (3) conducting product validation and making revisions and refinements based on validation data analysis from material experts, (4) learning design experts and software engineering experts, followed by individual trials, small group trials, and field trials to produce Good Learning media used in accordance with the characteristics of subjects and students as users.

Some of the uses and benefits in the use of e-learning media using Google classroom in the course drawing techniques are as follows: (1) the material is easy to understand because the concepts presented are planned to facilitate students and systematically, (2) the e-learning media using Google classroom gives an opportunity students to learn in accordance with the speed of each individual, (3) learn faster and interesting so it does not cause boredom because it is equipped with pictures and animations and a variety of practice questions. (4) there is an opportunity to answer questions at the time of the test if the answer is considered wrong with the aim that students can understand the material that has been learned, (5) e-learning media using Google classroom can also be used as an alternative to conventional and individual learning media.

A media can be said to be good after showing satisfactory results in achieving predetermined goals. In this case, a product trial is conducted in the learning process to determine the effectiveness of learning. The effectiveness of the media is obtained from the value of student learning outcomes. Miarso [26] indicators that can be used to determine effectiveness in the learning process are: (a) good material organization, (b) effective communication, (c) mastery and enthusiasm for the subject matter, (d) positive attitude towards students, (e) giving fair grades, (f) flexibility in the learning approach, and (g) good student learning outcomes.

From the results of data processing research conducted, there are differences in learning outcomes of courses in drawing techniques and AutoCAD between students who are taught using e-learning media using Google classroom and students who are taught without using e-learning media using Google classroom which is the average yield learning machine energy conversion of students who are taught by using e-learning media using Google classroom is higher at 80.46% compared to students who are taught without using e-learning media using
Google classroom which is at 71.72%. This data proves that the use of e-learning media using Google classroom is better in increasing students' competence and knowledge in the subject of drawing techniques and AutoCAD than without using e-learning media using Google classroom. The results of this study are in line with Lingin [27] in the development of e-learning media using Google classroom on Geography subjects using Macromedia Flash Professional 8.0 software. Proving that instructional media has an activity of 82.55% higher than the effectiveness of media learning books text of 77.84%. The development used a combination of e-learning media models using Google classroom [28] [29].

Johnson [30] in the development of e-learning media using Google classroom on mathematics subjects using Macromedia flash professional 8.0 software proves that e-learning media using Google classroom has an effectiveness of 70.73% higher than the effectiveness of using textbook learning media of 60.32%.

4. Conclusion

Based on the results and discussion above, the conclusion of this research as follows:

a. The results of the assessment conducted by material experts, media experts, and learning design experts in each aspect of the overall assessment are determined by the average score in their respective categories. The results of the development of blended learning-based learning models can improve student learning outcomes in drawing techniques and student AutoCAD, so it is worth developing.

b. The results of the material expert validation on the content/material feasibility aspect, the learning model based on blended learning that has been made are included in the very feasible criteria. The results of the validation of media experts on the aspects of the feasibility of media, learning models based on blended learning that has been made are included as feasible. The results of the design expert validation on aspects of media feasibility, interactive learning media design including very feasible criteria. At the individual trial stage the learning model based on blended learning in the excellent category. Furthermore, in the small group trial stage shows the learning model based on blended learning in the excellent category. Field test results give results that the learning model based on blended learning is included in the criteria very well. The blended learning based learning model is feasible to be used as a learning medium. Furthermore, it can be concluded that the learning model based on blended learning in the subject of drawing techniques and AutoCAD that has been developed, is included in very good.

c. The results showed that there were differences in average student learning outcomes using learning models based on blended learning with the average student scores before using learning media. The use of e-learning media using Google classroom is more "effective" to improve learning outcomes in drawing techniques and AutoCAD when compared to using textbook media, e-learning media using Google classroom has higher effectiveness than the effectiveness of textbook learning media.

5. Acknowledgements

Thank you to the Research and Community Service Institute of Medan State University and the Ministry of Research, Technology and Higher Education for providing research funding
through the Expertise Lecturer Group or KDBK for the 2019 budget year which is charged to the Budget Implementation Entry List or DIPA of Medan State University, so that research can be carried out and completed well.

6. References


The Development Of Learning Media Based On Collaborative Discovery Learning And Problem Based Learning In Instructional Design

Keysar Panjaitan¹, Khoiri², R. Mursid³
{pkeysar9@gmail.com¹, mursid.tp@gmail.com³}

Mechanical Engineering Eduction, Faculty of Engineering, Universitas Negeri Medan, Medan, North Sumatera, Indonesia¹,²,³

Abstract. The aim of this study is to develop learning media based on discovery learning and problem based learning to improve learning outcomes of instructional design, to find out the feasibility of collaborative discovery learning and problem based learning media on learning outcomes of instructional design, and to find out the effectiveness of learning media based on discovery learning collaboration and problem based learning on student learning outcomes of instructional design. The methods of this research is Research and development methods using R & D Borg and Gall, with odd semester 2019/2020 students who take instructional design courses in mechanical engineering education and automotive engineering education courses. The results of the study show that: the learning media developed are appropriate to be used in learning design learning, effective learning media can improve learning outcomes of instructional designs, and there are differences in learning outcomes of student instructional designs, and superior learning outcomes of student instructional designs using developed learning media.

Keywords : learning media, collaboration, discovery learning, problem based learning, instructional design

1. Introduction

The instructional system design as known as an organized procedure that includes the steps of analyzing, designing, developing, implementing and evaluating instruction. It refers to the notion of being micro and macro because it has implications for the system approach and the steps that must be followed in the system approach. In that definition also explained about the analysis step which includes the formulation process of what will be learned; the development step has implications for the writing and compilation process, or the production of learning materials; while the implementation step refers to the use of materials and strategies according to the context; and the last step is the assessment process is the process of determining the accuracy of learning.

The Various problems in the learning process of learning design courses in mechanical engineering and automotive engineering education are students didn't understand and plan well the function and role of learning design as an important part of the learning process to be carried out. Student preparation is required to be able to understand the learning design well. This concern is compounded by the theory learning patterns which are generally dominated by
lectures and do not empower students. The lack of media used makes it difficult for students to digest abstract concepts to be translated into abilities in Measuring.

Through this learning design course, learning media is developed based on discovery learning and problem-based learning. Dahar and Siregar [1] state that Content Knowledge is scientific knowledge that should be mastered by instructors include facts, concepts, principles, laws, and theories. The development of science and information technology or science and technology becomes a challenge that must be faced by prospective teachers by prioritizing their abilities. This is certainly a challenge for graduates of their primary education in the Faculty of Engineering to improve the quality and ability to compete with others in the current MEA Era. The various problems above require immediate resolution so that the quality of graduates produced can be maintained. Problem-based learning and discovery learning that are collaborated in the development of instructional media is one of the most suitable learning alternatives applied in accordance with the characteristics of the problems that occur. Judging from the limitations of the facility and considering the characteristics of the students concerned, print and non-print learning media are the most effective media. This is based on the condition that the majority of mechanical engineering education has computer facilities and the means of presentation. Thus, the development of learning media based on discovery learning collaboration and problem based learning to improve learning outcomes of learning design courses is very important.

1.1 Instructional Design

Instructional design is a procedure that consists of analyzing, designing, developing, implementing and assessing learning outcomes [2]. Stated by Morisson, Ross & Kemp [3] who defines learning design as a systematic design process to create more effective and efficient learning and make learning activities easier, based on what we know about theories learning, information technology, systematic analysis, research in education, and management methods.

Gagne [4] said that Instructional Systems Design (ISD) is a process of creating learning systems. The ISD contains a systematic and systemic process, which includes everything that can be documented, the application can be imitated, and the results can be predicted. Reiser and Dempsey [5] define instructional design as "a systematic process used to develop education and training programs consistently and reliably". It was further stated that learning technology was creative and active; is a system whose elements are interrelated and synergy to be effective.

Rothwell [6] explains the new things about learning design. He said that the design of learning is not just about creating learning, such as formulating goals, determining topics, determining learning strategies, evaluating learning outcomes and others. More broadly, the main purpose of learning design is to solve human performance problems.

Reiser & Dempsey [7] defines instructional design as "a systematic process used to develop education and training programs consistently and reliably". It was further stated that learning technology was creative and active; is a system whose elements are interrelated and synergy to be effective.

1.2 Instructional Systems Design

We understand that a system consists of several interrelated components or elements and each has the function of achieving the goals of the system. In the context of learning, Gagne in Suparman [8] said that the learning system is a set of events that affect students so that the learning process occurs. Based on this view the purpose of the learning system is the occurrence of learning processes in students so that the main concern of the learning designer is how to strive for learning activities to be effective and efficient? To realize this expectation, the search
related to learning system components becomes extremely important.

Reiser & Dempsey [9] suggested that instructional design is dynamic, and cybernetic meaning that the elements can be changed and communicate or work together easily. The characteristics of interdependence, synergy, dynamics, and cybernetics are needed in order to have an effective instructional design process. In addition, instructional design is centered on learning, oriented towards main objectives, including meaningful performance, including measurable results that are self-correcting and empirical as well as collaborative efforts.

1.3 Instructional Design Models

Instructional Design Models are known to use certain approaches. Namely: ADDIE Model, ASSURE Model, Dick and Carey Model, PPSI Model, AT and T Model, Degeng Model, Instructional Development Model (MPI), Gerlach and Ely Model, Kemp Model, ISD Model, and others.

Learning planning in terminology is planning and learning. Planning from the word plan, namely making decisions about what must be done to achieve goals. Planning is a process and way of thinking that can help create the expected results [10]. Planning as a process to determine where to go, and how to get to that place most effectively and efficiently [11]. Meanwhile, according to Terry [12] that planning is determining the work that must be carried out by the group to achieve the goals that have been determined.

Learning planning there are four main elements that must be possessed in every learning plan, namely; (1) there are objectives to be achieved; (2) the existence of strategies to achieve goals; (3) resources that can support; (4) implementation of each decision. The basis for learning planning is to improve learning. This effort is carried out with the following assumptions: Improving the quality of learning, learning is designed with a systems approach, learning design refers to how a person learns, learning designs are referred to individual students, learning designs must be referenced to goals, and learning designs are directed at ease of learning.

The Importance of Learning Planning, Deshimer [13] states that human nature has the ability and choice to create according to his views. Every human being lives in groups that are interconnected with one another so that forever requires coordination in carrying out various activities. Learning is a purposeful process. Learning is the process of working together. Learning is a complex process. The learning process will be effective when utilizing the various facilities and infrastructure available including utilizing various learning resources.

Learning planning in lectures makes it a task for students to carry out activities, including: Preparation of lesson plans is the initial activity of the entire learning process. The lesson’s plan is done by teacher, long before the implementation of learning by referring to the syllabus that is prepared based on core competencies and basic competencies. In this context, the teacher is no longer required to compile the syllabus. The teacher is obliged to only prepare lesson plans that will be implemented in the learning process. The lesson plans need to be prepared in a comprehensive and systematic manner that leads to interactive learning, inspiring, fun, challenging, motivating students to actively participate, and providing sufficient space for the growth of initiatives, creativity, and independence in accordance with the talents, interests, and development of good students physical or psychological.

1.4 Learning Media

The concept of media is developed, and the design of the media in this study. According to Richey, media research should place more emphasis on the design and development of research itself [14]. This definition emphasizes that research related to the media should be more focused on comparisons with existing media. In the design of learning systems, the media
usually describes the steps or procedures that need to be taken to create effective, efficient, and interesting learning activities [15]. So a media in the development of learning is a systematic process in the design, construction, utilization, management, and evaluation of learning systems. There are three components in the development of instructional media, namely: (1) learning conditions; (2) learning methods; and (3) learning outcomes. Learning conditions include learning characteristics in the form of objectives and learning barriers and student characteristics. Learning methods include how to organize learning materials, delivery strategies and management of activities. While learning outcomes include the effectiveness, efficiency, and attractiveness of learning for students [16].

Based on the constructivism paradigm about learning, the principle of media mediated instruction occupies a strategic position to realize optimal learning. The optimal learning inventory is one indicator to realize optimal student learning outcomes. Optimal learning outcomes are also a reflection of quality educational outcomes. Quality education requires the resources of teachers who are able and ready to play professionally in the school and community environment [17] [18] [19]. In the era of rapid development of science and technology today, teacher professionalism is not enough just to be able to teach students, but also must be able to manage information and the environment to facilitate students’ learning activities [20]. The concept of the environment includes a place of learning, methods, media, assessment systems, and facilities and infrastructure needed to package learning and arrange tutoring to facilitate student learning.

In general, the media is a tool to convey information or messages from one place to another. The media is used in the communication process, including teaching and learning activities. According to Santyasa [21], the learning process contains five components of communication, namely the teacher (communicator), learning material, learning media, students (communicant), and learning objectives. So, learning media are all things that can be used to channel messages (learning materials), so that it can stimulate students' attention, interests, thoughts, and feelings in learning activities to achieve learning goals. Learning media is an integral component of the learning system. That is, learning media cannot be separated from the learning process. Without learning media, the learning process cannot occur. Every teaching and learning process requires the selection and use of at least one medium to convey learning.

1.5 The Development of Media Learning Based on the collaboration of Discovery Learning and Problem Based Learning (DL-PBL)

According to Chaeruddin [22], there are several reasons why the media can enhance the quality of the learning process, namely: (1) clarifying the teaching material delivered by teachers (2) providing real experiences to students; (3) stimulating participants, students have a dialogue with themselves. In achieving learning objectives, the role of assistive devices or teaching aids plays an important role because the teaching aids material are easily understood by students [23]. Based on some of the opinions above, the understanding of learning media is a tool used to channel messages in the learning process so that it can stimulate students' thoughts, feelings, and interests to achieve the expected goals.

The Research conducted by Sugianto [24], the application of ICT-based learning media through the joyful learning model is needed to channel messages so that they can help overcome these problems. This study aims to identify the media, produce media, evaluate the validity, effectiveness, and practicality of ICT-based biology learning media through a joyful learning model.

Problem Based Learning is an effective approach to teaching high-level thinking processes with problem-oriented situations, including learning how to learn. According to Santyasa in
Ghofur [25], PBL is a strategy or approach that is designed to help the learning process by the steps contained in the problem-solving pattern that starts from the analysis, plans, solutions, and assessments inherent in each stage. PBL is not structured to assist teachers in conveying a lot of information but the teacher as a problem presenter, questioner, and facilitator.

According to Dasna [26], PBL should be used in learning because: (1) with PBL meaningful learning will occur. Students who learn to solve a problem then they will apply the knowledge they have or try to find out the knowledge needed. This means that learning is in the context of application concepts. Learning can be more meaningful and can be expanded when students are faced with situations where the concept is applied; (2) in PBL situations, students integrate knowledge and skills simultaneously and apply them in relevant contexts. That is, what they do in accordance with the real situation is no longer theoretical so that problems in the application of a concept or theory they will find at once during learning takes place; and (3) PBL can improve critical thinking skills, foster student initiative in work, internal motivation to learn, and can develop interpersonal relationships in group work.

DL-PBL learning model collaboration in the development of print and non-print learning media to provide convenience in the learning process of learning design courses greatly determines the quality of student learning outcomes. DL-PBL Collaboration in Learning Design (S1) Courses in Mechanical Engineering Education consists of 6 (six) stages of learning including (1) stimulation (stimulation/stimulation) by Orientating students to the problem; (2) problem statement (statement/problem identification) by Organizing students to study; (3) data collection followed by assisting independent and group investigations; (4) Data processing by verifying; (5) develops and presents the work; and (6) generalization (draw conclusions / generalizations) and Analyze and evaluate the process of overcoming the problem.

2. Method

This research is research and development consists of three stages, namely pre-media development, media development and media application where the research refers to the Borg & Gall R&D cycle [27], with a modified description and aligned with the actual research goals and conditions.

The research was conducted at the Mechanical Engineering Education Study Program and Automotive Engineering Education at UNIMED in Odd Semester 2019/2020. Both individual trials, small group trials, and main trials are conducted at Unimed. At the development stage of instructional media, targeting in this case are lecturers, learning experts, experts in study fields, and students who assess learning media that have been developed based on criteria, as follows: (1) Evaluation of learning experts (expert judgment) is determined based on expertise it has, (2) evaluators who carry out evaluations are determined based on the ability of lecturers with the classification of experts in the field of study.

This research uses research and development methods, carried out directly by collecting descriptive data that is processed and the analysis of inductive data. The implementation of this research follows the steps: (1) preliminary survey, (2) planning; learning media, learning strategies, learning methods, learning media, (3) media validation, (4) media trials and (5) media revisions.

The Data collection in research and development is grouped into three, namely preliminary studies, development, and validation tests. In each stage of the study selected specific data collection techniques by their respective goals. In the preliminary study, questionnaire /
questionnaire, observation, and documentation techniques were chosen, in addition to a literature review. In general, thirdly, these techniques are used together and complement each other.

The data analysis technique in this research and development uses qualitative and quantitative descriptive analysis. All data collected was analyzed using descriptive statistical techniques that were quantitatively separated by categories to sharpen the judgment in concluding, reducing data, displaying decision making data and verifying. Analysis of the data in this research and development is explained in three, namely the preliminary study, development and validation stages. In the validation stage, the significance and effectiveness of the results of the application of the media were analyzed using a quantitative (quasi-experimental) approach, by comparing the results in the experimental (control) group and the control group, under conditions before and after application. Quantitative analysis through trials conducted with the pretest-posttest and t-test analysis.

**Statistic Hypothesis:**

Ho: \( \mu_1 = \mu_2 \) and Ha: \( \mu_1 > \mu_2 \) Where:

\( \mu_1 \) = the average of student learning outcomes taught using learning media based on DL-PBL collaboration.

\( \mu_2 \) = the average of student learning outcomes by drawing technique and AutoCAD taught based on PBL.

Ho = There is no differences in students learning outcomes that is taught by using DL-PBL collaboration based learning media and students who are taught with PBL.

Ha = There is differences in students learning outcomes that is taught by using DL-PBL collaboration based learning media and students who are taught with PBL.

### 3. Results and Discussion

#### 3.1. Results

Based on product evaluation through a series of trials and revisions that have been made, the learning media based on DL-PBL collaboration in the subject of this learning design is valid. The trial was carried out with six stages, namely: (1) validation of material experts, (2) validation of learning designs, (3) validation of instructional media experts, (4) individual trials, (5) small group trials, and (6) tests try limited field.

<table>
<thead>
<tr>
<th>No.</th>
<th>Indicators</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>Total</th>
<th>%</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Clarity of material</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>24</td>
<td>96</td>
<td>Very Good</td>
</tr>
<tr>
<td>2.</td>
<td>Clarity of instructions learning</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>22</td>
<td>88</td>
<td>Very Good</td>
</tr>
<tr>
<td>3.</td>
<td>Ease of understanding learning</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>23</td>
<td>92</td>
<td>92</td>
<td>Very Good</td>
</tr>
<tr>
<td>4.</td>
<td>Speed of order of presentation</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>23</td>
<td>92</td>
<td>92</td>
<td>Very Good</td>
</tr>
<tr>
<td>5.</td>
<td>Adequacy of exercise</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>25</td>
<td>100</td>
<td>100</td>
<td>Very Good</td>
</tr>
<tr>
<td>6.</td>
<td>Clarity of feedback</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>23</td>
<td>92</td>
<td>92</td>
<td>Very Good</td>
</tr>
<tr>
<td>7.</td>
<td>Help students learning with programs</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>24</td>
<td>96</td>
<td>96</td>
<td>Very Good</td>
</tr>
<tr>
<td>No.</td>
<td>Indicators</td>
<td>M 1</td>
<td>M 2</td>
<td>M 3</td>
<td>M 4</td>
<td>M 5</td>
<td>Total</td>
<td>%</td>
<td>Criteria</td>
</tr>
<tr>
<td>-----</td>
<td>------------------------------------------------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-------</td>
<td>-----</td>
<td>------------------</td>
</tr>
<tr>
<td>1</td>
<td>The interest of the screen display</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>24</td>
<td>96</td>
<td>Very Good</td>
</tr>
<tr>
<td>2</td>
<td>Text Readability</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>23</td>
<td>92</td>
<td>Very Good</td>
</tr>
<tr>
<td>3</td>
<td>Image quality and animation</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>23</td>
<td>92</td>
<td>Very Good</td>
</tr>
<tr>
<td>4</td>
<td>Color composition</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>23</td>
<td>92</td>
<td>Very Good</td>
</tr>
<tr>
<td>5</td>
<td>Navigation</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>24</td>
<td>96</td>
<td>Very Good</td>
</tr>
<tr>
<td>6</td>
<td>Carrying capacity of music</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>23</td>
<td>92</td>
<td>Very Good</td>
</tr>
<tr>
<td>7</td>
<td>Interaction</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>23</td>
<td>92</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

The Results of Data Analysis of Individual Trial, Small Group and Field Trial

**Table 2.** The Individual Trial Against Collaboration-based learning media DL-PBL Learning Design

<table>
<thead>
<tr>
<th>No</th>
<th>Category</th>
<th>% Average</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aspects of learning materials Quality</td>
<td>82</td>
<td>Very Good</td>
</tr>
<tr>
<td>2</td>
<td>Aspects of technical/display Quality</td>
<td>85,7</td>
<td>Very Good</td>
</tr>
<tr>
<td></td>
<td><strong>Average</strong></td>
<td>82,85</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

**Table 3.** The Individual Trial Against Collaboration-based learning media DL-PBL Learning Design

<table>
<thead>
<tr>
<th>No</th>
<th>Category</th>
<th>% Average</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aspects of learning materials Quality</td>
<td>82</td>
<td>Very Good</td>
</tr>
<tr>
<td>2</td>
<td>Aspects of technical/display Quality</td>
<td>85,7</td>
<td>Very Good</td>
</tr>
<tr>
<td></td>
<td><strong>Average</strong></td>
<td>82,85</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

**Table 4.** Small Group Trial Against Collaboration-based learning media DL-PBL Learning Design

<table>
<thead>
<tr>
<th>No</th>
<th>Category</th>
<th>% Average</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aspects of learning materials Quality</td>
<td>92,57</td>
<td>Very Good</td>
</tr>
<tr>
<td>2</td>
<td>Aspects of technical/display Quality</td>
<td>89,71</td>
<td>Very Good</td>
</tr>
<tr>
<td></td>
<td><strong>Average</strong></td>
<td>91,14</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

**Table 5.** Field Trials Are Limited To Collaboration-Based Learning Media DL-PBL Learning Design

<table>
<thead>
<tr>
<th>No</th>
<th>Category</th>
<th>% Average</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aspects of learning materials Quality</td>
<td>90</td>
<td>Very Good</td>
</tr>
<tr>
<td>2</td>
<td>Aspects of technical/display Quality</td>
<td>95,70</td>
<td>Very Good</td>
</tr>
<tr>
<td></td>
<td><strong>Rata-rata</strong></td>
<td>92,85</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

The Data of Student Learning Outcomes Without Using Interactive Problem-Based Learning Media
Table 6. Frequency Distribution of Student Pretest Values Learned Without learning media based on DL-PBL collaboration

<table>
<thead>
<tr>
<th>No</th>
<th>Score</th>
<th>Fi</th>
<th>Xi</th>
<th>Fi,Xi</th>
<th>Xi^2</th>
<th>Fi,Xi^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>23,00-35,00</td>
<td>1</td>
<td>35</td>
<td>35</td>
<td>1225</td>
<td>1225</td>
</tr>
<tr>
<td>2</td>
<td>36,00-47,00</td>
<td>6</td>
<td>43</td>
<td>258</td>
<td>1849</td>
<td>11094</td>
</tr>
<tr>
<td>3</td>
<td>48,00-72,00</td>
<td>14</td>
<td>60,37</td>
<td>845,18</td>
<td>3644,54</td>
<td>51023,51</td>
</tr>
<tr>
<td>4</td>
<td>73,00-85,00</td>
<td>6</td>
<td>72,25</td>
<td>433,5</td>
<td>5220,06</td>
<td>31320,37</td>
</tr>
<tr>
<td>5</td>
<td>86,00-97,00</td>
<td>3</td>
<td>90,66</td>
<td>271,98</td>
<td>8219,24</td>
<td>24657,71</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>30</td>
<td></td>
<td>1843,7</td>
<td>119320,6</td>
<td></td>
</tr>
</tbody>
</table>

The Data of Student Learning Outcomes using learning media based on DL-PBL collaboration

Table 7. Frequency Distribution of Student Pretest Values Learned by Using Collaboration-based learning media DL-PBL

<table>
<thead>
<tr>
<th>No</th>
<th>Score</th>
<th>Fi</th>
<th>Xi</th>
<th>Fi,Xi</th>
<th>Xi^2</th>
<th>Fi,Xi^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>68,12-70,10</td>
<td>2</td>
<td>65</td>
<td>130</td>
<td>4225</td>
<td>260</td>
</tr>
<tr>
<td>2</td>
<td>70,10-76,40</td>
<td>1</td>
<td>70</td>
<td>70</td>
<td>4900</td>
<td>70</td>
</tr>
<tr>
<td>3</td>
<td>76,40-83,96</td>
<td>2</td>
<td>80</td>
<td>160</td>
<td>6400</td>
<td>320</td>
</tr>
<tr>
<td>4</td>
<td>83,96-91,88</td>
<td>12</td>
<td>87,5</td>
<td>1050</td>
<td>7656,25</td>
<td>12600</td>
</tr>
<tr>
<td>5</td>
<td>91,88-100</td>
<td>13</td>
<td>95,1</td>
<td>1236,3</td>
<td>9044,01</td>
<td>16071,9</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>30</td>
<td></td>
<td>2646,3</td>
<td>29321,9</td>
<td></td>
</tr>
</tbody>
</table>

The Difference of Average Student Learning Outcomes

Table 8. The Average Difference Test Results of Two Parties

<table>
<thead>
<tr>
<th>Class</th>
<th>N</th>
<th>Average value</th>
<th>DK</th>
<th>t_{count}</th>
<th>t_{table}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretes</td>
<td>30</td>
<td>62,4</td>
<td>58</td>
<td>41,6</td>
<td>2.04</td>
</tr>
<tr>
<td>Postes</td>
<td>30</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In the calculation of the average difference test of two parties obtained $t_{count}$ is greater than $t_{table}$, it can be concluded that there are differences in average student learning outcomes using learning media based on DL-PBL collaboration. The average value of student learning outcomes using DL-PBL collaboration-based learning media is better than student learning outcomes without using DL-PBL collaboration-based learning media.

3.2. Discussion

DL-PBL collaboration-based learning media on the development of DL-PBL collaboration-based learning media on learning design courses that have been developed by taking into account aspects of learning and the media as the principles of learning message design. The research development of DL-PBL collaboration-based learning media conducted is directed to produce a DL-PBL collaboration-based learning media for students in mechanical engineering and automotive engineering education programs that are used to improve the learning process and student competencies. Therefore, in the process this research is carried out by beginning a preliminary study, then designing learning media, validating products and conducting products and making revisions and improvements based on validation data analysis.
from material experts, learning design experts and learning media experts, followed by individual trials, trials try small groups and field trials so that learning media are produced that are suitable for use in accordance with the characteristics of the field of study and students as users.

The benefits obtained from the use of instructional media are concepts that are presented easily learned, understood, and systematically. DL-PBL-based collaborative learning media provide opportunities for students to learn according to their respective speeds, learn faster and not cause boredom respectively, faster and not cause boredom because it is equipped with pictures and animations and varied practice questions. This collaborative learning media based on DL-PBL can also be used as an alternative learning media both classically and individually. Furthermore, Krisnavati’s research [28] showed a percentage increase in student learning outcomes from pre-test to post-test by 40.27%. Multimedia learning products developed are effective for learning based on an increase in the percentage of pre-test to post-test. The research proves that the application of interactive learning media can improve student learning outcomes and according to indicators of success. The difference is that the results of other studies conducted by Proyambodo, Antuni, and Sari [29] show that multimedia learning has also proven to be effectively used as a source of independent learning by students and has better performance compared to classes without treatment. data from the trial results can be seen that the average value of student learning outcomes in the treatment class is 78.29 greater than the control class that is 73.92. Besides that in the control class as many as 18 students (48.65%), fewer than the treatment class as many as 27 students (77.14%). Students produce an average value of 75.57 greater than the control class that is 49.49 and as many as 20 students can achieve the above learning outcomes of 72, while in the control class only 1 student.

The results obtained are by the theory of discovery learning model learning. Discovery learning according to Rohani [30] is “a learning model that requires students to discover principles or relationships that were previously unknown to them which are the result of their learning experiences that have been carefully and carefully arranged by the teacher”. Discovery learning has the meaning that students as subjects in the learning process. Students have the basic ability to develop optimally according to their abilities. The lecturer is only as a facilitator and guide students to provide stimuli that can challenge students to feel involved in the learning process. Lecturers provide opportunities for students to find their information and knowledge based on the results obtained through their observations. So students can find principles or relationships that were previously unknown to them through their learning experiences that have been carefully and carefully arranged by the teacher. In addition to these theories, the results obtained in this study are also in line with the results of research relating to the discovery learning model of learning that has been done previously.

Research on the development of collaborative learning media based on DL-PBL, after testing a problem-based interactive learning media, was only conducted in a limited trial with a sample of 30 students. Extensive trials were not conducted so that the possibility of extraordinary factors still influenced the results of the study. Therefore the sample in the study must be large in number so that the research results can be realized. Besides that, students and lecturers' readiness to use learning media based on DL-PBL collaboration is different from the previous learning media. Unpreparedness of lecturers in using learning media can be overcome by explaining about learning media and its use. Whereas students' unpreparedness can be overcome by giving learning media interactive problem-based learning media so that it can be used as an independent learning tool to improve student competency and student learning outcomes.

Students who become research subjects cannot be tightly controlled, so the possibility of
different study time and learning experiences in each subject beyond the treatment given during
the learning process can affect student abilities. To overcome this limitation, it is necessary to
pay attention to the use of more samples, further tight control is needed on the sample so that
there is no bias when the sample is out of treatment.

4. Conclusion

The conclusions of the results and discussion above of this study as follows:

a. The results of the assessment by material experts, media experts and learning design experts
   in each aspect of the overall assessment are determined by the average score in their
   respective categories. The results of the development of learning media based on DL-PBL
   collaboration can improve students’ learning outcomes, so it is worth developing.

b. The results of the material expert validation on the aspect of content/material feasibility,
   learning media based on DL-PBL collaboration that have been made are included in the very
   feasible criteria. The results of the validation of media experts on the feasibility of media
   aspects, learning media based on DL-PBL collaboration that have been made are included
   as feasible. The results of the design expert validation on the aspect of media feasibility, the
   design of problem-based interactive learning media, including the criteria, are very feasible.
   At the individual trial stage the DL-PBL-based collaborative learning media showed very
   good. Furthermore, in the small group trial stage, the DL-PBL-based collaborative learning
   media shows very good categories. The results of field testing give the result that learning
   media based on DL-PBL collaboration is included in very good criteria. This media is
   appropriate to be used as a learning medium. Furthermore it can be concluded that the
   learning media based on DL-PBL collaboration on the learning planning material that has
   been developed, is included in the very well to be used as a learning media based on DL-
   PBL collaboration.

c. The results of calculations using the t test on differences in student learning outcomes using
   collaborative learning media based on DL-PBL show that the average value of students
   before using learning media was 62.4 and after using collaborative learning media based on
   DL-PBL increased by 90.5. Furthermore, based on the results of the analysis using the test
   formula t count > t table (41.6 > 2.045) so that it can be concluded that there are differences in
   average student learning outcomes using problem-based learning media.

4.1. Acknowledgements

Thank you to the Research and Community Service Institute of Medan State University
and the Ministry of Research, Technology and Higher Education for providing research funding
through the Expertise Lecturer Group or Kelompok Dosen Bidang Keahlian (KDBK) for the
2019 budget year which is charged to the Budget Implementation Entry List or Daftar Isian
Pelaksanaan Anggaran (DIPA) of Medan State University, so that research can be carried out
and completed well.
5. References


Net Balance Analysis Relationship of Learning Interests and Student Learning Outcomes of Teacher Explanation Skills in Medan City

Syafiatun Siregar¹, Harun Sitompul², Kinanti Wijaya³, Ahmad Andi Solahuddin, Mey Theresia Naibaho
{syafiatunsiregar@gmail.com¹, prof_runsit@yahoo.co.id², kinanti.w@gmail.com³}
Universitas Negeri Medan, Jurusan Pendidikan Teknik Bangunan, Medan¹²³

Abstract. This study aims to analyze the relationship of learning interest and student learning outcomes with the teacher's explaining skills using Chi-Square analysis and to determine the level of student optimism towards the teacher's explaining skills using the net balance method. Based on the trial instrument the results obtained; (1) The teacher's explaining skills there were 24 valid statements, (2) The Learning Interest variable there were 23 valid statements, (3) The Learning Outcomes variable with 31 valid questions. The results obtained are that there is a relationship between the skills of explaining teachers with student interest in learning with the acquisition of Chi-Square count 51.332 > Chi-Square table 37.65. In contrast, there was no relationship between the teacher's explaining skills and the learning outcomes obtained with the Chi-Square count calculated 18.710 < Chi-Square table 37.65. The net balance results contained 6 statements of students' pessimistic perceptions of the teacher's explaining skills.

Keywords: Teacher's Explaining Skills, Interest In Learning, Learning Outcomes.

1. Introduction

Vocational High School (SMK) is one of the secondary level educational institutions that manage vocational education. To achieve the educational goals in Vocational Schools is formulated from Government Regulation of the Republic of Indonesia Number 19 of 2005, namely; (1) Learn to have faith and be devoted to God Almighty; (2) Learn to understand and appreciate in developing an attitude of professionalism; (3) Learning to be able to carry out and act effectively; (4) Learn to live together and be useful to others; (5) Learning to build and find identity through an active, creative, effective and enjoyable learning process; (6) Become a mid-level workforce to fill current and future business and industrial needs. Government Regulation 19/2005 as a Vocational Guideline is expected to produce mid-level skilled workers in accordance with their area of expertise.

SMK in Medan City of North Sumatra Province in the Building Design and Information Design (DPIB) expertise program has a curriculum that has been prepared based on their respective engineering training program. The engineering education and training programs in Vocational Schools are divided into 3 groups, including (1) Normative Training Programs, (2) Adaptive, and (3) Productive. Of these three training programs, it is the productive training program that
is a subject of expertise that is directly related to student skills. Specifically to see the quality of learning, ideally, students master all subjects contained in the Normative Training Program, Adaptive Training Program, and Productive Training Program. Drawing techniques contained in the Productive Training Program need attention because this subject discusses drawing manually. This subject is very useful because it is a vocational requirement that has a close relationship with other subjects related to the Productive Training Program.

The Drawing techniques are directly related to science and technology (Science and Technology), especially in building techniques and daily life that have an important role in improving quality human resources. Drawing Engineering needs to be taught and mastered by all students in vocational and tertiary institutions. This subject aims to make students have the basic capital for manual drawing and drawing with software so that students are expected to master the subject of drawing techniques.

The reality is not as expected, this can be seen from the low level of student mastery of Drawing Techniques in the SMK environment in Medan, as can be seen in Figure 1 below. Figure 1. Shows that there are 22.64% of students who have not succeeded (not competent), and 77.36% of students who have succeeded (competent and quite competent). Overall, learning outcomes have not shown the success of a class. Mastery learning can be categorized to be successful if > 85% of students are competent.

The students’ success in learning to draw techniques is also largely determined by internal factors, namely student learning interest. Because the learning material does not match the interests of students, students will not be encouraged to study as well as possible because there is no attraction for him. Learning material that attracts students’ interest is easier to memorize and store, because interest activities changed. Interest can and does function as a powerful driving force. For this reason, an effort should be made to explore, grow and foster students’ interest in Engineering Drawing lessons.

The purpose of this study is to:

a. To find out the relationship between teacher's explaining skills and interest in learning
b. To find out the relationship between teacher's explaining skills and learning outcomes
c. To analyze students' perceptions of the teacher's explaining skills using net balances.
2. Literature Review

The Nature of Learning Outcomes in Drawing Techniques

Learning outcomes is the level of student ability in the learning process states learning outcomes are a result of the learning process by using measurement tools. Measurement of learning outcomes can take the form of tests arranged in a planned manner, both written tests, oral tests and tests of deeds. Learning outcomes are a change in an individual. These changes are not only about knowledge but also shape the skills and personal self-appreciation of individuals. Learning outcomes are the acquisition of something new in the behavior after someone has done the learning activities. The success of student learning in achieving teaching objectives can be realized by the acquisition of values obtained at the end of the learning process. Learning is a business process that is done by someone as a whole to obtain a change in a new behavior. Changes in behavior are as the result of his experience in interactions with the environment and interactions in learning.

Drawing techniques are the subjects of training taught in the Vocational Building Modeling and Information Design Skills Program (DPIB). The subjects aim at assigning how to draw a construction manually. With competent students from these subjects, students will be able to continue their studies in building engineering majors with deeper knowledge. Drawing techniques are productive subjects that lead to basic mastery in drawing techniques. Teaching and learning activities on these subjects carried out in the classroom and divided into two namely theory and practice. The theory of drawing techniques becomes fundamental and important, where students gain basic knowledge about the principles in drawing basic techniques and become a source of knowledge to understand the practice. Practical activities are concrete steps and proof of what has been taught in theory, in other words, practical activities are work based on theory.

Students' Perceptions About Teacher Explaining Skills

Perception is a process that is experienced by sense, which is the process of receiving a stimulus by an individual through the sense organ or also called a sensory process. Perception is the process of receiving an object's excitement, quality, the relationship between symptoms, and events until the stimulus is realized and understood [1]. Perception is an experience about objects, events or relationships obtained by concluding information and interpreting messages. Perception is giving meaning to sensory stimulus (sensory stimulus). Based on the definition above that perception is not a real thing. However, perception is a concentration of something that leaves a message to someone.

During the learning process, verbal and verbal communication in the classroom includes face-to-face interaction and communication that is needed between the participants involved in the class [2]. In this face-to-face interaction, the teacher uses verbal and non-verbal language to communicate the expectations of students, material, strong interactions between students and teachers, creating a comfortable atmosphere, giving praise, personal approach, showing discipline, good listener, and other things which are communicative to bring about a conducive and pleasant learning atmosphere. The purpose of the teacher using communication in the classroom is to (1) obtain relevant knowledge from students, (2) to respond and provide input to the things students ask about and (3) to describe learning experiences. It is hoped that with class communication, teacher communication skills will be identified, teachers will become more aware of their communication skills and communication patterns currently in their classrooms and will be able to evaluate whether these patterns provide opportunities for them students to study [3].
focusing on more than one teacher's explaining skill questions that they use when teaching, teachers will be able to practice and monitor the use of their communication skills not only as important input for their students but also to achieve more effective teaching when doing lessons. In addition, there are no studies examining how teacher language or communication skills contribute to their ESL classroom communication in the context of their teaching. In this study, speaking and explaining teacher skills, or using the term Bleach, communication skills are seen in the context in which what and how they are used, and as a contribution to the integration of teacher language as verbal communication skills (delivery of material) as a hierarchy of decisions and automatic actions which is used as an integrated whole, the lower one depends on the higher [4]. In this study, several statements such as the ability to explain the teacher, including attracting the attention of students; provide questions and answers, manage mistakes, explain, communicative language, and nonverbal communication skills are explored. Teacher and student communication such as socializing, directing, giving instructions and summarizing are important [5]. The most common communication skills used by teachers in the classroom are explaining the material, asking questions and raising questions or answers. The teacher in the class must be able to use high questioning skills. The teacher asks questions to assess student understanding and increase student involvement during the learning process. The teachers use communication skills that are less than socializing skills in teaching. In addition, nonverbal communication skills are also very important to be used by teachers.

**Interest to Learn**

Interest is the willingness of the soul that is active to receive something from outside. Each lesson must be strived to be able to attract students. Interest persists to pay attention to end enjoy some activity or content. Interest is a feeling of preference and a sense of interest in a thing or activity, without anyone asking. Interest is basically the acceptance of a relationship between oneself and something outside of oneself. Big interest is the effect on learning because if the lesson learned is not in accordance with the interests of students, the results are not satisfactory. Interest is the tendency of a subject to settle, feel interested in a particular subject area of study and feel happy studying the material. Someone who is interested in activity will pay attention to the activity consistently with pleasure.

...teacher has an important role in increasing and arousing student interest in learning. To get the best teaching results in the learning process the teacher is must always try to arouse the interests of the students so that all of their attention is focused and focused on the learning material after being taught. There are several ways to arouse interest in learning, namely (1) arising of a need, (2) connecting with past experience problems, (3) giving an opportunity to get good results, and (4) using various forms of teaching.

Those interest concerns activities freely chosen by individuals. Interest or interest involves the symptoms of the process associated with objects or activities that stimulate an individual's feelings of pleasure. Interest is associated with needs, for example, a man who is developing in need of physical growth will take an interest in physical activities such as soccer, volleyball or other activities that can accelerate his physical growth.
3. Methodology

This research was conducted at the State Vocational School in Medan City Building Design and Information Design Skills Program (DPIB) in 2019 Engineering Drawing subjects. The research method used by researchers in this study was a descriptive research type correlation study. This study uses three variables that are the skills of explaining the teacher, interest in learning, and learning outcomes. The crosstab analysis was carried out using SPPS version 23 which links a teacher's explaining skills with an interest in learning and the relationship between teachers explaining skills and learning outcomes. Next to the analysis of perception using net balance analysis.

Data processing is performed using the net balance method, namely by calculating the difference between the percentage of the number of respondents who give 'Always and Often' answers with the percentage of the number of respondents who give answers' Rarely and Never 'and ignoring the answers' Sometimes ”. As for measuring the perception of teacher activity with student learning interest and learning outcomes if the results are positive then students optimistic for the statements given otherwise will be pessimistic about the statement of minus value.

4. Results and Discussion

The study was conducted at 3 SMKs in Medan city. The population is all students in class X of the Building Design and Information Design (DPIB) expertise program while the sample is taken as many as 98 students representing 3 public SMKs in Medan. Assessment of the ability to explain the teacher was done by giving answers in the category Always, Often, Sometimes, Rarely, and Never. The rating scale uses a Likert scale with the highest range of 5 and lowest 1. The results of the frequency distribution obtained data as follows in Table 1.

<table>
<thead>
<tr>
<th></th>
<th>Teacher's Explaining Skill</th>
<th>Interest To Learn</th>
<th>Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>N Valid</td>
<td>98</td>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mean</td>
<td>91,4286</td>
<td>80,8673</td>
<td>19,7857</td>
</tr>
<tr>
<td>Median</td>
<td>92,0000</td>
<td>83,0000</td>
<td>19,0000</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>9,73780</td>
<td>7,90750</td>
<td>3,57035</td>
</tr>
<tr>
<td>Minimum</td>
<td>71,00</td>
<td>59,00</td>
<td>14,00</td>
</tr>
<tr>
<td>Maximum</td>
<td>112,00</td>
<td>96,00</td>
<td>27,00</td>
</tr>
</tbody>
</table>

Teacher's explaining skills have the lowest range of 71 and the highest value of 112 out of 24 valid statements distributed to students. Learning interest has a range that has the lowest values 57 and the highest value 96 of 23 valid statements distributed to students. Learning outcomes have the lowest values 14 and the highest value of 27 of 31 valid statements distributed to students. From the table, it is found that the average ability to explain the teacher is equal to 91.46 or 76.21%. Figure 1, Figure 2 and Figure 3 explain the frequency distribution of each variable tested.
The cross-tabulation analysis was carried out, namely between the variables Explaining the Teacher's Skills with Interest in Learning and the Skills Explaining the Teacher's Learning Outcomes in Drawing Techniques. The results can be seen in Table 2 and Table 3. Then the crosstab analysis shown in Table 4 and Table 5.

Table 2 Results Of Crosstab Skills Explain Teacher And Interest In Learning

<table>
<thead>
<tr>
<th>Interest To Learn</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 2. Results of Frequency Distribution of Teacher Explaining Skills

Fig. 3 Learning Interest Frequency Distribution Results

Fig. 4. Results of Frequency Distribution Learning outcomes
From Table 3 the Chi-Square count = 51.332 while the Chi-Square_{table} = 37.65 (df = 25). Expect Chi-Square_{count} > Chi-Square_{table}, which means that Ho was rejected and Ha was accepted which should be related to the skill of explaining the teacher and the interest in learning, according to Kogut & Silver, 2009; Kazi et al, 2012), during the learning process it was very important verbal and non verbal communication in class. The intended communication is the interaction or communication between students and participants. In line with Farrell (2009) that states the purpose of teachers using communication in the classroom is to foster and increase student’s learning interest during the learning process. Therefore the teacher’s explaining skills are closely related to students’ interest in learning. Teachers must be able to foster interest in learning in order to obtain optimal learning outcomes.

## Table 4. Results Of Crosstab Skills Explain Teacher And Learning Outcomes

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher's Learning Skill</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>71 - 77</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>78 - 84</td>
<td>2</td>
<td>5</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>21</td>
</tr>
<tr>
<td>85 - 91</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>92 - 98</td>
<td>2</td>
<td>3</td>
<td>13</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>25</td>
</tr>
<tr>
<td>99 - 105</td>
<td>0</td>
<td>8</td>
<td>8</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>106 - 112</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>24</td>
<td>38</td>
<td>9</td>
<td>8</td>
<td>13</td>
<td>98</td>
</tr>
</tbody>
</table>

## Table 5. Results Of Crosstab Skills Explain Teacher And Learning Outcomes

<table>
<thead>
<tr>
<th>Value</th>
<th>df</th>
<th>Asymptotic Significance (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>18,710*</td>
<td>25</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>21,698</td>
<td>25</td>
</tr>
<tr>
<td>Linear-by-Linear Association</td>
<td>.086</td>
<td>1</td>
</tr>
</tbody>
</table>

N of Valid Cases 98

a. 29 cells (80.6%) have expected count less than 5. The minimum expected count is .37.
From Table 5, the Chi-Square count = 18.710 while the Chi-Square table = 37.65 (df = 25). This means that the Chi-Square count < Chi-Square table, which means that Ho was rejected and Ha was accepted, which means there is no relationship between the skill of explaining the teacher and the learning outcomes. Slameto (2010: 54) states the factors that influence learning outcomes consist of internal factors and external factors. Internal factors are factors that originate in the individual who is learning, namely physical, psychological, and fatigue. External factors are factors that exist outside the individual namely family, school, and community (environmental) factors. Therefore, the teacher's explaining skill has no effect on student learning outcomes.

**Table 5: Results of Net Balance Analysis Teacher's Explaining Skills**

<table>
<thead>
<tr>
<th>No</th>
<th>Answer</th>
<th>Net Balance</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Up</td>
<td>Down</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>13</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>13</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>11</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>10</td>
<td>-6</td>
</tr>
<tr>
<td>7</td>
<td>17</td>
<td>0</td>
<td>17</td>
</tr>
<tr>
<td>8</td>
<td>7</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>8</td>
<td>10</td>
<td>-2</td>
</tr>
<tr>
<td>10</td>
<td>7</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>3</td>
<td>14</td>
<td>-11</td>
</tr>
<tr>
<td>12</td>
<td>8</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>13</td>
<td>12</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>14</td>
<td>12</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>15</td>
<td>8</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>16</td>
<td>12</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>17</td>
<td>5</td>
<td>11</td>
<td>-6</td>
</tr>
<tr>
<td>18</td>
<td>12</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>19</td>
<td>12</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>20</td>
<td>11</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>21</td>
<td>9</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>22</td>
<td>5</td>
<td>7</td>
<td>-2</td>
</tr>
<tr>
<td>23</td>
<td>4</td>
<td>12</td>
<td>-8</td>
</tr>
<tr>
<td>24</td>
<td>7</td>
<td>7</td>
<td>0</td>
</tr>
</tbody>
</table>

Net Balance analysis is carried out to assess students' perceptions of the learning process undertaken. Net balance analysis is performed by looking at valid instruments. There are 24 valid instruments for the teacher's ability to explain to the teacher. Net balance done by reducing the value of 'up' (Frequently and Always) by the value 'down' (Rarely and Never). Furthermore, a value of > 0 will be considered optimistic and a value of < 0 will be considered pessimistic about the questions were given.

Table 6 shows the results of the net balance analysis skills for explaining teachers. From these results it was found that there are 6 questions that are pessimistic about the ability to explain the teacher, namely in (1) When explaining the subject, the teacher uses language that is difficult for students to understand, (2) The teacher does not care about students'
understanding of the subject matter described, (3) Before implementing the learning process, the teacher does not need to inform the subject matter to be explained, (4) The teacher does not need to remember students to repeat at home the lesson material that has been explained, (5) The teacher never gives an opportunity to students to ask about the subject matter which is not yet clear, (6) The teacher never gives assignments to the material described. Seeing the description of the statement given with students' perceptions of the skills of explaining the teacher needs to be improved both from the teacher's internal and external teachers.

5. Acknowledgements

This research was a joint work of several lecturers majoring in Building Engineering Education assisted by students who carry out research for thesis reports. This research will not work well without the support of various parties. Gratitude was conveyed to the Dean of the Faculty of Engineering Unimed, Prof. Dr. Harun Sitompul, M. Pd. who acted as validator and who gave a lot of input in writing the report. A sincere greeting was conveyed to student Mey Theresia Naibaho hopefully, you will succeed in achieving your goals. Furthermore, the gratitude is conveyed to the principal and teachers of State Vocational High School 2, State Vocational High School 5 and Provsu National Vocational School who provided data and helped this research.

6. References

Inquiry Base Learning Model in Electrical Machine Learning

Marwan Affandi1), Adi Sutopo2), Mustamam3)
Universitas Negeri Medan, Indonesia1,2,3
marwanafandi@unimed.ac.id

Abstract. This paper aims to discuss the importance of electrical machine modules in the learning system in the Department of Electrical Engineering. Mastery of electrical machinery courses is part of the main competencies that must be mastered by Electrical Engineering students. This is because electric engines are a major part of the electric power system, namely in the generation, distribution and use of electrical energy. The mastery of electrical machine competence is not only theoretically (cognitive) but must be accompanied by the ability to operate and maintain its operations. The mastery of the competence of the electric machine can be achieved through practical activities and analysis of the results of the practice carried out carefully and comprehensively. Practical and analytical activities can be optimized if students are active and try to find solutions to problems independently through inquiry learning models.

Keywords: electrical machines, electrical machine competencies, inquiry models

1. Introduction

The mastery of electrical machinery in electrical engineering curriculum both for electrical engineering (non-educational) and electrical engineering education is included in core competencies. This is because electrical machines are a major part of the power system of the generation, distribution and consumption of electrical energy. Electrical machines consist of electrical generators, electric motors as well as transformers. Based on the kind of wave motors and generators consist of direct current and alternating current. Transformers consist of power transformers and measuring transformers.

Electrical machine function in electrical energy generation is generating electrical energy in the form of generators. The electricity generated by the generator needs to be channeled to consumers that are up to hundreds of kilometers, so it requires an electrical machine to raise its electricity voltage to be more effective and efficient with the transformer. Meanwhile, consumers (users) consisting of industries, agencies and the general public use a lot of electric motors to move mechanical equipment to produce mechanical energy (rotary) such as; Fan, AC, water pump, lathes, scrap and so forth.

Mastery of electrical machine competence is the main for all electrical engineering students, because of the importance of electrical machines in human life and industry. Competency mastery of electrical machine theoretically and practically can be achieved if in the process of learning to teach electrical machine material using model and learning approach in accordance with the characteristics of electrical machine material. It also takes adequate tools and materials as a learning resource.
The source of electrical machine learning can be textbook, Journal, Report of research results, electrical machine equipment and materials. These learning resources need to be organized to form an integrated learning model, making it easier for lecturers and students in teaching and learning activities to achieve the learning outcomes expected by the industry and society.

Electric machine based on its direction source is divided into two; namely DC electrical machine and AC. The AC power machine consists of DC Generator and DC Motor with the same construction, so that the DC generator can be converted into DC motor and vice versa depending on requirement. The difference is that the generators generate electrical power and require a starting drive, while DC Motors require electrical power to be converted into motion energy. DC machines, IE generator or motor consist of generators/DC motors series, generators/motor shunt and generators/motor components.

AC Power Machine based on its use consists of generators, motors, and transformers. The AC generator consists of synchronous generators and Asynkron generators. Based on the façade consists of 1 phase and 3 phases. AC motor is divided into two of the motor Syncrone and motor Asyncron. The Asyncron motor is based on a 1-phase and 3-phase motor. The 3-phase Asynchronous motor consists of a cage rotor motor and a puncte rotor motor. While the 1st phase Asynchronous motor consists of various types of motors namely series motor, shaded pole, motor start capacitor, motor running capacitor, and motor repulsion.

The transformer is an electric machine that has no moving parts or is called a static electrical machine, but has the same working principle with other electrical machines that is by electromagnetic induction. Based on its fasts the transformer consists of 1 phase transformer and three phase transformer. Based on its roll consists of two-coil transformers and a single-coil transformer (auto transformer). Based on its use consists of power transformers and measuring transformers. Based on the tension changes are divided into two namely the transformer step up and transformer step down. The function of the transformer is to move the electrical power from one circuit to another by not reducing the electrical power except for the resulting losses on the transformer.

The electrical machine in its operation cannot stand alone but it requires a measuring device and other auxiliary materials. Assistive devices can serve as safety and ease of operation. AIDS serve as safeguards such as over load relay, MCB, while auxiliary equipment for operation function consist of connecting cables, magnetic switch and mechanical switch. In addition to be able to understand the character (characteristic) Kettle machine requires various measuring instruments such as volt meter, ampere meter, cos Q meter, frequency meter and watt meter.

The Trainer module is developed based on the need for electrical practice as a student guideline in the activities at the lab/workshop. Electrical Machine module contains guidelines in implementing the electrical machine practice. By using electrical machine tools in the laboratory of Energy Conversion Department of Electrical Engineering, materials and tools required include: Electrical machines, magnetic contactors, push buttons, relays, safety fuse, and measuring instruments. All materials and tools are assembled in a trainer that allows students to carry out various electrical machine experiments.

Research and experiments that students can do include: characteristics of electrical machines, electrical machine operating systems and other research-related electrical machines. Designing the electric engine trainer module with the inquiry approach model is the safety factor of the tool, material and use of attention. The inquiry Model to be used in Electrical machine module is Confirmation inquiry [1]. Confirmation inquiry is deemed appropriate for the development of electrical machine module because of its purpose to confirm for further
knowledge, in this case the knowledge of electrical machine. The purpose of the Electrical machine module is to provide direction to the students in order to apply their theoretical knowledge in the form of direct practice development. Development of Electrical Machine trainer module designed to adjust availability tools and materials in electrical machine laboratory.

Electric machine Trainer module with Confirmation Inquiry model provides extensive opportunity on students to develop electrical machine knowledge. Model Confirmation Inquiry in Electrical machine module is expected to encourage students of electrical engineering active, creative, and innovative. In addition to using the Model Confirmation Inquiry students are able to elaborate various supporting knowledge so as to make the knowledge of electrical engineering students become comprehensive. Inquiry-based learning provides opportunities for students to: develop skills they will need all their lives, learn to cope with problems that may not have clear solutions, deal with changes and challenges to understandings and shape their search for solutions, Now and in the future [1].

2. Method of Inquiry Learning Model in Practice Learning

The mastery of knowledge and technology of electrical machinery for students is not limited in cognitive mastery but also psychomotor mastery. The importance of psychomotor mastery is not to be released from the knowledge ability of electrical machines. The ability of psychomotor in electrical machines is the ability to operate electrical machines in accordance with the prevailing operational standards and electrical engine characteristics, so that the use of electric machines becomes safe, effective and efficient.

The learning of electrical machines for students is very important because all industries are unable to escape the needs of electrical machines in their production. Similarly, government and private agencies and households are currently unable to break away from electrical machines, albeit with relatively small power values. The application of the enquiries model is done with the enquiries guided system. The suppression of the Inquenous model is emphasized on the student's efforts in planning the wiring in engine operation, operating, and measuring[6]. The mentoring is done as an assessment and feedback to what is planned and practiced by the students so that when an error occurs it can be repaired immediately. It is important always carried out supervision in the implementation of the practice, because in addition to harmful students can also lead to damage to the electrical machine used in practice.

There are 4 stages in enquiries Learning model: The first phase of inquiry-based learning is one characterized by interaction, Clarification by analyzing data, identifying and clarifying misconceptions, and otherwise "getting a feel" for the scale, nature, and possibility of selected topics of inquiry, Questioning The Questioning phase is a critical phase of The inquiry-based learning process, if for no other reason than misunderstandings, lack of organization, uneven confidence, or an inability to see The "big picture" surface here more clearly than other Phases, and Design At This final stage of the inquiry-based learning process, learners are focused on design [2,5].

Meanwhile, the stage in the implementing of the Inquiry model [4]: Phases the new inquiry-based learning is Orientation focuses on stimulating interest and curiosity in relation to the problem at hand. Conceptualization is a process of understanding a concept or concepts belonging to the stated problem. It is divided into two sub-phases, Questioning and Hypothesis Generation., Investigation is the phase where curiosity is turned into action in order to respond
to the stated research questions or hypotheses, Conclusion is the phase in which the basic conclusions of a study are stated. Discussion contains the sub-phases of Communication and Reflection. Communication can be seen as an external process where students present and communicate their findings and conclusions to others, and receive feedback and comments from other.

3. Analysis, Result and Discussion

The inquisitive approach in the module only gives an overview of how students issue ideas or develop ideas that have to be applied in application settings and understanding the characteristics of electrical machines based on science that already owned about the electric machine. Based on this, students can pour development ideas and develop a minimal psychomotor ability at articulation level such as being able to build and expand the control circuit of the electric generator motor and formulate transformer magnitudes of its characteristic trials. Some have emphasized the active nature of student involvement, associating inquiry with "hands-on" learning and experiential or activity-based instruction. Others have linked inquiry with a discovery approach or with development of process skills associated with "The scientific method." Though these various concepts are interrelated, inquiry-oriented instruction is not synonymous with any of them. [2,3]

Enquiries approach encourages students to integrate the science that is owned as a basis in developing and building a series of electrical machines for various needs. This is considering the electrical machine cannot stand alone in its operation [7]. Students should be able to relate between alternating current electric circuits that talk about a balanced circuit, a series of triangular stars. In addition to the capability of electrical installations such as arranging a true and safer power system as a base in the operation of electrical machines. This can be done when learning using the project method. The intended project is the duties given to the students in the form of development themes in the application and operation of electric machine operations.

![Fig 1. Knowledge and Skills of Electrical Machine](image-url)
3. Conclusion

1. The mastery of electric machines is a major competency that must be possessed by electrical engineering students because industry, government/private agencies, the public cannot be separated from the use of electrical machines.
2. Mastery of electrical machine competence comprehensively achieved if the students in the Learning conduct analysis activities conducted theoretically and practically.
3. Deeper mastery of electrical machine competence can be implemented with enquiries learning methods that encourage students to be active, creative and innovative in the operation and security of electrical machinery.

5. References

Improvement of Quantum Teaching Model Assisted by Comics against Student Learning Outcomes

Marnoko¹, Sriadhi², M. Martiano³
{marnoko1964@gmail.com ¹, sriadhisy@gmail.com ², martinno84@gmail.com ³}

Universitas Muhammadiyah Sumatera Utara, Pendidikan Akuntansi¹, Universitas Negeri Medan, Pendidikan Teknologi Informatika dan Komputer²³

Abstract. Research focus on the low student learning outcomes 6th semester advanced accounting courses II in the accounting study program at the University of Muhammadiyah North Sumatra 2017/2018 Learning Year. The purpose of this study was to determine the effect of Quantum Teaching Type Active Learning Model aided by Comic Media on Improving Student Learning Outcomes. The population of 6th semester is 144 students. The results showed that 1) Through the cooperative quantum Cooperative learning model showed a very effective increase in student learning activities namely the average score of student learning outcomes in the first cycle of 66.55, in the second cycle increased with the average activity of students in the second cycle achieving 70.22, in the Third cycle increased with an average of student activity in the third cycle reached 73.30, and in the Fourth cycle increased with an average student activity in the fourth cycle reaching 73.30, Thus it can be concluded that, there is a significant effect of the Active Learning Model Type Quantum Teaching assisted by Comic Media Against the Improvement of Results in Advanced Accounting Learning II.

Keywords: accounting, media, outcomes, cycle

1. Introduction

The use of media for learning really supports student learning outcomes because of the role of the media it is very important to avoid the assumptions of students, observations at the University of Muhammadiyah North Sumatra in advanced accounting courses II semester 6, the use of media as learning still has not played an active role, the media which is generally used, namely the use of projector as teaching material, this causes it to be one-way, so that students obtain student learning outcomes as follows:
Based on the above data students have a score below 75 as many as 78 people while students who score above 75 are 36. It can be concluded that new methods are needed to attract students to be able to play an active role in lectures one of them by using the quantum teaching comic model. Quantum teaching can create quality interactions that can improve learning outcomes while comics can make students better understand the lesson because comics can make learning more fun. Quantum Teaching describes new ways that facilitate the learning process so that it is easy to analyze problems and achieve their goals, especially in the discussion of adjusting journal material in service companies. The material tends to require understanding and accuracy, so by using the Quantum Teaching Model assisted by Comic Media, it is expected that students will be able to find their own solutions to problems in adjusting service company journals.

2. Research Methods

The purpose of this research is to see an increase in student learning activities, and how lecturers prepare, and master the material using the Quantum Teaching model assisted by Comic Media. The design of this research model has 4 cycles namely planning, implementation, action, observation and reflection. The intended planning the Quantum Teaching model assisted by Comic Media, in advanced financial accounting courses II, Creating Lecture Program Units (SAP) in accordance with the model used, making student worksheets, designing and determining the implementation of the Quantum Teaching model assisted by Comic Media, preparing tools and materials to assist the research process, creating an observation letter format between lecturers and students, measuring students the range of values used for the description test in this study is 0 to 100 with the formula:

\[ X_i = \frac{S_p i}{S_m} \times 100 \]
With:
\[ \text{Xi} = \text{Value obtained by the i-th student} \]
\[ \text{Spi} = \text{Score obtained by the i-th student} \]
\[ \text{Sm} = \text{Maximum score possible (ideal score)} \]

Calculate the average value of student learning outcomes with the formula:

\[ \bar{X} = \frac{\sum_{i=1}^{n} \text{Spi}}{n} \]

\( \bar{X} \) = average value obtained by students
\( \text{Xi} \) = The total number of scores obtained by students overall
\( n \) = the total number of students

Determine the level of mastery learning achievement in a classical percentage of the number of students whose learning outcomes are complete, using the formula:

\[ \frac{\sum TB}{N} \times 100\% \]

With:
\( \sum TB \) = Number of students who have completed their studies
\( N \) = Total number of students

3. Results and Discussion

Research Results Observation of Student Learning Activities Comic quantum learning models on advanced accounting material were obtained using observation sheets of student learning activities. To determine the achievement of the indicators in the student activity observation sheet given a score of accomplishment for each activity carried out by students during the learning process that starts with a Score of 1 to 4.
From the results of observations of the activities of students in the first cycle showed the total number of scores obtained by 84 students with an average student activity reaching a value of <75, 17 students getting a score of 70-75, and 12 students getting grades above 75. Based on observations made by lecturers, students still do not read the habit because comics are still dominated by a large amount of writing, and also lecturers' explanations of the material are not well understood by students, and students are embarrassed to ask about the material presented. To overcome this, the researcher made an innovation adding questions that were carried out by the comic, so students had to solve the cases given by the comic. The results obtained in cycle II are 70 students who have grades below 70, student learning outcomes in 75-70 namely 25 people, and 18 students get grades> 75. Based on observations students begin to actively work on assignments given by comics and students ask the lecturer about the material provided. This study was continued in cycle III, the results obtained were 43 students achieving grades below 70, there were 40 students achieving grades 75-70, and 30 students achieving grades above 70, on this last cycle originating from the student's broad value obtained 18 students had grades below 70, 45 students have grades 75-70, and 50 students have grades> 75. So that it can be seen the development of average scores obtained by students:
From the picture can be seen that in the first cycle the average value of students reached 66.55, in the second cycle the average value of students reached 70.22, in the third cycle reached 73.30, and in the fourth cycle it reached 85.66.

4. Conclusion

After applying the comic quantum learning model showed a very effective increase in student learning activities namely the average score of student activities in the first cycle 66.55 then in the second cycle experienced a significant increase in the average student activity in the second cycle reached 70.22, the implementation of student learning activities the comic quantum model has a positive impact on student learning outcomes. This is because the number of learning outcomes below <70 is reduced from the first cycle which is 84 students, in the second cycle that is 70 students, in the third cycle that is 43 students, and in the fourth cycle that is 18 students.

5. Reference

Developing Google Classroom Based Learning Media for Patisserie Subject to Improve Students’ Learning Outcomes in Culinary Art Education Unimed

Yuspa Hanum1, Nila Handayani2, Mastarina Barus3, Erli Mutiara4
{yuspa_hanum@yahoo.com1, nilateguh@yahoo.co.id2, mastarinabarus@yahoo.co.id3, erli_mutiara@yahoo.co.id4}

Department of Family Welfare Education, Faculty of Engineering, Universitas Negeri Medan, Medan, Indonesia1,2,3,4

yuspa_hanum@yahoo.com

Abstract. The purpose of this study is to develop google classroom learning media in patisserie subject. The type of this study is Research and Development (R&D). The location of this study is in Culinary Art Program Study, Faculty of Engineering, Universitas Negeri Medan. This study was conducted from June-November 2019. Media validation for this subject consisted of 3 material experts, 3 media and design experts, and 22 students of Culinary Art Education Study Program as media users. The data collection technique used the questionnaire. The data analysis technique is descriptive. Based on the results of this study according to the material expert validator based on the feasibility of the content obtained a value of 83% with good criteria, the presentation of material is 78% with good criteria and the language is 90% with very good. Based on the media validator, the presentation of the media is 90% with very good criteria, the media graphic is 94.44% with very good criteria, based on the material aspect user validator is 89.87% with good criteria, the media aspect display is 84.03% with very good criteria. The results of this study can be concluded that the google classroom media is good for learning media for the students of Culinary Art Study Program in Universitas Negeri Medan.

Keywords: Google Classroom, Media, Patisserie

1. Introduction

The education is currently growing; various kinds of updates are carried out in order to improve the quality and quantity of education. To improve the quality of education, various breakthroughs are needed both in curriculum development, learning innovation, and fulfillment of educational facilities and infrastructure. To improve the learning process, the lecturer is required to make learning more innovative which encourages students to learn optimally both in independent learning and in classroom learning [1].

The patisserie subject is one of the courses in the Culinary Art Education Study Program, in
accordance with the KKNI curriculum. Patisserie is knowledge in food processing and serving, especially processing and serving various types of cakes. During this time, the lecturer just give an explanation before practice, and the students are required to study by the modules or practice the instructions by themselves.

Based on the observations, it was found that some students were not understood in practice. That makes the students can’t finish their practice on time. When teaching in the class, the lecturer did not use learning media in the Patisserie subject. To make learning more interesting, it is necessary to use Google Classroom based learning media that can help students understand the material presented by lecturers and can communicate with lecturers if there are problems felt by students. And the students also can use these media independently in the outside class hours. If learning media is chosen, developed, used and utilized appropriately and well, it will provide enormous benefits in the teaching and learning process. Therefore, special attention needs to be paid to this learning media so that it can be used in the Culinary Education Study Program, because it is very helpful for lecturers and motivates students, and improves learning outcomes in learning both individually and in groups [2].

The development of technology and the internet in recent years has not only affected electronic products, but also in the education, especially learning methods. Maybe everyone was experienced sitting in a classroom with friends while the lecturer was explained the lesson in front of the class. This method is still applied today, but technological sophistication affects changes in teaching patterns. One of the technological developments in education is the emergence of Google Classroom that was officially released in August 2014. As the name implies, Google tries to ‘move’ the classroom to the online realm [3]. Google Classroom or in the Indonesian language that is Google Classroom is a mixed learning porch which is intended for each scope of education intended to find a way out of difficulties in making, sharing and classifying each assignment without paper. Utilization of Google classroom can be through multiplatform that can be through a computer and can through devices. Lecturers and students can visit the site https://classroom.google.com or can download the PlayStore application on Android or through the app store on iOS with the Google Classroom keyword [2]. The use is free of charge so that its utilization can be carried out as needed. The facilities available in e-learning based on Google Classroom to support learning are numerous, but in reality lecturers have not utilized internet-connected computer facilities for learning activities. Based on this, the researcher needs to do this with the title "Developing Google Classroom Based Learning Media for Patisserie Subject To Improve Students’ Learning Outcomes in Culinary Art Education Unimed " The purpose of this study is to develop Google Classroom Based Learning Media.

2. Research Method

The design of this study is Research and Development (R&D). The location of this study is in Culinary Art Program Study, Department of Family Welfare Education, Faculty of Engineering, Universitas Negeri Medan. This study was conducted from June-November 2019. Media validation for this subject consisted of 3 material experts, 3 media and design experts, and 22 students of Culinary Art Education Study Program as media users. The data collection techniques used the questionnaire. Data obtained through a questionnaire were analyzed using descriptive statistics.
4. Results and Discussion

a. Quality of Learning Materials.

The quality of learning material on the google classroom learning media on Patisserie learning has 3 aspects assessed. The first aspect is about the appropriateness of the content, the second aspect is the evaluation of the presentation and the third aspect is the assessment of the language used in instructional media.

Based on the results of this study according to the material experts on the aspect of content eligibility including good criteria by 83.00 percent. Based on the answer to the appropriateness of the contents, namely the suitability and accuracy indicators of the material with a competency of 50 percent of respondents said that it was sufficient and 50 percent agreed strongly. On the indicator of the accuracy of the coverage of the material with a competency of 50 percent of respondents said it was enough and 50 percent of the respondents stated strongly agree. The suitability of the concept with each material tells the validation expert 50 percent strongly agree. In the depth indicator of learning material 50 percent of respondents stated that it was enough and 50 percent of respondents stated that they were very much in agreement. In the indicator of the suitability of the material with the curriculum by 50 percent agreed. The accuracy of the sequence of delivery of learning materials as much as 50 percent of respondents said that “Enough” and 50 percent of respondents said “Very Agree”.

Based on the results of this study according to experts on the material aspects of presentation including good criteria by 78 percent. Based on the expert validation of the material, according to the presentation on the material indicators are presented simply and clearly as much as 50 percent of respondents expressed disagreement and 50 percent stated Strongly Agree. The material indicators are presented coherently, from simple to complex, 50 percent of material validation experts stated that it was sufficient and 50 percent agreed. On the indicator presentation of interactive material as much as 100 percent of respondents agreed. In the picture and material indicators as much as 50 percent of respondents agreed and 50 percent of respondents expressed strongly agree. In the time allocation indicator according to the need to learn as much as 50 percent of experts said that was enough and 50 percent agreed strongly.

Based on the results of this study according to experts on the material aspects of language including very good criteria by 90 percent. Based on the material experts, linguistic aspects, namely the language indicator used is simple as many as 50 percent of respondents agreed and 50 percent stated strongly agree. In the indicator of material digestibility and logical exposure as much as 50 percent of respondents agreed and 50 percent stated strongly agree. In the indicator of the language used is easy to understand as much as 50 percent of respondents said agree and 50 percent expressed strongly agree.

b. Quality Learning Design

The quality of learning design on google classroom-based learning media on patisserie learning has 2 aspects of assessment. The first aspect is about presentation and the second aspect is the evaluation of graphics.
Based on the results of this study according to media experts on the presentation aspects including very good criteria by 94.44 percent. Based on media experts on the presentation aspect, namely on the material indicators presented simply and clearly as much as 50 percent of experts stated agree and 50 percent expressed strongly agree. The material indicators are presented coherently, from simple to complex and from general to specific, as many as 50 percent of experts agreed and 50 percent strongly agreed. Interesting indicators “to study” as much as 100 percent of experts said they strongly agreed. Indicators of images and materials according to as much as 100 percent of experts stated strongly agree. Indicators of the use of different texts to mark important parts as much as 100 percent expressed strongly agree. On the indicator explanation of the term as much as 100 percent agree. In simple language indicators, 100 percent agree strongly. On the indicator of material digestibility and exposure 50 percent stated agreed and 50 percent of respondents stated strongly agree.

Based on the results of this study according to media experts on the graphic aspects including very good criteria by 90 percent. Based on the aspect of graphic that is the accuracy of the color composition indicator used as much as 50 percent of experts said agree and 50 percent expressed strongly agree. In the illustrated picture indicators according to the concept as much as 50 percent said they agreed 50 percent said they strongly agreed. “Easy to understand” indicators as much as 100 percent of respondents expressed strongly agree. The type and size indicator can be read as much as 50 percent of respondents agreed and 50 percent strongly agreed. Indicator of the comparison of letters between titles, subtitles, and manuscripts is proportional as much as 50 percent of respondents agreed and 50 percent strongly agreed. On the indicator of the accuracy of the selection of music and sound as much as 50 percent of respondents said it was enough and 50 percent agreed. In the indicators of “easy-to-use” showed as many as 100 percent of respondents stated strongly agree.

c. Technical Quality and Display

The technical quality and appearance of the google classroom-based learning media have 2 aspects of assessment conducted by students as media user respondents. Those aspects are the first aspect regarding the material and the second aspect of the assessment of the appearance of the media. Based on the results of this study according to users on material aspects including good criteria by 89.87 percent. Based on the material aspects of the suitability indicator and the accuracy of the material as much as 5 percent of respondents said it was enough, 18 percent agreed and 77 percent stated strongly agree. In the indicator of clarity of learning instructions as much as 5 percent of respondents said it was enough, 18 percent said they agreed and 77 percent said they strongly agreed. Indicators of ease of understanding sentences in the text as much as 9 percent of respondents said it was enough, 18 percent agreed and 73 percent stated strongly agree. Indicators of exercise adequacy as much as 5 percent of respondents said they disagree, 5 percent said it was enough, 63 percent said they agreed and 27 percent strongly agreed. On the indicator of clarity of feedback as much as 5 percent of respondents said it was enough, 50 percent said they agreed and 45 percent strongly agreed. On the indicator of ease of access as much as 5 percent of respondents said they disagree, 45 percent said they agree and 50 percent expressed strongly agree.
Based on the results of this study according to the display aspects including good criteria by 84.03 percent. The distribution of respondents based on the display aspect is the indicator of the beauty of the color display as much as 5 percent of respondents said it was enough, 22 percent said they agreed and 73 percent said they strongly agreed. On the text readability indicator 18 percent of respondents stated that they disagree, 5 percent said it was enough, 23 percent said they agreed and 54 percent said they strongly agreed. Indicators of image quality and animation showed as much as 5 percent of respondents said it was enough, 27 percent said they agreed and 68 percent said they strongly agreed. The color composition indicator of 23 percent of respondents stated "Agree" and 77 percent stated strongly agree. Navigation Indicator as much as 10 percent of respondents said that it was enough, 45 percent said they agreed and 45 percent said they strongly agreed. On the music carrying capacity indicator as many as 14 percent of respondents said they did not agree, 45 percent said they disagreed, 9 percent said they were enough, 18 percent said they agreed and 14 percent strongly agreed. On the interaction indicator as much as 9 percent of respondents said they disagree, 14 percent said it was enough, 36 percent said they agreed and 41 percent said they strongly agreed.

d. Results of Development Assessment Based Learning Media Google Classroom

Based on the results of this study, the google classroom based learning media has 3 validation experts. The first assessment is based on material experts, the second is based on media experts and the third is based on user ratings. Developing Google Classroom Based Learning Media according to material experts obtained a value of 82.86% including good criteria. According to media experts, a value of 92.5 percent is included, including a very good criterion. According to the user, a value of 86.82 percent is included as a good criterion.

e. Discussion of Research Results

Google classroom learning media development is the development of learning material that has been developed by taking into account aspects of learning. Development research conducted to produce a product in the form of google classroom learning media used by students of the Catering Education at Medan State University that is used to improve students’ learning processes.

The use of google classroom learning media allows students to more easily understand learning because of this learning media allows students to interact directly, so that each student has no difficulty imagining in reading because in this media has been explained in detail. In addition, this learning media is very practical because students can learn the material contained in this learning media at home or using laptops and cellphones or gadgets. This media can also test the ability and understanding of students directly through tests or questions, so students can find out the mistakes that have been made in working on the exercise questions. Aspects that are revised and refined based on data analysis and trials and input from material experts, media experts and users aim to explore some aspects that are prevalent in the process of developing a product. In Figure 1, it can be seen the average percentage of the results of the assessment of the google classroom learning media according to material experts, media experts and users.

In figure 1 it can be seen that the assessment based on the validation expert is material expert obtained a value of 82.86 percent including good criteria, according to media experts a value of 92.50 percent is included including very good criteria, according to the user obtained a value of 86.82 percent including good criteria. The results of this study are in accordance with the results of
Wulansari's research [6] with the title Development of Learning Tools Based on Blended Learning Models by Utilizing Google Classroom in Vector Material in Three Dimensional Spaces in Class X MIA 4 of SMA Negeri 7 Yogyakarta. The results of this study indicate that the learning tools based on the blended learning model using google classroom on vector material are valid with excellent categories.

The results of this study are also in accordance with the results of Marasmita's research [4] with the title Development of Google Classroom-based E-Learning Learning Media to Increase Student Learning Motivation in Economics X Class Subjects at Nogosari 1 Public High School. The results showed that from all assessments of media developed according to the level of eligibility included in the category Very Eligible to use. The results of this study are also in line with the results of Melisa's research (2019) under the title Development of E-Learning Based Learning Media in the Subject Development of Students in the Department of Electronics Engineering Education, Makassar State University. The results showed that the development of instructional media in the subject of media expert 1 student development got a percentage of 97% declared very feasible. Media expert 2 obtained a percentage of 96% declared very feasible. The results of student trials in one-on-one trials obtaining a percentage of 91% were declared very feasible, the results of small group trials obtaining a percentage of 88% were stated to be very feasible and the results of the large group trials obtaining a percentage of 89% were declared to be very feasible. From the results of research on learning media development of students developed has a category of "very feasible" to be used or implemented in learning the development of students.

The results of this study are also in accordance with Mansur's research results [7] with the title Development of Google Classroom-Based Mobile Learning Media for Marketing Subjects Basic Competencies Implementing Product Promotion (Study in Class X Marketing at SMK Muhammadiyah 2 Malang). The results showed that based on the results of the validation of the two material experts reached an average of 96.67%. The results of the validation of media experts get an average of 95.56% that states the learning media of mobile learning based on Google classroom is very valid and worth testing. The results of student responses at the stage of field trials resulted in
an average percentage of 94.41% that states that the learning media for mobile learning is appropriate.

3. Conclusions and Suggestions

Conclusion
Based on the results of this study can be concluded:
1. Google Classroom Based Learning Media for Patisserie Subject according to material experts include good categories with a value of 82.86%.
2. Google Classroom Based Learning Media for Patisserie Subject according to media experts include very good category with a value of 92.5%.
3. Google Classroom Based Learning Media for Patisserie Subject according to users, include good category with an average of 86.82%.

Suggestion
Based on the results of this study it can be suggested:
1. It is recommended that every lecturer use the google classroom learning media in teaching and learning activities in the classroom.
2. Google Classroom can be used by students as the independent learning media.

4. Acknowledgement
The author would like to thank LPPM Unimed for funding this research. Thank you also to the validation experts and the users, who have helped carry out this research, as well as all those who have supported the implementation of this research.

5. References

[5] Melisa I. *Development of E-Learning Based Learning Media in the Subject of Student Development in Department of Electronics Engineering Education Universitas Negeri


The Use Of A Tutorial Video-Aided Learning Module On Soil Mechanical Practicum

Suhairiani¹, Nahesson. H. Panjaitan², Enny Keristiana Sinaga³
¹,²,³Universitas Negeri Medan, Medan, Indonesia
suhairiani@unimed.ac.id

Abstract. This study aims to improve the mastery of the material in the soil mechanics practicum course by using a learning module that is equipped with a video tutorial on S1 Civil Engineering students. It is a Research and Development learning media based on print and audio visual media in the form of modules and videos aided by the adobe premiere pro cc application that uses 4D research procedures that have been modified into 3 stages namely, (1) the defining stage, analyzing the soil mechanics practicum material (2) design phase, module making and video using adobe premiere pro cc (3) application development stage, product making in the form of teaching modules, complete with video tutorials. Instruments used, validation sheets for media and material experts, media evaluation questionnaires by lecturers and student questionnaire responses given to 30 students. The results of the research validation show that the learning module that is equipped with a video tutorial that is packaged in the form of a book and a CD has good criteria and the results of a questionnaire analysis of student interest in learning are positive, meaning that it can improve the effective learning process, especially of testing procedures and data analysis.

Keywords: Adobe Premiere Pro cc, Modules, Soil Mechanical Practicum, Video Tutorials

1. Introduction

Practical Soil Mechanics courses are required subjects for students in the S1 Civil Engineering, D3 Civil Engineering or S1 Building Engineering Education courses. The Soil Mechanics course is very important because students are expected to not only understand and master the theory obtained in the Soil Mechanics course but can also practice and apply the theory using practicum tools used to collect data so that at the end of the practicum students can interpret the data and collect it into a practicum report correctly.

In the learning process delivery of a material to achieve the learning outcomes is very important with the material and skills that must be mastered students, student learning requires supporting tools such as tools / media / learning resources. "Learning media is a tool that serves to convey learning messages" [1]. To convey learning messages from teachers to students, teachers usually use teaching aids in the form of images, models, or other tools that can provide concrete experiences, motivation to learn, and enhance power absorbency and learning retention [2]. The use of teaching aids or learning media is an inseparable part and is an integration of the
learning methods used. Learning aids are one of the dynamic elements in learning. The position of aids has an important role because it can help the learning process of students. The use of assistive device is for abstract learning materials can be concrete and make an unattractive learning atmosphere interesting. Many learning aids or media are created for independent learning nowadays, but to find a choice or a solution for tools that are really good so that the learning process becomes effective and interesting and fun is a problem that needs to be sought a solution.

Learning modules are instructional materials that are arranged systematically and attractively covering the contents of the material, methods and evaluations that can be used independently to achieve the expected competencies [3]. The module developed must have the characteristics needed as a module in order to be able to produce modules that are able to increase the motivation to use it. The five characteristics of a module are self-instruction, self-contained, stand alone, adaptive, and user-friendly. Currently students only use standard practicum modules and theory books that are relevant to the material. And from the results of the use of standard modules only 11.27% of students received an A grade, 33.80% of students received a B grade, 49.30% of students received a C grade and 5.63% of students received an E score, from the percentage obtained can be seen still finding a declining final value in learning outcomes in the Soil Mechanics Practicum course. The final grade indicator is not good because, firstly, students still find it difficult to understand the material when carrying out the test which results in many errors found in testing, secondly, there are still many errors found in interpreting the results of the test data. From the two indicators, at the final examination of practicum grades in the Soil Mechanics course still found C and E.

Educational Industry Revolution 4.0 is a general term used by educational theorists to describe various ways of integrating technology. The number of technological applications is one of them in making videos. From the results of the above learning values in this study the author tries to do development research by displaying a learning module that is equipped with a video tutorial. Making this video using the help of a computer program that is using the Adobe Premiere Pro cc program.

Adobe Premiere Pro cc is a non-linear (NLE) based video editing program from Adobe Systems. That is one software product from Adobe Creative Suite. Adobe Premiere Pro cc has about 45 video effects and 12 audio effects, which are able to change the display pattern and animate video and audio clips. Adobe Premiere Pro has important features, including Monitor Capture (video recorder) Monitor, Trim (clip cutting tool) Monitor, and Titler (Maker of title text) Monitor. In Adobe Premiere Pro cc video effects, there are Keyframes like those in Adobe After Effects (how to animate them is almost the same). In Titler, you can make the title text and change the properties of the text such as changing the shape of the letters, giving and changing colors, giving contours, outlines, making motion animations or moving text (roll and/or crawl), can also be used to give shapes/shapes so that the appearance of the title/text of the video looks more attractive. The last stage is export/output/save the project in the form of video and distributed to various media that can display video formats [4].

The selection of this program is intended to produce good quality video results, because the results of this development research are expected to have an increased impact on learning outcomes. So as to motivate students to be more creative, effective and efficient, and can reduce student boredom in the learning process, and as a basic capital skills (skills) in the work of land inspection and investigation in the world of Civil Engineering construction.
2. Research Methods

This type of research is research and development. Research and development methods are research methods used to produce certain products and test the effectiveness of these products [5]. The product developed is a learning module that is assisted by video tutorials on soil mechanics practicums for S1 Civil Engineering students in 2019/2020 Academic Year.

This development model is modified from the 4D learning device model developed by Thiagarajan, Dorothy S. Semmel, and Melvyn I Semmel which consists of 4 stages namely define, design, develop, and disseminate [6]. But in this study only carried out three stages, namely the definition, design and development. In this study only carried out until the development stage due to time constraints, there are also steps in the design stage to produce a learning model can be seen in Figure 1 below.

![Flowchart of Research Methods](image)

There are 3 (three) data obtained in this study, namely (1) Media Validity data obtained from the material expert validator and the media expert validator, (2) practicality data obtained from the practicality test of the module which was tested with 6 samples of students who took eyes soil mechanics practice lectures, and (3) effectiveness data obtained from valid, practical and effective module effectiveness tests, which were tested with 26 Civil Engineering undergraduate students taking Civil Engineering practicum courses in 2019/2020.

In this study, the data analysis technique used is quantitative descriptive analysis. In this study the data for the feasibility analysis obtained from a validation questionnaire by media
The results of the assessment by experts on the validation sheet are classified into 5 categories of choices with a rating scale range of 5 scores, scores 2, scores 3, scores 4, and scores 5. Data analysis techniques with 5 categories are chosen by grouping data based on product qualifications will be assessed. The average score obtained is then entered into qualitative categories as contained in Table 1 that was adapted from [7].

Table 1. Criteria for Quantitative Data Conversion to Qualitative Data

<table>
<thead>
<tr>
<th>Score Range</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X &gt; \bar{X}_i + 1.8 \text{sbi}$</td>
<td>Very Good</td>
</tr>
<tr>
<td>$\bar{X}_i + 0.6 \text{sbi} &lt; X \leq \bar{X}_i + 1.8 \text{sbi}$</td>
<td>Good</td>
</tr>
<tr>
<td>$\bar{X}_i - 0.6 \text{sbi} &lt; X \leq \bar{X}_i + 0.6 \text{sbi}$</td>
<td>Good Enough</td>
</tr>
<tr>
<td>$\bar{X}_i - 1.8 \text{sbi} &lt; X \leq \bar{X}_i - 0.6 \text{sbi}$</td>
<td>Poorly</td>
</tr>
<tr>
<td>$X \leq \bar{X}_i - 1.8 \text{sbi}$</td>
<td>Very Poor</td>
</tr>
</tbody>
</table>

With; $x =$ average score; $\bar{X}_i =$ ideal score average ($1/2 \text{ max score} + \text{ min score}$); sbi = standard deviation idea ($1/6 \text{ max score} + \text{ min score}$). In this study learning media is said to be valid if it meets the minimum good qualitative criteria. Learning media is said to be practical if the teacher's assessment and student's assessment of learning are in a practical category, The questionnaire of media practicality is described by the technique of frequency data analysis using the formula [7].

$$\bar{X} = \frac{\sum^n x_i}{n}$$  \hspace{1cm} (1)

With; $x =$ average score; $n =$ many statement items; dan $x_i =$ score on the question to –i

The practicality category using the Likert scale does not allow the statement of neutral items [8]. So there are only two statements on the Likert scale, positive item statements and negative item statements. And grouped as in Table 2 below.

Table 2. Response Attitude Categories

<table>
<thead>
<tr>
<th>Response Attitude Categories</th>
<th>Score Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very positive attitude</td>
<td>$\text{Kuartil 3} \leq X \leq \text{skor maksimal}$</td>
</tr>
<tr>
<td>Positive attitude</td>
<td>$\text{Median} \leq X &lt; \text{kuartil 3}$</td>
</tr>
<tr>
<td>Negative attitude</td>
<td>$\text{Kuartil 1} \leq X &lt; \text{median}$</td>
</tr>
<tr>
<td>Very negative attitude</td>
<td>$\text{Score Minimal} \leq X \leq X &lt; \text{Kuartil 1}$</td>
</tr>
</tbody>
</table>

Where:

- Minimum : The minimum score obtained by each respondent multiplied by the number of respondents
- Median : The sum of the maximum total scores with a minimum total score divided by two
- Quartile 1 : The sum total of the minimum score with a median divided by two
- Quartile 3 : Maximum score sum results with a median divided by two
- Maximum : The maximum score obtained by each respondent multiplied by the number of respondents
3. Results And Discussion

Development Procedure

3.1 Define Stage

Activities at this stage are carried out to establish and define development requirements. In general, in this definition activities are carried out to identify problems and data collection processes. From the results of the identification of the problems carried out using the method of observation and interviews to the team of lecturers supporting the soil mechanics practicum course and obtained data (a) the low understanding of students in the soil mechanics testing material, (b) there are still many errors found in testing, (c) there are still many errors found in interpreting the test data, (d) there is no module used in learning, only fixated on the practicum handbook. And the process of activities carried out at the time of data collection is conducting observations related to learning data such as syllabus/rps, and looking for material sources that will be used for research as well as for making modules and videos from several references.

3.2 Design Stage

Making the initial product or product design. There are also steps in the design stage to produce learning are designing the initial design of the module, collecting material to be made on the module and making the learning module, which then the results of making the module are made into a video. The appearance of the module and video as shown in Figures 2 and 3 below.

![Fig 2. Display of Learning Modules](image)

![Fig 3. Display Learning Videos](image)

3.3 Development Stage

Module Validation and Learning Videos by Material Experts. The material validator is conducted by 2 (two) material experts who have Geotechnical expertise from 2 universities namely Medan State University, and Muhammadiyah University, North Sumatra. Overall the validator gave a score of 83.53% for the use of learning modules and 90% for video tutorials on soil mechanics practicum courses. It can be concluded that the learning module developed in terms of the material is categorized as "very good (SB)". And aspects of the assessment of learning modules and the use of video tutorials can be seen from Figure 4 and 5 below.
Module Validation and Learning Videos by Media Experts

For media validators, 2 (two) media experts have media expertise from 2 universities, Medan State University and North Sumatra Muhammadiyah University. Overall the validator gave a score of 91.82% for the use of learning modules and 92.5% for video tutorials on soil mechanics practicum courses. It can be concluded that the learning modules developed from the media side are categorized as "good (B)". And aspects of the assessment of learning modules and the use of video tutorials can be seen from Figure 6 and 7 below.
Revision Of Model I

The learning model that has been developed and has been corrected by media experts and material experts, there will be inputs for improving the product / learning model.

Practical Test

Practical Test is limited to learning in the classroom according to the real situation encountered. In this study, a limited trial was conducted on 6 students. In accordance with the formulation contained in Table 2 and aspects of material assessment and media display by students on a limited product trial can be seen in Table 3 and table 4 below.
Table 3. Aspects of Material Evaluation by Student On Practical Tests

<table>
<thead>
<tr>
<th>NO</th>
<th>Rating Item</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 2 3 4 5 6</td>
</tr>
<tr>
<td>1</td>
<td>Easy to understand the material</td>
<td>5 5 5 5 5 4</td>
</tr>
<tr>
<td>2</td>
<td>Language is easy to understand</td>
<td>5 4 5 4 5 5</td>
</tr>
<tr>
<td>3</td>
<td>Font size of the font is easy to read</td>
<td>5 5 3 5 4 5</td>
</tr>
<tr>
<td>4</td>
<td>Image clarity</td>
<td>5 5 5 4 5 5</td>
</tr>
<tr>
<td>5</td>
<td>Match between material and module with clarity of illustration</td>
<td>4 5 5 4 5 5</td>
</tr>
<tr>
<td>6</td>
<td>Exercise</td>
<td>5 4 5 4 4 5</td>
</tr>
<tr>
<td>7</td>
<td>Answer key</td>
<td>5 5 5 5 5 4</td>
</tr>
<tr>
<td>8</td>
<td>Information increases student knowledge</td>
<td>5 5 3 4 5 5</td>
</tr>
<tr>
<td>9</td>
<td>The understanding process is helped by modules and videos</td>
<td>4 4 5 5 4 4</td>
</tr>
<tr>
<td>10</td>
<td>References increase student knowledge</td>
<td>5 5 4 5 5 5</td>
</tr>
<tr>
<td>11</td>
<td>Modules and videos can focus attention</td>
<td>5 4 5 4 5 5</td>
</tr>
<tr>
<td>12</td>
<td>Practicality of Modules</td>
<td>5 5 3 5 3 5</td>
</tr>
<tr>
<td>13</td>
<td>Enthusiastic and motivated learning using modules</td>
<td>5 5 4 5 5 5</td>
</tr>
<tr>
<td></td>
<td>Total Score</td>
<td>63 61 56 59 58 64</td>
</tr>
<tr>
<td></td>
<td>Total Number of Scores</td>
<td>361</td>
</tr>
</tbody>
</table>

And if the total value of the total score entered into Table 2, the values obtained as in Table 4 below.

Table 4. Results of Response Attitudes Categories

<table>
<thead>
<tr>
<th>Response Attitude Category</th>
<th>Score Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>very positive attitude</td>
<td>312 - 390</td>
</tr>
<tr>
<td>positive attitude</td>
<td>234 – 312</td>
</tr>
<tr>
<td>negative attitude</td>
<td>156 – 234</td>
</tr>
<tr>
<td>very negative attitude</td>
<td>78 - 156</td>
</tr>
</tbody>
</table>

Overall, it can be concluded that students who conduct practical tests state that the material in the learning module that is developed is included in the aspect of the category of very positive attitude.

Revision Of Model II

The revision of the model at this stage is no longer based on the results of validation or expert input. but the revised model, based on the results at the time of the practical test. Overall, from the aspect of learning and media aspects the results of limited trials conducted by 6 students showed that the material on the learning media developed included the aspects of the category of positive response attitudes and the media was appropriate to be used for 26 S1 Civil Engineering students who took the soil mechanics practicum.

Effective Test

Effectiveness testing on soil mechanics practicum courses was conducted on 26 students. Effectiveness is obtained from the value of learning outcomes data from test results, namely pre-test before treatment and post-test after treatment. Learning outcomes here are included to find out the improvement in learning outcomes after the pretest and posttest. This test aims to
determine whether a certain value (which is given as a comparison). Here are the experimental value data as in Table 5 below.

<table>
<thead>
<tr>
<th>Score</th>
<th>Total Students</th>
<th>Pretest</th>
<th>Postest</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>9</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>9</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>4</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>1</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>0</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
<td>26</td>
<td></td>
</tr>
</tbody>
</table>

From the results of Table 5 above, the average Pre-Test and Post-Test scores are:

a. Average Pre Test scores
   \[ \bar{X}_o = \frac{\sum x_i}{n} = \frac{1470}{26} = 56.54 \]

b. Average Post Test scores
   \[ \bar{X}_o = \frac{\sum x_i}{n} = \frac{2060}{26} = 79.23 \]

A student has the ability to understand a material concept that is taught, if the criteria are of good value or have an interval range of 60-80 [7].

In this study a video tutorial assisted learning module to improve the ability to understand the concept of material in the soil mechanics practicum 2019/2020 Academic Year is considered effective if the percentage of posttest is greater than the percentage of pretest and good classification.

To get these criteria, the interpretation of the learning completeness data of students must be calculated first, where from the results of the data in Table 5 above obtained the percentage of completeness for Pre-Test and Post-Test is learning completeness data obtained

a. Percentage of completeness pretest
   \[ (pretest) = \frac{23}{26} \times 100\% = 88.47\% \]

b. Percentage of completeness posttest
   \[ (posttest) = \frac{23}{25} \times 100\% = 92.00\% \]

Based on the analysis it was found that the percentage of posttest was greater than the percentage of pretest (88.47> 53.84%) and was in the Good criteria. So it can be concluded that the video tutorial assisted learning module is declared effective for use in learning the soil mechanics practicum course.

4. Conclusion

Based on the results of research and discussion, it can be concluded that:

The first design of learning modules for soil mechanics practicum courses with video tutorial assistance developed through 3 stages, namely: (1) Definition (2) Design of display design and (3) development. Secondly the quality of the learning modules for soil mechanics practicum
with video tutorials developed, which are divided into 3 elements: material, media, and student experience using modules and videos. The third assessment of the material on the learning media as a whole validator of the material gave a score of 83.53% for the use of learning modules and 90% for video tutorials on soil mechanics practicum and entry into excellent categories (SB), as well as the evaluation of material on video tutorials, in the overall validator gave a score of 91.82% for the use of learning modules and 92.5% for video tutorials on soil mechanics practicum courses. and enter the category of "good (B)". And the fourth the students' responses to their experiences using the learning module of the soil mechanics practical course video tutorial seen from two aspects, namely: limited trials (small groups) and effectiveness trials (large groups), Overall, that students who conduct limited trials and the effectiveness test states that the material and media in the learning module of soil mechanics practicum with video tutorial developed are included in the category of positive response attitude categories, and can be used as an alternative media to improve mastery in the learning of soil mechanics practice courses because it is good from in terms of material and media design.

5. Acknowledgements

Thanks to the Department of Building Engineering, at the Medan State University for competitiveness research at the faculty level (KDBK) in 2019.

6. References

Analysis of Mechanical Properties and Micro Structure of Body Valve Bolts, Alloy Steel Grade B7 Material as a Result of Offshore Application

Qamaruddin1, Mochamad Iwan Nur Irawan2, Dwi Wahyuni Wulandari3, Iskandar Adji Purnomo4
{qamaruddin@stimar.ac.id}

Sekolah Tinggi Ilmu Maritim (STIMar) “AMI” Jakarta1,3,4, Universitas Islam “45” (UNISMA) Bekasi2

Abstract. The objective of this research is to examine the mechanical properties and microstructure of body valve bolts using the alloy steel grade B7 material after being applied for more than 12 months on offshore location. The experimental steps conducted in the research were specimens check based on maker specification, preparation of specimens, tensile and hardness tests for mechanical properties and metallography for micro structure, analysis and conclusion. The total specimens were 18 bolts. Based on the research, it was found that the tensile strength 94.9 kgf/mm2 and hardness 30.0 HRC, the micro structure was consisting of ferit and pearlit. Comparing the result of testing of the used bolts to the new ones and the standard ones by ASTM A193, it can be concluded the used bolts remained applicable on condition that there is no defect and corrosion existing.

Keywords: Mechanical Properties, Micro Structure, Body Valve Bolts, Alloy Steel Grade B7.

1. Introduction

One of the most important parts of a valve is the body bolt, because it holds the load as long as the valve unit is used. In addition to the size and type of material, it must be in accordance with the conditions of use, this bolt also needs to be ensured of its reliability after long-term use (over 1 year), especially if the valve is installed in an area that is exposed to a corrosive outside environment.

For each valve bolt check, PT. OSA Industries Indonesia conduct non-destructive or NDT (Non Destructive Test) and the body valve bolt can be reused if the NDT results are good. Based on the incident experienced by one of the clients of PT. OSA Industries Indonesia, there were 3 (three) cases of the body valve bolt being broken during operation and the valve was split causing a leak of gas and oil spoiled out and the drilling division had to be stopped. The customer requested that each valve repair be replaced by a new bolt body.

From the experience above, it seemed necessary to conduct research and analysis in the form of property mechanical testing (tensile test, hardness test) and microstructure of the body valve bolts. This is to ensure the reliability of the bolt after being used (over 1 year) in the offshore field.
2. Methodology

The flow of research is roughly depicted as shown in Figure 1.

![Figure 1: The flow of research](image)

The research was starting from examining data of the bolt specified by maker, specimen preparation, then conducting hardness test by using Rockweel, Tensile test using ASTM F-606 and microstructure test by 500x magnification. After the respective tests, conducting analysis and finally drawing conclusion.

a. Material preparation

Specimen/Material used for testing with total 18 pcs consisting of:

a. Tensile Test: New Bolts (3 pcs) and Used Bolts (3 pcs)
b. Hardness Test: New Bolts (3 pcs) and Used Bolts (3 pcs)
c. Micro Structure: New Bolts (3 pcs) and Used Bolts (3 pcs)

![Fig.2. Specimen dimension for testing (a) Tensile test, (b) hardness test, (c) micro structure](image)
b. Equipments

- Cutting machine
- Grinding machine
- Lapping machine
- Polishing machine
- Lathe
- Tensile test machine
- Hardness test (Rockwell C)
- Vernier Caliper
- Optical microscope

c. Experimental process

The bolt was processed as shown in Figure 2 by using the respective machine. For micro structure purpose, the specimen was being polished, etched by nital and picture taken by optical microscope 500x magnification.

3. Result and Discussion

The chemical composition of new bolts and used ones is shown in Table 1 and 2. In figure 3, it can be seen the sample of certificate released by maker shown in Table 3. Table 3 represents the result of hardness test and table 4 shows the result of tensile test. Figure 4 shows the representation of the microstructure of new bolts and used ones.

Fig.3 Sample of certificate by maker
Table 1. The chemical composition of New bolt ASTM 193

<table>
<thead>
<tr>
<th>Specimen/Element</th>
<th>C</th>
<th>Mn</th>
<th>P (max)</th>
<th>S (max)</th>
<th>Cr</th>
<th>Si</th>
<th>Mo</th>
</tr>
</thead>
<tbody>
<tr>
<td>standard</td>
<td>0.37-0.49</td>
<td>0.65-1.10</td>
<td>0.035</td>
<td>0.04</td>
<td>0.75-1.20</td>
<td>0.15-0.35</td>
<td>0.15-0.25</td>
</tr>
<tr>
<td>PT.X</td>
<td>0.384</td>
<td>0.715</td>
<td>0.018</td>
<td>0.011</td>
<td>1.010</td>
<td>0.307</td>
<td>0.20</td>
</tr>
<tr>
<td>PT.Y</td>
<td>0.370</td>
<td>0.780</td>
<td>0.011</td>
<td>0.007</td>
<td>0.970</td>
<td>0.210</td>
<td>0.15</td>
</tr>
<tr>
<td>PT.Z</td>
<td>0.383</td>
<td>0.860</td>
<td>0.016</td>
<td>0.035</td>
<td>1.078</td>
<td>0.150</td>
<td>0.18</td>
</tr>
</tbody>
</table>

Table 2. The chemical composition of Used bolt ASTM 193

<table>
<thead>
<tr>
<th>Specimen/Element</th>
<th>C</th>
<th>Mn</th>
<th>P (max)</th>
<th>S (max)</th>
<th>Cr</th>
<th>Si</th>
<th>Mo</th>
</tr>
</thead>
<tbody>
<tr>
<td>standard</td>
<td>0.37-0.49</td>
<td>0.65-1.10</td>
<td>0.035</td>
<td>0.04</td>
<td>0.75-1.20</td>
<td>0.15-0.35</td>
<td>0.15-0.25</td>
</tr>
<tr>
<td>BV-0676B</td>
<td>0.374</td>
<td>0.920</td>
<td>0.027</td>
<td>0.009</td>
<td>0.967</td>
<td>0.234</td>
<td>0.21</td>
</tr>
<tr>
<td>BV-0035B</td>
<td>0.379</td>
<td>0.927</td>
<td>0.019</td>
<td>0.007</td>
<td>1.030</td>
<td>0.329</td>
<td>0.19</td>
</tr>
<tr>
<td>CHV-0078B</td>
<td>0.373</td>
<td>0.777</td>
<td>0.015</td>
<td>0.007</td>
<td>0.918</td>
<td>0.237</td>
<td>0.18</td>
</tr>
</tbody>
</table>

Table 3. The Hardness Test of New and Used Bolts (Load 150 Kgf) Standar ASTM A193 Grade B7 (max. 35 HRC)

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Average</th>
<th>ASTM A193 (max)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Bolts</td>
<td>33.2</td>
<td>35.0</td>
<td>OK</td>
</tr>
<tr>
<td>Used Bolts</td>
<td>30.0</td>
<td>35.0</td>
<td>OK</td>
</tr>
</tbody>
</table>

Table 4. The Tensile Test of New and Used Bolts (Kgf/mm²)

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Average</th>
<th>ASTM A193 (min)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Bolts</td>
<td>93.6</td>
<td>87.9</td>
<td>OK</td>
</tr>
<tr>
<td>Used Bolts</td>
<td>94.9</td>
<td>87.9</td>
<td>OK</td>
</tr>
</tbody>
</table>

Fig. 4. Microstructure (a) New bolt, (b) Used bolt (500x)

Based on the result of the hardness test and tensile test as depicted in Table 3 and 4, the values of the used body valve bolt and the values of the new one have relatively the same, although the
spread of the used body valve bolt occurs after use or the locking process in the field which caused the material structure to develop and this resulted in a reduction of the value of the hardness and strength.

In Figure 4, micro structure observations on the new bolt of this specimen show the pearlite (dark) region is relatively more dominant than the ferrite phase (light color). The parent metal contains 0.370% carbon so it is said that this carbon steel is hypoeutectoid.

4. Conclusion

Based on the result and discussion, the following conclusion can be drawn is comparing the result of the test both hardness and tensile test between the new bolts and the used ones, the used ones remain useable. The microstructure of the new bolts and used ones were consisting of ferit and pearlit phases which belong to carbon steel.

5. References

Power System Modeling and Network Simulation: The Content Validity of the E-MAP Model in Electric Power Transmission Technology

Agus Junaidi¹, Joni S Rambe², Rudi Salman³, Rahmaniar⁴, Rosnelli⁵

{agusjunaidi@unimed.ac.id ¹, jonirambe@unimed.ac.id ², rudisalman@unimed.ac.id ³, rahmaniar@dosen.pancabudi.ac.id ⁴, rosnelli@unimed.ac.id ⁵}

Universitas Negeri Medan, Jurusan Pendidikan Teknik Elektro, Medan¹,²,³,⁴,⁵

Abstract. E-MAP model is a learning model based on product modeling and simulation. This model was built to meet the learning needs of Electric Power Transmission technology. (EPT) EPT is a higher education course that requires critical thinking skills / HOTS (Higher Other Thinking Skill), because each EPT study material requires mathematical equations. Updating the model that requires EPT-based HOTS learning is done by preparing the E-MAP model with the syntax steps of FACTA (Find, Analysis, Construction Modeling of System, Tracking and Assessment). The model development strategy are carried out within 3 main stages, the first stage is to build modeling and simulation products for EPT learning needs, the second stage is to product content validation and the third stage is to syntax construct validation. Validation is carried out by experts in their fields and becomes the main indicator in the successful development of the E-MAP model. The results of this E-MAP model development study are: Modeling and simulation products obtained are used in EPT learning and model books that can be used as a reference in HOTS-based EPT learning.

Keywords: E-MAP, EPT, HOTS. Modeling and Simulation.

1. Introduction

Higher education institutions in Indonesia have a strategic and centralistic role in developing Human Resources (HR) based on competencies and skills. Preparation of reliable HR competencies through strategic policies in the Indonesian National Qualification Framework (KKNI). KKNI comprehensively strengthens the needs of human resources through learning outcomes (CP) in accordance with the interests of stakeholders. HR competencies with suitable, sufficient and fit abilities are carried out through the process of organizing higher education through the learning process. Higher Education Institutions in Indonesia have a strategic role in producing competent and competitive human resources, as well as agents of change towards a better life for the nation. HR competencies generated by tertiary institutions become an important concern in the education community. The State of Indonesia is currently faced with the free market regulation of the ASEAN Economic Community (AEC) which demands that the human resources produced by tertiary institutions have innovative and productive competencies. The quality of productive human resources has relevance to the welfare of a nation. The essence of national welfare can be seen from the aspects of good economic growth and the ability of a nation to compete with other nations [1]. Efforts to develop learning strategies and strengthen 4C competencies (Communication, Collaborative, Critical Thinking, and Creativity) at the Higher Education level are carried out to produce productive
and quality Human Resources (HR) for employment. However, at present, the 4C competencies needed through the process of providing education in tertiary institutions are intended to meet the job market in the industrial era 4.0, which is still not optimal. This is due to not maximizing the potential of human resources, technology, innovation, and information so that the workforce in Indonesia is still dominated by HR with the classification of Primary and Secondary Education [2]. Strengthening the capacity and learning ability of students can be developed through the construction of student-centered learning. Learning activities that focus on student centering are the most important contributions of constructivism. Constructivism is part of a learning theory found in educational psychology that explains how people can gain knowledge and learning, because it has direct application to education with knowledge ideas developed and that constructivist educators invite students to continue to assess how this activity helps students gain understanding [3].

The concept of learning through knowledge construction is actively carried out by students, supported by students’ Higher Order Thinking Skills (HOTS). The domain of critical thinking skills can be done with learning strategies based on modeling, analysis and simulation. Learning with the HOTS strategy entitled [4,5]. Analysis of question papers in engineering courses with Respect To HOTS explains the importance of learning strategies with HOTS thinking skills managed by the Faculty of Engineering. Bloom’s Taxonomy Approach at the HOTS level as an active learning strategy to improve students’ critical thinking skills and creative thinking skills. Educational institutions in the engineering department are required to facilitate managerial management of HOTS-based learning, to further encourage critical thinking and creative thinking from students so that students do not only remember facts or general information. This is closely related to the problems of the needs of the world of work that requires graduates in the field of engineering in order to have the ability to formulate, develop, and understand practical problems as a challenging task.

Efforts to create an active learning platform for students with HOTS strategy are carried out through an investigation-based learning approach and simulation products. Through inquiry-based learning characteristics assisted with computer technology, an E-MAP learning model was developed in the field of engineering electric power transmission technology, which requires a HOTS strategy in the learning process.

**Theory of developing the E-MAP Model**

The E-MAP model is built on the basis of an educational philosophy, as shown in figure 1. The PSE approach through P, PS and PE integration results in a PSE rule in the development of science and technology.
E-MAP Model in learning Electric Power Transmission (EPT)

Electric Power Transmission (EPT) is a course taught to students in the Electrical Engineering Study Program in Higher Education. The course discusses the study of electrical power delivery systems with material on the study of voltage profiles, sending and receiving sides, transmission modeling, efficiency, channel regulation on transmission based on the transmission line length classification [8]. The concept of analysis with abstract complexity in EPT learning materials requires critical analytical skills through critical thinking skills. Information is obtained through a questionnaire distributed to lecturers and students, explicitly the results of the questionnaire distribution can be concluded (1). The material concepts delivered at EPT courses with the level of analysis using advanced mathematical equations, require the expertise of HOTS critical thinking skills (2). In the process of solving EPT problems requires a model that can help accelerate students gain a good understanding of EPT material (3). The need for learning aids (computer technology) becomes an important tool for students in solving problems of the analysis model in the study of electrical power delivery systems.

From the elaboration of research background related to the importance of electricity competence through the learning process in the EPT field, efforts are needed in realizing the validity, effectiveness and practicality of EPT learning through the mechanism of developing learning models. The characteristics of choosing the right model become the main key in achieving the expected results. The characteristics of the IbL model have characteristics in solving learning problems that require HOTS high-level thinking skills. The field of engineering and analysis of electric power transmission systems, with the selection of the right model in accordance with the characteristics of EPT courses. IbL becomes an important part in learning
science and technology because the IbL model has stages that meet the criteria for learning needs in the field of science and technology studies including EPT courses. The IbL model is the basis for developing the FACTA model in EPT learning. FACTA Model is a development model with syntax, FACTA (Find, Analysis, Construct Modeling of Systems, Tracking, Assessment). The FACTA model was arranged as an effort to improve the quality of learning in EPT subjects, with the development of the FACTA model it is expected to improve the quality of learning in science and technology for electricity engineering courses in EPT subjects in the Electrical Engineering Study Program at the College.

2. Methodology

The concept used in developing the E-MAP model is shown in the mechanism of model development as shown in figure 2.

Figure 2 shows a conceptual framework diagram for the development of the PACTA Model. Starting from the strategic issue of 21st century learning, the integration of technology in learning with the need for critical thinking skills to meet the needs of work in the era of technological disruption. The rationale related to the problem raised is that learning is not optimal in the Electric Power Transmission (TDL) course, because TDL learning is still at the LOTS level so the TDL learning outcomes are not optimal. Technology integration, ICT utilization and HOTS thinking skills strategy in TDL learning are not optimal.
Learning models that meet the characteristics of HOTS are observed through literature study, questionnaire distribution and benchmarking activities. The model that meets the characteristics of HOTS is a model that meets the criteria of the level C4 to C6 cognitive domain at the level of critical thinking of Bloom's Taxonomy. IbL with the characteristics of learning centered on students, develops the concept of independent learning, knowledge is constructed by students through investigation (investigation) so that critical thinking skills are developed by students to solve problems. IbL became a model that was adapted for the development of the FACTA model to solve TDL learning problems. The FACTA model is a development model for answering EPT learning problems that require HOTS skills. The FACTA model is applied to determine the validity, practicality and effectiveness of the model in EPT learning.

3. Results and Discussion
   a. Simulation Product

   The results achieved in this study are the development of simulation products for Electric Power System Networks using software. One part of the simulation results as shown in figure 3

![Fig 3. Single Line Diagram EPT](image)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MVA RATING</th>
<th>VOLTAGE RATING</th>
<th>$X_1$ (PU)</th>
<th>$X_2$ (PU)</th>
<th>$X_0$ (PU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>100</td>
<td>13.8 kV</td>
<td>0.2</td>
<td>0.2</td>
<td>0.05</td>
</tr>
<tr>
<td>G2</td>
<td>100</td>
<td>13.8 kV</td>
<td>0.2</td>
<td>0.2</td>
<td>0.05</td>
</tr>
<tr>
<td>T1</td>
<td>100</td>
<td>13.8/230 kV</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>T2</td>
<td>100</td>
<td>13.8/230 kV</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>L23</td>
<td>100</td>
<td>230 kV</td>
<td>0.1</td>
<td>0.1</td>
<td>0.3</td>
</tr>
<tr>
<td>L26</td>
<td>100</td>
<td>230 kV</td>
<td>0.1</td>
<td>0.1</td>
<td>0.3</td>
</tr>
<tr>
<td>L34</td>
<td>100</td>
<td>230 kV</td>
<td>0.1</td>
<td>0.1</td>
<td>0.3</td>
</tr>
<tr>
<td>L46</td>
<td>100</td>
<td>230 kV</td>
<td>0.1</td>
<td>0.1</td>
<td>0.3</td>
</tr>
</tbody>
</table>

**Simulation Results**

Total fault current = 5.7143 per unit

<table>
<thead>
<tr>
<th>Bus No.</th>
<th>Voltage Magnitude</th>
<th>Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.4286</td>
<td>0.0000</td>
</tr>
<tr>
<td>2</td>
<td>0.2857</td>
<td>0.0000</td>
</tr>
<tr>
<td>3</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>4</td>
<td>0.2857</td>
<td>0.0000</td>
</tr>
<tr>
<td>5</td>
<td>0.4286</td>
<td>0.0000</td>
</tr>
<tr>
<td>6</td>
<td>0.2857</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

**Line currents for fault at bus No. 3**

<table>
<thead>
<tr>
<th>From Bus</th>
<th>To Bus</th>
<th>Current Magnitude</th>
<th>Angle degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>1</td>
<td>2.8571</td>
<td>-90.0000</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>2.8571</td>
<td>-90.0000</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>2.8571</td>
<td>-90.0000</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>0.0000</td>
<td>-90.0000</td>
</tr>
<tr>
<td>3</td>
<td>F</td>
<td>5.7143</td>
<td>-90.0000</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2.8571</td>
<td>-90.0000</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>0.0000</td>
<td>-90.0000</td>
</tr>
<tr>
<td>G</td>
<td>5</td>
<td>2.8571</td>
<td>-90.0000</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>2.8571</td>
<td>-90.0000</td>
</tr>
</tbody>
</table>
The simulation shows the tracking data of the SCC analysis to determine the Breaker capacity of the EPT system through symmetric interference analysis. This is a part of the product that resulted from the development of the E-MAP model.

b. Results of Validation of Syntax Constructions

The syntactic construct of the E-MAP model was tested using Lisrel software. From the results of the validity test using the Lisrel program, the validity test results are shown in Table 2.

<table>
<thead>
<tr>
<th>Syntax</th>
<th>$X^2$</th>
<th>df</th>
<th>p-value</th>
<th>RSMEA</th>
<th>$X^2/df$</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>7,33</td>
<td>14</td>
<td>0,92</td>
<td>0,00</td>
<td>0,52</td>
<td>Goodness-of-fit</td>
</tr>
<tr>
<td>A</td>
<td>1,14</td>
<td>2</td>
<td>0,56</td>
<td>0,00</td>
<td>0,57</td>
<td>Goodness-of-fit</td>
</tr>
<tr>
<td>C</td>
<td>2,70</td>
<td>5</td>
<td>0,59</td>
<td>0,00</td>
<td>0,74</td>
<td>Goodness-of-fit</td>
</tr>
<tr>
<td>T</td>
<td>0,52</td>
<td>2</td>
<td>0,77</td>
<td>0,00</td>
<td>0,26</td>
<td>Goodness-of-fit</td>
</tr>
<tr>
<td>A</td>
<td>0,57</td>
<td>2</td>
<td>0,75</td>
<td>0,00</td>
<td>0,28</td>
<td>Goodness-of-fit</td>
</tr>
</tbody>
</table>


c. Content Validation Test Results

Content validity based on Aiken’s V validation test [9] in his research he tested 55 respondents and the coefficient of validity based on the Aiken's V approach was 0.83 and was stated to be significant in meeting the content validity criteria of research on the Validity Study and Reliability for E-Government Success Factors. Aikens V is used to test the validity of the contents of the E-MAP Model against 2 book products produced and assessed by experts/ experts declared valid

4. Conclusion

Conclusions from the Development of the E-MAP model are:
1. The E-MAP model produces EPT learning products with HOTS characteristics because it is supported by simulation products on the EPT system
2. The validation results of the syntax construct and the E-MAP model with the FACTA syntax is valid.
3. The content validation of the EPT learning module and the Lecturer Guide is valid

5. References


The Use Of Excel Macro Feature On Cost Estimation Calculation

Putri Lynna A. Luthan¹, Nathanael Sitanggang²
{putri.lynna@gmail.com¹, nathanaelsitanggang@unimed.ac.id²}

Faculty of Engineering, Universitas Negeri Medan, Indonesia¹,²

Abstract. This study aims to describe the stages of calculating the construction costs estimation using the Macro feature on Excel. The problem that being studied is how are the stages of using the Excel Macro to determine the volume of steel and the reinforcement model that needed for a construction. The research method used is a qualitative descriptive type with the research subject being a construction project contractor who uses an Excel Macro for a Micro Hydro Power Plant development project. Data is obtained through observation, interviews and reviewing various sources of documents. The results found are the stages of using Excel macros to calculate the number, model of reinforcement, dimensions, code and the amount of residual material produced by the estimator as a guide for workers. This finding is very useful because with the use of Excel macro can improve the estimation work for planning consultants and contractors to be more effective and efficient.

Key words: excel macros, cost estimateion, models, steel weights, estimators

1. Introduction

Along with the advancement of digital technology that continues to grow rapidly until the current Industrial Revolution 4.0 era, the development of software for Civil Engineering work has also been widely available and used by the plan consultants and construction building contractors to perform calculations quickly and accurately. One of the available software is an Excel macro feature that is used to calculate cost estimation of a construction building. With the availability of this feature, the plan consultant and the contractor can store documents as a database. But based on observations there are still many contractors who have not used the Excel macro feature. The results of these observations are in line with Soeparto and Trigunarsyah [1] and Pramudyo [2] which explain that Information Communication Technology (ICT) in the implementation of construction projects has not been used effectively, so that the Indonesian construction workforce will be less competitive than foreign workers, so it is needed to master the development of Information Technology for construction workers. The challenge faced by planner and contractor today is to prepare the Indonesian construction workers who are professional and able to utilize ICT effectively. A special excel macro feature is used to calculate the use of steel and reinforcement models that will be used in a construction building. Macros are codes or scripts, while Visual Basic is a programming language used to create macros [3].
This Excel macro feature does not require a high programming language, with the ability of using Excel we will be able to operate the program that has been designed [4]. The software used in the construction project is designed by the contractor as a construction agent and can only be used by the designer. In order for the software to be used continuously, other resources that can use the feature are needed [5]. The use of the excel macro feature should be trained to estimators who have been able to read the picture and understand how to calculate the calculation.

During this calculation the construction in construction projects still do a lot of manual calculations, so that it has difficulty in managing the Bar Bending Schedule (BBS) on the calculation of the reinforcement. The expected competence in BBS work is to provide data on the number of bars of reinforcement, dimension, weight, shape and code with the help of Excel macro feature. The problem in this research is how are the stages of using Excel macros in calculating the cost estimation of construction buildings? This study describes the work stages that are carried out by estimators to calculate cost using the Excel macro feature. This research is very useful for plan consultants and construction building contractors because it can help the estimator work more effectively and efficiently.

2. Research Method

This study uses qualitative research methods with descriptive type. This study seeks to understand the meaning and images derived from individuals and groups [6][7]. Data collection was carried out using observation and interview methods [8] with 1 estimation contractor on Micro Hydro Power Plant construction in Medan City that had used macro excel features on 3 (three) construction projects. Sampling was determined based on purposive sampling technique [9] for estimators using the Excel Macro feature. Data analysis used is thematic analysis techniques that continued with interpretation. The credibility of this research is based on communicative validity, argumentative validity, and ecological validity [8].

The use of excel macro as a calculation tool has been carried out by several researchers such as [10][11]. Usability test with VBA program macro excel feature has an effective value of 58%, [10] and the level of accuracy of differences in the use of excel macros with manuals is 0.005% [11].

Research conducted by [12], the prototype built can present the data needed and has been tested by comparing the results of the analysis so that there is a match between the admin and the observer.

According to [13], from the results of testing using the energy audit data of the Electrical Engineering building at Diponegoro University Semarang resulted in the conclusion that the opportunity to save energy is feasible with the Microsoft Excel macro feature. Based on several literature studies, it can be stated that Excel macros can be used to collect data so that the waste that can occur is as small as possible.

3. Result And Discussion

Based on the results of the study, the calculation process of bar bending schedule by using excel macros is done by stages, namely

...
3.1. Preparation phase

At the preparation stage there are several things that are needed, namely:
1. Ability to operate excel
2. The macro excel feature that has been designed
3. Reinforcement drawings

3.2. Implementation phase

After getting the BBS file from the contractor the file is opened, if when the BBS file is opened it turns out that the macro facility in Excel is not active then it must first be activated. To activate macros in excel software, there are several steps, starting from the options-trust settings-macro settings (enable all macros + trust access to the VBA) that can be seen in Fig.1.

![Figure 1 Activate the Excel macro feature](image_url)

After the steps in Figure 1 are done, then the excel worksheet will lose the security warning command, which can be seen in Figure 2.
In Figure 2 we see a worksheet without a security warning, this worksheet is what we will use to operate the calculation of forms and models of reinforcement. On the worksheet there are various forms of reinforcement used for the cleaning work shown in Figure 3. The next step is to place the cursor under the code written in Figure 4, then to choose the reinforcement model in Figure 3 that will be calculated according to the working picture.

**Figure 2** Worksheet without security warning

**Figure 3** Reinforcement model

**Figure 4** Initial steps
In Figure 4, the first step to start calculating with an Excel macro is to place the cursor in the 14th row of b column, then choose the reinforcement model to be used, the worksheet will look like in Figure 5.

Figure 5 Input data according to work drawings

With the emergence of a reinforcement model on the worksheet, do fill in the code, size, number of diameters. The computer automatically calculates to get the required amount of weight shown in column K shown in Figure 6.

Figure 6 Weight of steel
The next step is the data entry of the number of pieces and length of steel based on the work picture which can be seen in Figure 7.

![Figure 7 Data input on the number and length of steel](image)

In reinforcement type construction projects used various models and sizes, models and sizes used based on images for construction of consultant planners. The next stage is the input process of reinforcement models and other shapes which can be seen in Figure 8.

![Figure 8 Advanced data input](image)
The next stage is the same process as the stage in Figure 4 according to the work drawings. Then after all models are inputted based on work drawings, the next step is to pay attention to the calculation of the length of remaining steel which can be used in the other reinforcement models shown in Figure 9.

![Figure 9 The process of transferring residual steel](image)

After all the pictures and calculations are inputted, the next step is to see the number of steel usage, steel diameter and the model that will be displayed in Figure 10. Place the cursor on the 145th row position and click the number then you will see the total steel usage in accordance with the diameter desired.
In Figure 10 shows the results needed for the model, diameter and amount of steel as a guide for the contractors to cut steel size and the amount in accordance with the calculations size that has been done and Excel Macros.

5. Conclusion

Based on the results and discussion it can be concluded that, with the use of Excel macro features, it can improve the work estimation of plan consultants and contractor to be more effective and efficient. The effectiveness of work estimation is obtained in calculations in determining the amount, model of reinforcement, dimension, code and amount of residual material. The findings are very useful for the plan consultants and contractor.

6. References


Green Infrastructure Emergency: Abandoned Development

Nurul Fitria Marina  
{nufina.ku@gmail.com}  
Universitas Muhammadiyah Surabaya, Sutorejo Street no.59 Surabaya

Abstract. Development, both on a large scale and small scale, must have a connection with environmental development. However, in the development of the environment, especially the green environment, it is often abandoned and not well planned. This can be seen in the length of post-development environmental recovery. Impression of hot, dirty, dry, and not beautiful to be a scene that must be faced for several years after development. Green Open Space that is presented is generally only a tree that is not arranged through design and aesthetics. Of course this is very unfortunate considering the condition of the natural environment is inversely proportional to urban development. So, there needs to be more attention for planners, designers, and construction practitioners in paying attention to this matter.

Keywords: green infrastructure, built environment, sustainable Development

1. Introduction

Sustainable development is a development that consider the balance between economy, social welfare and environment along with the implementation of renewable energy. Sustainable development is a development that unites every infrastructure and is interrelated. However, what is seen now is physical development in the form of transportation lines and technology and their buildings. Especially the green infrastructure which is currently very scarce. The lack of infrastructure needs to be a subject when planning and construction. Seeing the development of the city that is currently rife, criticism of the negative effects on the environment is rarely heard. The rise of physical development certainly reduces green land, especially if no green land replacement is prepared. The impact of the lack of green land is the lack of clean air, the lack of water catchment areas so that flooding is widespread. Green land functions, among others: bio-ecological functions, socio-economic economic functions, aesthetic functions.

Development and technological progress have risks to decrease the extent and quality of the environment. Infrastructure development is not only in the form of roads and buildings, but also drainage, green space, and utilities. Technology as part of the utility and as a medium to facilitate performance actually forgets the relationship between the environment and technological progress.

Development and technological progress certainly hope for a better life for humans, but humans also need a good environment so that humans are physically and psychologically controlled. By looking at the phenomena that occur, especially in Indonesia, it will be seen...
problems, conditions on the ground, and solutions to the challenges of development and technological progress.

The aim of this study was to find out the environmental solutions in carrying out development and technological development, and a reminder of the manifestation of sustainable development.

2. Methodology

The method used was phenomenological qualitative which saw a current experienced event visibly. The stages need to be performed were the focus of research, data, data analysis, results, and recommendations.

Phenomenological method: (1) Focus of the Problem, problems raised was in the form of events or things that occur around us both in the form of social studies and the natural environment. (2) Data Information, the data obtained was based on observations, interviews, and documentation. Data was not nominal, but based on objective findings in narratives. (3) Analysis, presentation of the analysis was analytical descriptive by multiplying data information, connecting with various sources, comparing, and finding the results. (4) Results, presentation of the results of the analysis has answered the questions of the raised issues. (5) Recommendations, recommendations were made so that events or problems that occur could be minimized and avoided.

3. Result and Discussion

3.1 Focus of the Problem

The concept of a sustainable city cannot be optimally performed, provided that the focus of attention on the physical development of the city and transportation. The phenomenon seen around us today was the absence of an aesthetic planning about the presence of green space as part of sustainable development. The development and technology that were formed actually leave the environment as a counterweight to development. In building design, almost no attention was paid to landscape design or other green open space.

Architecture as a science in design has a lot of focus on buildings. In fact, environmental design, in this case green space, was part of the aesthetic value of a building object. For example, development in major cities in Indonesia.

3.2 Data Information

Sustainable development certainly created a sustainable city, where sustainable cities were the cities that enable citizens to meet their needs and improve their welfare without reducing current or future environmental conditions.

The principles of a sustainable city:
- Environmental carrying capacity, the city is designed and managed within the limits determined by the natural environment and its carrying capacity.
- Reversibility, reversible intervention so that cities can adjust the challenges without disturbing the environmental carrying capacity.
- Resilience, cities are flexible and able to respond to external pressures.
- Efficiency, the economic benefits of environmental efficiency.
- Justice / equity, resources and services are able to reach all city residents.
The concept of sustainable cities were promoting ecologically designed buildings, reducing the volume of vehicles with alternative modes, promoting recycling programs, providing wider green space, maintaining natural habitats.

The rise of vertical housing construction was inversely proportional to the environmental conditions in the site. This was very visible in parking areas and parks. The parking area was focused on parking arrangement and vehicle circulation, but the shade and beauty of the parking area was often overlooked. For stakeholders, the park area was often considered an empty land that can make money, so it often closed the park by making it a building.

Based on interviews with users of newly built objects, feel that the impression of aridity and heat cannot be separated in development. In addition, it was very apparent that there was no unity of planning between buildings and the environment, especially green land. There needed to be further emphasis on the importance of unity of planning and design of buildings with their environment.

In addition to building, infrastructure development that was very visible was road construction. The construction of the cross-provincial road seems to be a major work and was needed by the community to improve the economy. The road construction must have previously been in the form of green or forested land. In the process, the impression of dirty and arid did not escape the sight.

3.3 Data Analysis

![Fig. 1. Primary Principles of Sustainable Development](image1)

Based on the scheme in the figure showed the relationship between economic, development, and environment that could not be separated and go hand in hand. But what was seen now, development was focused on a small part of the element of sustainable development.

![Fig. 2. Building And Parking Area With Lack Environment](image2)
Based on the picture, it appeared that parking as part of the design, was actually designed "just" and what it was. Supported by the procurement of trees without careful design. The trees that were actually provided will grow as expected after the next few years. However, there was still a need for design so as not to impress the "rest" of development and be the last concern.

![Building And Parking Area With Lack Environment](image)

**Fig. 3. Building And Parking Area With Lack Environment**

In Figure 3, it was the same location but in a different year from Figure 2. In Figure 2, it was a picture before construction of a new building, but in Figure 1 there appeared to be no change in the environment when the construction was complete. This showed that there was no difference in the conditions of improvement between before and after development. In addition it also showed the environmental conditions that were increasingly neglected and were not a counterweight to development.

![Expand Capacity of Roads](image)

**Fig. 4. Expand Capacity of Roads**

Road construction as a form of ease of access, turned out to be inversely proportional to the concept of sustainable development, which needed to reduce the number of vehicles. Road construction and the addition of road segments were also expected to be a solution to traffic congestion, but if you see Figure 4, it was clear that the construction and addition of roads actually increase traffic jams.
3.4 Results

Based on the results of the analysis of some of these findings, showed that the development carried out was inversely proportional to the announced planning and concept of sustainable development. Almost all aspects of development that were currently still running were not in accordance with the concept of sustainable development. Green Open Space as part of green infrastructure was always ignored and the final result in development, no longer part of development such as the concept of sustainable development.

3.5 Recommendations

There is a need for concrete and real action on sustainable development so that people can enjoy the results even into the future. Green space or green infrastructure needs to be part of the design.

4. Conclusions

Green infrastructure continues to be a discussion of environmentalists. Development will be balanced and sustainable if the construction designers and actors continue to pay attention to green land in the process.

Suggestions

Educators need to implant and train learners to include green land in every design. For construction players, there needs to be awareness and concrete action on the importance of green land in a development. For capital owners (business people), profits are not only gained from physical sales but also the provision of the environment to be of added value and increase the sale value of a place. For the government, people's welfare is assessed from the quality of their lives so that they are able to work optimally and improve the economy.

5. References

Analysis of the Effect of Using Camshaft Racing on Power and Torque in Motorcycle

Hasan Maksum1, Wawan Purwanto2, Miky Andes Putra3, Hanapi Hasan4
{hasan_maksum@yahoo.co.id1, wawan5527@ft.unp.ac.id2, mikyandesputra99@gmail.com3, hanapi_hasan@unimed.ac.id4}

Department of Automotive, Faculty of Engineering, Universitas Negeri Padang, Indonesia1,2,3, Department of Mechanical Engineering, Faculty of Engineering, Universitas Negeri Medan, Indonesia4

Abstract. This study examines the power and torque generated by the use of camshaft racing on a motorcycle with 125cc rotary engine 4500, 6000 and 7500 rpm. Data was analyzed by means of directly observing experimental results then summed and determine the results of the research that has been done in the form of graphs and tables. In this test of dynamometer used tool to determine power and torque. The results of this study indicate that increased use camshaft torsional rotation racing at 4500 rpm 1.21 Nm (18.42%), whereas at 6000 rpm rotation increased by 1.61 Nm (22.61%) and 7500 rpm rotation torque is increased 1.7 Nm (30.20%). Then the power increase in use of 0.82 kW racing camshaft (26.37%) in the round of 4500 rpm, 6000 rpm while the rotation increased by 0.99 kW (20.10%) and 7500 rpm rotation power increased by 1.46 (33.87%).

Keywords: Camshaft Racing, Power, Torque, Motorcycle.

1. Introduction

The internal combustion engine (ICE) has been optimized for more than half a century, although the approach and purpose of optimization have changed over the years in response to changes in the environment in which the engine is used [1]. Policy changes, improved technology, revised fuel and reduced vehicle and engine sizes are indicated as possible ways to improve vehicle fuel economy, which in turn reduces pollutant emissions [2]. In the last three decades, advanced technologies such as Direct Injection, turbocharging, and Variable Camshaft Timing (VCT) have contributed significantly to the evolution of engine design [3]. The combination of this technology, together with the reduction in engine size, has simultaneously had a positive effect on fuel consumption and emissions, as well as on driving pleasure [4].

The mechanics took many ways to produce high-performance motorcycles, which is to make modifications to the engine. Modifications made by making important components on the motor, especially on the cylinder head. This is because bicycle engine power is generated by the combustion process at the cylinder head.

There are various ways to make modifications to the cylinder head. One of them is by porting the inlet and exhaust, redesigning the combustion chamber, enlarging the ventilation holes in the carburetor, making changes to the inlet and exhaust valve, and much more.
This is done with the aim of getting as much fuel and air supply as possible into the cylinder head. In other words, it aims to obtain Volumetric efficiency as much as possible is expected to produce optimal power. To get maximum efficiency of volumetric to produce the most optimal power it can be done by the camshaft modifications or replacements.

Camshaft is an important part of car engines and other internal combustion engines. Quality and work efficiency have a direct influence on automotive quality and the development of the entire automotive industry [5]. The role of the camshaft is to determine the valve opening time, set the valve duration of the opening duration, determines the length of the Valve inlet and Exhaust Valve duration and the main components of the valve-train mechanism. Properly opening and closing the valve or valve on the cylinder head will increase engine power [6]. Rotary camshaft engine vibrations cause increased wear, unpleasant noise, and improper movement which will reduce their performance and reliability [7, 8].

Modifying or replacing a standard camshaft with camshaft racing aims to obtain higher performance. That is why research needs to be carried out to what extent the difference in the influence of the use of standard camshafts and camshaft racing on motorcycle, which in turn can be obtained differences in power and torque. Therefore, researchers are interested in examining and diagnosing "The Effects of Using Camshaft Racing on Motorbikes' Power and Torque".

2. Theoretical Review

Camshaft

Camshaft is an eccentric projection on a rotating shaft that is used to regulate the opening and closing of valves with various mechanical intermediaries such as a timing chain or timing belt [9]. In a camshaft design, both intake lobes and exhaust lobes, they must have their respective peaks. The peak of the intake lobe is called the intake lobe centerline and the peak of the exhaust lobe is also called the exhaust lobe centerline. The distance between the two lobes is called a lobe separation; because it is measured in degrees, it is called a lobe separation angle. Lobe separation angle (LSA) is also called the distance in camshaft rotation between the intake lobe centerline and the exhaust lobe centerline.

Camshaft Racing

In order to meet maximum motor performance, it can be done through an analysis of modifying the camshaft. This is done in principle to get a faster and longer duration of the inlet valve opening. While the exhaust valve opening is made late and closes faster. Modifications are made by changing the angle formed between the inlet cam and the exhaust cam, which are not the same for each engine. The assumption of the camshaft degree can be determined by looking first at each motor brand and model because it has a different character,
here it is needed special expertise and high accuracy to evaluate and refine motor work in order to overhaul work performance or motor power performance in order to produce maximum power. Among them by changing the cam degree angle, duration, lift and overlap to determine the optimal valve work. To increase engine speed is to modify the camshaft/cam/noken as [9].

Camshaft racing is a camshaft whose main function is better than the standard camshaft, For example: (1) A valve that is pressed deeper serves to increase the fuel that goes into and (2) The valve is open longer so that there is more time which is available for the fuel to go into the cylinder. The following can be illustrated a diagram of the opening/closing time of the valve on a standard camshaft and a 4 stroke 125 cc motorcycle racing camshaft:

Fig 2. Standard camshaft valve diagram

A standard camshaft with duration of 260 °, that is, the valve goes into, will open at the point 2 ° before TMA, and will close at the point 25 ° after TMB and the exhaust valve will open at point 34 ° before TMB and will close at the point 0 ° after TMA. The camshaft has a 6.5 mm camshaft lobe lift for suction valves and 6 mm for exhaust valves.

Fig 3. Camshaft racing valve diagram

Camshaft racing with the duration of 270°, the inlet valve will open at a point 10 ° before TMA and will close at a point 60 ° after TMB and the exhaust valve will open at point 55 ° before TMB and will close at a point 20 ° after TMA. This camshaft has an 8 mm camshaft lift lobe for suction valves and 8 mm for exhaust valves.
The Effects of Using Camshaft Racing on Power and Torque

The use of camshaft racing will affect at least a mixture of fuel and air that enters or goes into the combustion chamber. The actual volume of air entering/going into the cylinder can be expressed in a ratio between the volume of air entering and the volume of piston steps from the upper dead point to the lower dead point. This figure/number is hereinafter referred to as "Volumetric Efficiency". If the number/figure of volumetric efficiencies is greater, more air will enter/go into the cylinder and the flow will be smoother.

The efficiency of the intake of a mixture of air and fuel (filling efficiency) is, the ratio between the volume of fuel and air at ambient pressure and temperature. Increasing the volume of air/fuel entering/going into the cylinder means that there are more explosions will be used to produce power [9,11].

3. Research Method

In this research model, there is an experimental group and a control group with a pattern in the table below.

<table>
<thead>
<tr>
<th>Group</th>
<th>Treatment</th>
<th>Test Result</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>-</td>
<td>O₁</td>
<td>motorcycle using camshaft standard</td>
</tr>
<tr>
<td>R</td>
<td>X</td>
<td>O₂</td>
<td>motorcycle using camshaft racing</td>
</tr>
</tbody>
</table>

Description:
R : Experimental and control group
X : Treatment using camshaft racing
O₁ : Effect without treatment
O₂ : The effect after using camshaft racing

Object of Research

The object of research is the target or object that is the subject of discussion in research. The object of research in this study is a four-stroke motorcycle unit. In this case, the data to be taken is the power and torque of the motorcycle. Specifications of the motorcycle used:

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine Type</td>
<td>4 steps SOHC 2-Air cooling valve</td>
</tr>
<tr>
<td>Number of cylinder</td>
<td>1</td>
</tr>
<tr>
<td>Displacement</td>
<td>124.8 cc</td>
</tr>
<tr>
<td>Bore x stroke</td>
<td>52.4 x 57.9 mm</td>
</tr>
<tr>
<td>Compression ratio</td>
<td>9.0 : 1</td>
</tr>
<tr>
<td>Maximum Torque</td>
<td>10.1 Nm/ 4000 rpm</td>
</tr>
<tr>
<td>Maximum power</td>
<td>6.94 kW/ 7500 rpm</td>
</tr>
</tbody>
</table>
Research procedure
This research was conducted in several stages;

Preparation phase
First (a) The preparation stage of the machines and tools needed in the research process; (b) Before the test is carried out, the motorcycle is reconditioned according to the manufacturer's standards without any changes or modifications; (c) Then start the motor at its idle speed for 5 minutes so that the motor reaches its working temperature, which is ± 80°C; (d) After reaching the working temperature, the engine is turned off and the motorcycle is positioned on the dynamometer; (e) Install dynotest safety equipment; (f) Turn on the vehicle cooling blower; (g) Start the vehicle engine, then calibrate the engine compression ratio on the dynamometer.

3.2.2 Power and torque Testing Phase
First (a) Turn the gas handle slowly up to 2000 rpm, then press the start/stop dynamometer button, the gas handle is then rotated until the engine reaches the maximum rotation, after the engine reaches the maximum rotation then the gas handle is released slowly until the idle turns and pushes the start/stop dynamometer button; (b) Print the results of power and torque tests; (c) Steps "a" and "b" are repeated 3 times, to get the best results; (d) Printing test results in the form of power and torque at an engine speed of 4500, 6000 and 7500 rpm.

3.2.3 Data Analysis Stages
Researchers conduct data analysis to reveal increased power and torque by using camshaft racing and standard camshafts at 4500, 6000 and 7500 rpm engine speeds.

4. Results and Discussion

4.1 Research Finding (Result)

<table>
<thead>
<tr>
<th>RPM</th>
<th>Torque (Nm) Testing</th>
<th>Torque (Nm) Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>4500</td>
<td>8.12</td>
<td>4.99</td>
</tr>
<tr>
<td>6000</td>
<td>7.71</td>
<td>6.58</td>
</tr>
<tr>
<td>7500</td>
<td>5.38</td>
<td>6.32</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RPM</th>
<th>Power (kW) Testing</th>
<th>Power (kW) Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>4500</td>
<td>3.86</td>
<td>2.36</td>
</tr>
<tr>
<td>6000</td>
<td>4.85</td>
<td>4.15</td>
</tr>
<tr>
<td>7500</td>
<td>4.23</td>
<td>4.61</td>
</tr>
</tbody>
</table>
4.2 Research Chart/Graph

Based on the results of the tests which have been done, the mean/average data from three tests can be converted into graphs as follows.

On the graph, it can be seen that the use of camshaft racing affects the torque produced by the 125 cc motorcycle engine. At 4500 rpm using a standard camshaft has a torque of 6.75 Nm and an increase in the use of camshaft racing 8.27 Nm, then at 6000 rpm using a standard camshaft produces torque of 7.12 Nm and an increase of 8.73 Nm on the use of camshaft racing and at 7500 rotation the data shows that on a standard camshaft produces torque of 5.63 Nm while on camshaft racing the torque data increases to 7.33 Nm.

In the 4500 rpm rotation test using standard camshaft produces 3.11 kW power and an increase in the use of 3.93 kW camshaft racing, then at 6000 rpm rotation using standard camshaft produces 4.48 kW power and an increase of 5.47 kW in the use of camshaft racing and in the round of 7500 the data shows that using a standard camshaft produces power of 4.31 kW while in camshaft racing the power data increases to 5.77 kW.

In the process of implementing the t-test results of this study, the t hitting price will be searched. The results of the t hitting will be compared with the t table to see the significance level. The value of the t table used is at a significant level of 5% which is equal to 2.776. The power and torque analysis that is carried out consists of two groups: standard conditions with the use of camshaft racing. This analysis is described in the following table.

<table>
<thead>
<tr>
<th>RPM</th>
<th>X̄&lt;sub&gt;mean&lt;/sub&gt;</th>
<th>Y&lt;sub&gt;mean&lt;/sub&gt;</th>
<th>N&lt;sub&gt;x&lt;/sub&gt;</th>
<th>N&lt;sub&gt;y&lt;/sub&gt;</th>
<th>S&lt;sub&gt;x&lt;/sub&gt;</th>
<th>S&lt;sub&gt;y&lt;/sub&gt;</th>
<th>T&lt;sub&gt;test&lt;/sub&gt;</th>
<th>t&lt;sub&gt;table&lt;/sub&gt;</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>4500</td>
<td>6.57</td>
<td>7.78</td>
<td>3</td>
<td>3</td>
<td>0.3509</td>
<td>0.1332</td>
<td>-2.506</td>
<td>2.776</td>
<td>Tidak Signifikan</td>
</tr>
<tr>
<td>6000</td>
<td>7.12</td>
<td>8.73</td>
<td>3</td>
<td>3</td>
<td>0.1429</td>
<td>0.3232</td>
<td>3.560</td>
<td>2.776</td>
<td>Signifikan</td>
</tr>
<tr>
<td>7500</td>
<td>5.63</td>
<td>7.33</td>
<td>3</td>
<td>3</td>
<td>0.2479</td>
<td>1.0067</td>
<td>-2.195</td>
<td>2.776</td>
<td>Tidak Signifikan</td>
</tr>
</tbody>
</table>
The results of the analysis show significant and insignificant in the use of camshaft racing towards the torque produced by the engine. The use of camshaft racing results is not significant to the torque at 4500 and 7500-rpm engine speed with a $t_{\text{count}}$ of -2.506 Nm which is smaller than the $t_{\text{table}}$ 2.776 at 4500 rotation and at 7500-rpm with a $t_{\text{count}}$'s value of -2.195 less than $t_{\text{table}}$ 2.776, whereas at 6000 rounds, the results were significant with a $t_{\text{count}}$ of 3.560 Nm which was greater than the $t_{\text{table}}$ 2.776. That is, the null hypothesis (Ho) against torque is accepted and the alternative hypothesis (Ha) is rejected because there are insignificant results of the analysis of torque testing data.

| Table 6. Data Analysis of Power Testing Results on 125 cc Motorcycle. |
|-------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| RPM   | $X_{\text{avg}}$ | $Y_{\text{avg}}$ | $n_x$ | $n_y$ | $S_x$ | $S_y$ | $t_{\text{obs}}$ | $t_{\text{table}}$ | Significance |
| 4500  | 3.11            | 3.93            | 3    | 3    | 0.06 | 0.06 | 3.700           | 2.776           | Significant |
| 6000  | 4.48            | 5.47            | 3    | 3    | 0.15 | 0.06 | 3.240           | 2.776           | Significant |
| 7500  | 4.31            | 5.77            | 3    | 3    | 0.06 | 0.06 | 6.590           | 2.776           | Significant |

Based on data analysis above it is obtained $t_{\text{count}}$ which is then compared with $t_{\text{table}}$. The use of camshaft racing results significantly in powers at 4500, 6000 and 7500-rpm engine speeds with a $t_{\text{count}}$ of 3,700 kW which is greater than the $t_{\text{table}}$ 2,776 at 4500 turns, at 6000-rpm at a tune of 3,240 kW greater than the $t_{\text{table}}$ 2,776. Then at 7500 rounds, the $t_{\text{count}}$ of 6.590 kW is also greater than the $t_{\text{table}}$ 2.776. The value of the $t_{\text{table}}$ used is at a significant level of 5%. That is, the null hypothesis (Ho) towards/against the power is rejected and the alternative hypothesis (Ha) is accepted.

4.3 Discussion

The data on the results of power and torque testing on a 125 cc motorcycle using camshaft racing using dyno test can be seen in tables 3 and 4 as well as the graphs in figures 3 and 5.

The data and hypotheses put forward are in accordance with the theory, to meet maximum motor performance, an analysis can be made to modify the camshaft [9]. This is done in principle to get a faster and longer duration of the inlet valve opening. While the exhaust valve opening is made late and closes faster. Modifications are made by changing the angle formed between the inlet cam and the exhaust cam, which are not the same for each engine. The assumption of the camshaft degree can be determined by looking first at each motor brand and model because it has a different character, here it is needed special expertise and high accuracy to evaluate and refine motor work in order to modify work performance or motor power performance in order to produce maximum power. Among them by changing the cam degree angle, duration, lift and overlap to determine the optimal valve work. To increase engine speed is to modify the camshaft/cam/noken as."

The increased torque and power due to the use of camshaft racing which is inseparable from the theory every change in valve lift settings will affect the entire valve and cylinder. The
shape and size of the cam largely determines the point of movement, speed of opening and closing the valve and the amount of valve lift from the seat [9]. Based on the results of testing the power and torque using dynotest, the test shows that the increase in power and torque occurs at a minimum rotation up to a certain rotation which is the peak torque and power, then at higher engine speed, torque and power will decrease. Both torque and power are shown as engine speed. At low speed, torque increases as engine speed increases, as engine speed increases the torque reaches a maximum and then decreases [10]. Torque decreases because the engine is unable to ingest a full charge of air at higher speeds. Indicated power increases with speed, while power increases to a maximum and then decreases at higher speeds. This is because friction losses increase with speed and become the dominant factor at very high speeds. For many automobile engines, maximum power occurs at about 6000 to 7000 RPM about one and half times the speed of maximum torque.

Torque and power both have functions at the engine speed. At low speeds, torque increases with increasing engine speed. When engine speed increases further, torque reaches its maximum point and then decreases. Torque is reduced because the engine cannot swallow a full charge from the air at a higher speed. The indicator power increases with engine speed, power increases to the maximum point and then decreases at higher speeds. This is because friction losses increase with speed and become a dominant factor at very high speeds. For most car engines, maximum power occurs at around 6000 to 7000 RPM, about one and a half times the speed at maximum torque.

5. Conclusion

Based on the results and discussion of the research that has been done, it can be concluded that there is an effect of torque generated in 125 cc motorcycle testing using camshaft racing, at 4500 rpm rotation an increase in torque of 1.21 Nm (18.42%), while at 6000 rpm torque increased by 1.61 Nm (22.61%) and at engine speed of 7500 rpm the torque generated increased at the use of camshaft racing by 1.7 Nm (30.20%). There is an effect of the power generated in 125 cc motorcycle testing using camshaft racing, at 4500 rpm rotation, there was an increase in power by 0.82 kW (26.37%), whereas at 6000 rpm rotation the power increased by 0.99 kW (22.10%) and at 7500 rpm engine speed the power generated increases in the use of camshaft racing by 1.46 kW (33.87%).

6. References


Biomass as An Alternative Energy Source: Recent Progress and Development Based on Thermal Processes to Respond to the Future Energy Mix in Indonesia

J.P. Simanjuntak¹, E. Daryanto² and B.H. Tambunan³
{janterps@gmail.com¹, ekadaryanto@unimed.ac.id², bisrulhapis@gmail.com³}
Universitas Negeri Medan, Mechanical Engineering Department, Medan¹,²,³

Abstract. The purpose of this article is to review and share the information as well as an achievement that has been obtained in the field of solid biomass waste into energy conversion in Indonesia especially on thermal processes. The future energy in Indonesia has been prepared since long time ago which can be known from the research activities and scientific articles that have been published in journals and also through local social media. Energy resilience in the future is prepared to respond to an increase in the human population, development in all fields that certainly requires quite a lot of energy. Biomass is one of the potential future energy sources which are considered as waste. In addition to its abundant, biomass is known to be environmentally friendly because it does not contribute to the air pollution, does not cause the greenhouse effect, and does not cause climate and weather changes. Several efforts to support Indonesia's energy mix in the future based on thermal processes were reported.

Keywords: Solid biomass, Combustion, Gasification

1. Introduction

Industrial Revolution 4.0 is a big challenge for Indonesia as a developing country with a large population. In developing country, Indonesia requires a lot of high technology equipment that can be used to support the development. Many things can be done using equipment so that the use of manpower is reduced. This is called the era of disruption which is characteristic of the 4.0 Industrial Revolution. To overcome these problems, the government must encourage the development of several crucial sectors. However, the main problem arises is energy that need to drive all developing sectors. The fact that Indonesia's main source of energy still dominated by fossil fuels. The negative effect of fossil utilization is human civilization damage since the past. As an addition, the most issue is about harmful climate change. Therefore, the most appropriate solution is to replace the fossil fuel into renewable carbon neutral energy sources.

Transportation sector, especially personal vehicles will become the most electric users in year 2050 due to the President Regulation No. 55/2019 issue concerning the Acceleration of the Battery–Based Electric Motor Vehicle Program for transportation and also the Government Regulation No. 73/2019 which sets the amount of exhaust emissions and also the fuel consumption of vehicle. Both regulations encourage the use of electrical energy as the driving
force and of course will require the electric charger infrastructure. The two regulations also intended to reduce the fossil fuel utilization to mitigate the impact on climate change.

Until now climate change has become the center of global attention because it causes a huge negative impact. There is no other choice except to encourage the utilization of green energy sources, such as biomass that is classified as a renewable energy source. However, several problems in developing biomass include investment and operational costs are still high, short live time of equipment, air pollution, and light particles problem that are released free into the air, biomass collection, transportation, and processing. Indonesia has committed to reduce the use of fossil fuels and utilize biomass energy to 17% of the total national energy mix due to Indonesia's support for the Paris agreement. However, the government hopes that the implementation of biomass as an alternative energy does not conflict with food supply and environmental conservation in order to reduce the impact on climate change.

The depletion of the main energy production especially oil and gas, has encouraged the government to make renewable energy to a top priority for maintaining national energy security and independence. To safeguard the future energy sector's readiness, the use of renewable energy has already begun. But, Indonesia faced with three serious problems in developing biomass as energy sources, namely the regulation, the environmental aspect, and infrastructure problems. This has a negative impact on the development and growth of energy which determines the readiness of the energy mix in the future. Until year 2018, the portion of electric supply is still dominated by the state electricity company or Perusahaan Listrik Negara (PLN) with coal as the fuel as shown in Fig 1 below.

![Fig 1. State electric capacity in year 2018 (a) based on supplier, (b) based on fuel (Direktorat Jenderal Ketenagalistrikan, 2018)](image)

Biomass potential in Indonesia is very large and can be utilized as a national energy supply in the future. However, biomass energy is currently not fully utilized. Based on Presidential Regulation No. 22/2017 concerning the National Energy General Plan, it is stated that 23% of the national energy mix in 2025 is expected to be supplied from renewable energy as shown in Fig 2. This target is equal to 45 GW of generating capacity. At present the installed renewable energy generating capacity is still 9 GW. It means that an additional 36 GW is needed until 2025. The achievement during year 2015–2018 periods reached only 5% while to pursue the target by 2025 required up to 10% achievement each year. Seeing this reality, the government is pessimistic that the 23% in year 2025 will be achieved.

According to the national statistical data center or Badan Pusat Statistik (BPS) review year 2019, Indonesia should be more massive in developing renewable energy–based power plants. However, the energy mix used to generate electric from year 1998 to 2018 is still dominated by the coal whilst electric generation from renewable energy still retarded even though these energy sources are very abundant. BPS review 2019 also pointed out that the contribution of renewable energy is only 5.5% of the total electric generation in 2018. This slight increase compared to year 2017 by 5.3%. There is also a target to new and renewable energy mix (EBT) in 2020 by
17%, while in 2025 is expected to reach 23%, and in 2050 the contribution is expected to have reached 31% as shown in Fig 2 below.

![Fig 2. Indonesia energy mix target by 2015 (RUEN)](image)

The current energy mix to support Indonesia's development comes from coal, crude oil, natural gas, hydropower, and renewable energy. Specifically for renewable energy, to date, as a wholly renewable energy still accounts for 3% [1]. This situation is relatively low considering the abundant potential of renewable energy. At present, the government's attention began to look at this new energy source, but the management is not yet perfect. The government target that the installed electric capacity energy from biomass in 2050 about 4% as shown in Fig 3.

![Fig 3. The installed capacity of electrical energy from EBT in 2050 (RK) [2]](image)

2. Recent activity on university laboratory-based

The motivation for developing biomass as a renewable energy source is referred to the Minister of Energy and Mineral Resources Regulation No. 12/2019 which mentions and regulates the generation of electricity from biomass for one's community by obtaining an operating permit. To get energy from biomass, a conversion process is carried out, most of which use high-temperature called thermochemical processes that requires a suitable reactor. Indonesia so far has been made efforts to increase the economic value of biomass by using thermal process technology which until now continued to improve its performance [3-9]. Several studies have been conducted in Indonesia related to the use of biomass as an energy source. The following figures are the research progress and development of biomass into energy conversion, especially electrical energy that can be used in the district yet connected to the national electricity grid.
Some agricultural residues as shown in Fig 4 such as (a) Candlenut shells, (b) Coconut shells, (c) Sawdust, and (d) Peat soils are tested by using the gasifiers and stoves. Fig. 4e showed the gasification with sawdust as feedstock. With the new design reactor used, an internally circulating fluidized bed is an attractive to produce flammable gas contain heating values close to 7 MJ/m³ [5]. Based on local biomass, the reactor must be adjusted; the fixed–bed gasifier model may be used as shown in Fig. 4f. By using a downdraft gasifier type, the candlenut shell and coconut shell can be used to produce flammable gas [10]. Gasification and combustion–based furnaces are also developed referring to the implementation of biomass technology that suitable for use in areas where biomass is found. Biomass in Fig. 4a to 4c also produce potential thermal energy with the gasification process as shown in Fig. 4g, this is known from the temperature of the fire generated [11]. Fig. 4 is the development of a biomass burning furnace. Some conventional stoves were modified and tested using coconut shells. Through modification, it is obtained that the furnace with an external combustion air supply has the best performance shown by fire temperature [12].

Energy from biomass is also another option to drive the engines in the future. But until now the fuel for transportation is still dominated by liquid fuels and natural gas according to President Regulation No. 64/2012 [13, 14]. However, along with technology developments, the use of gas for engine has also begun to be developed to replace liquid fuels. In Indonesia, the use of gas for engines has a promising future in transportation sector. They concluded that the fuel gas from biomass with a minimum heating value (3 MJ/m³) can be used to drive the engine.
3. Power plant development biomass–based in Indonesia

Until now, government policies in the energy law have yet to be realized concerning the matters previously explained, especially the utilization of biomass into electrical energy by utilizing power plants. The following is the information on biomass–based power plan in Indonesia collected from the internet.

Table 1. Recent power plan based biomass in Indonesia

<table>
<thead>
<tr>
<th>No</th>
<th>Location</th>
<th>Capacity</th>
<th>Biomass</th>
<th>Technology</th>
<th>COD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kalimantan Barat</td>
<td>15 MW</td>
<td>Palm shell</td>
<td>Gasification</td>
<td>2018</td>
</tr>
<tr>
<td>2</td>
<td>Kalimantan Tengah</td>
<td>10 MW</td>
<td>Palm shell</td>
<td>Combustion</td>
<td>N.D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 MW</td>
<td>Palm shell</td>
<td>Combustion</td>
<td>N.D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 MW</td>
<td>Palm shell</td>
<td>Combustion</td>
<td>N.D</td>
</tr>
<tr>
<td>3</td>
<td>Kalimantan Barat</td>
<td>10 MW</td>
<td>Palm shell, Rice husk, Corncoh, Sugarcane Bagasse</td>
<td>Combustion</td>
<td>N.D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15 MW</td>
<td>Palm shell, Rice husk, Corncoh, Sugarcane Bagasse</td>
<td>Combustion</td>
<td>2018</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 MW</td>
<td>Palm shell</td>
<td>Combustion</td>
<td>N.D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 MW</td>
<td>Palm shell</td>
<td>Combustion</td>
<td>N.D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1x15 MW</td>
<td>Palm shell</td>
<td>Combustion</td>
<td>N.D</td>
</tr>
<tr>
<td>4</td>
<td>Mentawai, Sumatera Barat</td>
<td>300 kW</td>
<td>Bamboo</td>
<td>Combustion</td>
<td>2018</td>
</tr>
<tr>
<td></td>
<td></td>
<td>150 kW</td>
<td>Bamboo</td>
<td>Combustion</td>
<td>N.D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1x15 MW</td>
<td>Rubber wood</td>
<td>Combustion</td>
<td>N.D</td>
</tr>
<tr>
<td>5</td>
<td>Sumatera Utara</td>
<td>2x15 MW</td>
<td>Palm shell, Corncoh, Sawdust, Rice husk</td>
<td>Combustion</td>
<td>2012</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1x9,9 MW</td>
<td>Rubber wood</td>
<td>Combustion</td>
<td>2020</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1x15 MW</td>
<td>Rubber wood</td>
<td>Combustion</td>
<td>N.D</td>
</tr>
<tr>
<td>6</td>
<td>Jambi</td>
<td>10 MW</td>
<td>Palm shell</td>
<td>Combustion</td>
<td>N.D</td>
</tr>
<tr>
<td>7</td>
<td>Cilegon</td>
<td>1x15 MW</td>
<td>Palm shell</td>
<td>Combustion</td>
<td>N.D</td>
</tr>
<tr>
<td>8</td>
<td>Nias, Sumatera Utara</td>
<td>18 MW</td>
<td>Bamboo</td>
<td>Combustion</td>
<td>N.D</td>
</tr>
<tr>
<td>10</td>
<td>Sumba</td>
<td>1 MW</td>
<td>Bamboo, Wood chips</td>
<td>Combustion</td>
<td>N.D</td>
</tr>
<tr>
<td>11</td>
<td>Bali</td>
<td>150 kW</td>
<td>Wood pellet</td>
<td>Combustion</td>
<td>N.D</td>
</tr>
<tr>
<td>12</td>
<td>Sulawesi Tengah</td>
<td></td>
<td>Corncoh</td>
<td>Combustion</td>
<td>N.D</td>
</tr>
<tr>
<td>13</td>
<td>Sumatera Selatan</td>
<td>3 MW</td>
<td>Rice husk</td>
<td>Combustion</td>
<td>N.D</td>
</tr>
</tbody>
</table>

COD: commercial operating date
N.D : not detected

4. Closing remarks and future works

Progress and achievements towards the biomass to energy conversion in Indonesia has been presented. Until now, the development and improvement of the reactor performance are very rapid. Specifically for gas fuel (syngas) from biomass, it is strongly recommended by the writer's and team to develop this technology until syngas is obtained properly which can be applied to engines.
5. Acknowledgements

The authors would like to acknowledge the Universitas Negeri Medan for financial support through DIPA with Contract Number 292D/UN33.8/PL/2019. The authors highly acknowledge support from mechanical engineering workshop members, and also two final project students for their participation and contribution to this project.

6. References


Blended Learning for Vocational Teacher Candidates

Muhammad Amin¹, Salman Bintang²
{aminunimed@unimed.ac.id¹, salmanbintang1968@gmail.com²}
Universitas Negeri Medan, Jurusan Pendidikan Teknik Elektro, Medan¹²

Abstract. This study aims to see the effectiveness of using Google Classroom-aided blended learning for vocational teacher candidates. The effectiveness of blended learning in terms of the socialization of knowledge transfer and the internalization of knowledge transfer for vocational teacher candidates is good, in order to be able to adapt it for learning in vocational high schools. In detail the research was carried out to find: (1) the effective use of methods and strategies in the Google classroom assisted blended learning model for prospective teachers, (2) the effective use of the tools, media, and learning resources used in the Google classroom assisted blended model for prospective teachers, (3) the effectiveness of learning management on the use of google classroom assisted blended for prospective teachers, and (4) the effectiveness of learning outcomes using blended learning for prospective teachers. The research method uses a development and evaluation approach. The development approach is used to develop methods, strategies in the blended model that are used, while the evaluation approach is carried out to evaluate the results of development used. The results showed that: (1) the use of models and strategies in the Google classroom assisted blended learning model is very effective (3.88) for prospective teacher students, (2) the use of tools, media, and learning resources used in the Google classroom assisted blended model very effective (3.86) for prospective teacher students, (3) Management of learning in the use of google classroom-assisted blended has been very effective (3.88) for prospective teacher students, and (4) learning outcomes in the use of Google-assisted blended classroom learning outcomes Students are better than before using Google classroom assisted blended.

Keywords: Blended learning, vocational, teacher candidates, google classroom.

1 Introduction

Higher education continues to be challenged to continue to carry out their various roles to face the challenges and changes that occur in this era, especially in the aspects of education and teaching, development, and dissemination, as a breadbasket of the treasury of knowledge for the community. In this regard, there are at least three important things and need to be done by universities. First, universities must start implementing hybrid teaching systems. Here, universities must be able to respond to the development of the role of technology. In this case, the application of online learning or lecture technology should now be considered, which is now known as Massive Open Online Courses (MOOCs). [1]. But this way of learning and lecturing is still in doubt and is considered not to be widely applicable in subjects that require skills training that is dependent on laboratory equipment because they must use high technology or require adequate communication technology equipment [2].

The quality of students in the future is largely determined by the role of teachers in schools today. In view of the need to understand how the world changes transform for a better human
life. Besides that, it is also necessary to understand the transformation that also takes place in the world of education we know the terms Education 1.0, Education 2.0, Education 3.0, and finally Education 4.0 as an answer to social development due to the times. Views on how humans learn also need to be adapted. The terms pedagogy, mesagogy, andragogy, and heutagogy form the basis that should be understood by the teacher. Each view of learning is needed in an effort to treat students in digesting knowledge / competencies that are adapted to the available environment.

The phenomenon that occurs in the field of education is the challenge that not only focuses on what is taught, but also the way of teaching where the education itself is based on the need to meet the needs that exist in the future [3]. It is common consumption that education is now seen as a lifelong process not just as a stepping stone towards the professional world. Education 4.0 is considered an opportunity for schools that are ready to grow their students' readiness to enter a new round of the world of education that is changing so fast. Teachers are required not only to be able to change the way their students think facing all the obstacles they experience, but also have a heroic role that is not easily replaced; how important the role of the teacher for the future of their students. The role of the teacher is more complex than in previous eras. The complexity is shown, for example, how a teacher must respond to the changing needs of students, technological developments that are rapidly reaching and filling the world, or demands for excellence from society, and changes in social construction in society and globalization [4].

In addition to preparing responsive steps to answer challenges, universities should also instill five basic values to equip students to excel in facing change, namely resilience, adaptability, integrity, competency, and continuous improvement. Resilience, resilience, is needed in the midst of uncertainty, competitive climate, and various economic shocks, cultural clash, and the existence of disruptive innovation. A prospective teacher must have the ability to survive, survive, not easily give up and get frustrated in dealing with various circumstances, because the process of forming prospective teachers must be done superiorly [5]. A superior learning process for prospective teachers requires adaptability that encourages or adapt to changes that occur both at domestic and international levels. Integrity, students must uphold personal and professional integrity, such as honesty, tolerance, mutual cooperation, mutual assistance, adhere to scientific principles, and professionalism. The policy gives strict sanctions for every violation of rules and law enforcement will firmly make students with personal integrity. Then, competency, where students must have the competence and qualifications in the field they are involved in and be able to understand the development of other fields so that they are not narrow-minded. Policy provides flexibility / requires students to take courses in other fields is an effort to improve field competence and knowledge across fields. Meanwhile, continuous improvement prepares students to become true learners so that they continue to make improvements in their occupied fields.

The implementation of learning process for prospective teachers is carried out in order to apply learning practices that are relevant to the learning situation in the School. This condition is carried out to make it easier to adapt in the form of internationalization to prospective teachers. Basically learning in schools is oriented to the demands of the curriculum that applies in schools, where learning is carried out with the Scientific Approach approach using various learning models such as discovery learning, Problem Based learning, Project Based Learning, and others that are relevant to the scientific approach. Educating learning is learning that inspires students. Educative learning can be created through the use of appropriate learning methods and following the tastes of the times. The Scientific Approach Method is one example that meets these criteria. Furthermore, based on the tastes of the times, it turns out that learning oriented to blended learning, is also very liked by students so that the learning activities are applied in learning using
a scientific approach, with learning methods oriented towards blended learning. Blended learning activities that are online are determined by using Google classroom facilities.

2 Research Method

This research uses a mixture of qualitative and quantitative approaches. The research began with Research and Development (R & D) research to develop blended learning models and tools that are relevant to the learning needs of vocational teacher candidates. The research model was adapted from Thiagarajan, Semmel, and Semmel in [6] by using Four-D Models. This model consists of 4 stages of development, namely: define, design, develop, and assess or adapt to a 4-P model, namely (1) Define which includes the front end analysis, student analysis, task analysis, concept analysis, and formulation learning objectives. (2) Design which includes the stage of compiling the benchmark reference test, the stage of media selection, format selection. (3) Development includes device validation by experts followed by revisions, simulations, limited trials with real students. (4) Disseminate stage is the stage of using devices that have been developed on a broader scale. In this final stage, a quasi-experimental method is used to determine the effectiveness of the use of the discovered model.

The application of the results of the development model is done by asking for responses from prospective teacher students about the implementation of lectures with blended, because this method is expected to be adopted by the con teacher students after they teach at the Vocational School. Data collection techniques in this study used instruments in the form of questionnaires, interview guides and documentation in development activities, and used test instruments in the model effectiveness test activities. The data analysis technique used in this study was a different test and continued with a simple qualitative descriptive analysis technique.

3 Research Result and Discussion

Development Results

The results of the needs analysis found a description of the planning steps and types of lecture activities that are possible to be carried out online and face to face in accordance with the curriculum used. The blended lecture activity model is planned by integrating the application of six lecture assignments, and describing various lecture activities as in Figure 1. The developed model is equipped with standards or provisions relating to the use of the model in each subject. The models consist of provisions relating to the quality standards of learning planning, implementation of lectures, and monitoring and evaluation.
Fig 1. Blended learning activities for prospective SMK teachers

Provisions relating to the quality standards of learning planning, consisting of: (1) Lecturers plan for blended learning arranged based on scientific learning principles compiled in the Lecture Events Unit, (2) The lecturer prepares teaching materials and is socialized to students through the lecturer blog, (3) Lecturers are able to choose the most suitable learning method to achieve the desired learning outcome (product), (4) Learning resources are provided in accordance with the learning objectives, and (5) Learning facilities and infrastructure are able to support learning. This condition will create a learning process that can be done by students and lecturers not limited by time and place [7] and [8].

Furthermore, the provisions governing the Learning Implementation Standards include: (1) Lecturers must be disciplined in implementing learning, both online and in class, (2) Students must be actively involved, both online and face-to-face activities, so as to create interactions that support learning, (3) Lecturers must be pedagogical, personal, social, and professional exemplary in the face-to-face learning process, (4) Lecturers must act as facilitators that encourage the creation of student learning independence, (5) learning methods applied must be able to develop learners as much as possible, (6) Learning facilities and infrastructure must be utilized optimally, (7) Learning methods must direct students to learn independently and in groups, (8) Lecturers are able to develop and use a variety of teaching media, (9) Learning resources can be accessed by interested parties, and (10) Administration of learning support activities is carried out transparently and accountably.

While the standards set in the Monitoring and Evaluation activities include: (1) Assessment of learning outcomes is carried out transparently, (2) Evaluation of learning must be able to measure the achievement of competence, conscience, and compasion, (3) Lecturers utilize feedback from students to improve the learning process, (4) Lecturers and students
reflect on the learning process for continuous improvement, and (5) The learning process is evaluated every face-to-face activity, (6) Each lecturer must develop and provide subject assignments consisting of routine, critical assignments book reports, review journals, mini research, idea engineering, and projects in order to evaluate learning outcomes and to improve students' learning abilities and experiences, (7) Each assignment is corrected, discussed and/or returned to students as feedback on the process and results of learning through selected media channels, and (8) Minimum number of assignments given should be adjusted to the credit load and planned in the learning plan.

The use of blended learning models for vocational teacher candidates, in addition to being expected to be adapted when they become teachers, also increases students' ability to apply learning practices and improves student learning outcomes of prospective teachers. Therefore, one indication of the effectiveness of using the model is that there is a good response from prospective teacher students, as well as an increase in student learning outcomes. To see an increase in student learning outcomes towards the use of models in subjects that are the subject of research, it is necessary to study learning data on the application of the model and student learning outcomes data in the same course and the same teaching lecturer before using the model.

To see the impact of the transfer of knowledge about the application of the blended model to vocational teacher candidates, an evaluation was conducted related to the socialization activities and internalization of the knowledge that was impacted on the prospective teachers. Evaluation of socialization activities and internalization of the implementation of blended learning carried out on three aspects which include: (1) aspects of using approaches, strategies, methods, and learning techniques; (2) the use of tools, media and learning resources; (3) Class management and how to motivate students. Next to see the effectiveness of the implementation of blended learning for vocational teacher candidates, an evaluation of learning outcomes is conducted. Evaluation of aspects 1 to 3 is carried out using a questionnaire, while evaluation of learning outcomes is done through an assessment of the assignments of prospective teacher students and the results of midterm exams.

**Result of Socialization and Internalization of knowledge transfer**

The results of an analysis of questionnaires that have been filled out by students related to the socialization aspects of the use of approaches, strategies, methods, and learning techniques; aspects of using tools, media and learning resources; and aspects of classroom management and how to motivate students obtained an average score of 3.87 from a scale of 1 to 4. This shows that overall student responses to the three aspects included in the category are very good. When viewed in each category, it appears that aspects of the use of approaches, strategies, methods, and learning techniques obtain an average response of 3.88; aspects of the use of tools, media, and learning resources obtained an average response of 3.86; and aspects of classroom management and how to motivate students obtained an average response of 3.88. It also shows that each aspect evaluated shows the response from students in the very good category (Figure 2).

Results of an analysis of questionnaires that have been filled out by prospective teacher students related to aspects of internalizing the ability to use approaches, strategies, methods, and learning techniques; aspects of using tools, media and learning resources; and aspects of classroom management and how to motivate students obtained an average of 3.80 from a scale of 1 to 4. This shows that overall the ability of prospective teachers to internationalize the three aspects is included in the category of very good. When viewed in each category, it can be seen
that the ability to use approaches, strategies, methods, and learning techniques obtain an average response of 3.82; the ability to use tools, media, and learning resources obtained an average of 3.80; and the ability to manage classrooms and how to motivate students obtained an average response of 3.78. This also shows that each of the aspects evaluated showed a very good category (Figure 3).

![Figure 2. Average Response of Socialization Results of Lecture Implementation](image1)

![Figure 3. Average Response Result of Students' Ability to Internalize Lecture Implementation](image2)

The results of the evaluation of the items on the aspects of the use of approaches, methods, strategies and learning techniques, obtained student responses from all items on average 3.88
with a very good category. These results indicate that the use of approaches, methods, strategies and learning techniques in lecturing activities has been very good, but if traced there is one of the questions that obtained the lowest response which is an average of 3.72. The lowest response obtained is a response that is related to the suitability of the method used with the expectations of students, this can occur due to the number of course participants who take lectures, so there are some students who have different learning characteristics, and feel that the method used is not optimal in helping with lecturing activities, and of course this should be able to be a study to be followed up on in the next learning process.

The results of the evaluation of the ability of prospective teachers to internalize aspects of the use of approaches, methods, strategies and learning techniques used showed an average ability of 3.82 in the excellent category. This proves that prospective teacher students are able to internalize the practice of using approaches, methods, strategies and learning techniques applied in blended learning. The evaluation results also show that there is a strong correlation between the socialization activities provided and the ability to internalize the knowledge practiced (Figure 4).

![Fig 4. Data Outcomes of Socialization and Internalization Capability of Using Approaches, Strategies, Methods and Learning Techniques](image)

The results of the evaluation of the items on the aspect of the socialization of the use of media tools and learning resources, obtained student responses from all items an average of 3.86 with a very good category. These results indicate that the use of media tools and learning resources in lecturing activities has been very good, but if traced there is one of the questions that obtained the lowest response that is an average of 3.78. The lowest response obtained is the response related to the use of media tools make it easier to understand lecture scenarios for students, this is possible because students feel the existence of a media tool in the form of a google classroom has not been fully helpful in understanding scenarios of whole learning
activities. This condition is indeed realized, because not all activities have been regulated in google classroom, so there are still a number of activities that are adapted to the conditions that occur, especially with the number of participants who are unpredictable in accordance with the previous plan. This condition causes some students to feel that the media tools used have not been maximized in assisting them in lecturing activities, and of course this should be able to be a study for follow-up to the next learning process.

The results of the evaluation of the ability of prospective teachers to internalize aspects of the use of media tools and learning resources used showed an average of 3.80 in the excellent category. This proves that prospective teacher students are able to internalize the practice of using media and learning resources applied in blended learning. The evaluation results also show that there is a strong correlation between the socialization activities provided and the ability to internalize the knowledge practiced (Figure 5).

![Figure 5. Results of Socialization and Internalization of the Ability to Use Media Tools and Learning Resources](image)

The results of the evaluation of the items on the aspects of class management socialization and how to motivate students obtained student responses that the aspects of aspects related to management obtained an average of 3.83 with a very good category, and items related to aspects of motivating students obtained an average response 3.94 with a very good category. These results indicate that classroom management and how to motivate students in lecturing activities are already very good, but if traced there is one of the questions that gets the lowest response that is an average of 3.71. The lowest response obtained is a response related to the compatibility between management and study material, this can occur due to the large number
of course participants who take lectures, so that there are some students who have not yet benefited maximally from classroom management conducted by lecturers, and of course this should be able to become a study to be followed up on the next learning process.

The results of the evaluation of the ability of prospective teachers to internalize aspects of classroom management and how to motivate students used showed an average ability of 3.78 in the excellent category. This proves that prospective teacher students have been able to internalize the practice of using classroom management and how to motivate students to apply it in blended learning. The evaluation results also show that there is a strong correlation between the socialization activities provided and the ability to internalize the knowledge practiced (Figure 6).

![Figure 6](image)

**Figure 6.** Results of the Socialization and Internalization of Students' Management and Motivation Ability.

Evaluation of learning outcomes obtained by students shows that there are 87.93% of students who get an A (90-100), 10.36% of students who get a B (80-89), and 1.72% of students who get a C (70-79). This shows that the level of success of students in following this lecture is very good. When compared with previous lecture activities which show that students get in entrepreneurship education courses is still low. Comparison of the percentage of value acquisition between students taught with the current model (blended model) with the previous student's grade value is shown in Figure 7.
**Discussion**

The evaluation results from three aspects show that the socialization activities of the use of blended learning given to prospective teachers are strongly correlated with their ability to internalize the knowledge provided, this is in accordance with the view [9] that everything that is received both seen, heard, and read will greatly affect the process of growth of knowledge, personality, and intellectual someone. Furthermore [10] internalization requires a long process, and if this internalization process is successful then a person is able to attach his knowledge in his daily life, with his own awareness of individuals already able to comply with existing values and norms without coercion. From the results of socialization, experiences gained such as the desire to maintain life, mingle, imitate, know, worship, beauty, are all learned and will go through a process of internalization which will eventually become a part of the individual's personality.

Based on these conditions, the blended learning process undertaken for prospective teachers is certainly very helpful in internalizing various aspects of learning practices that can be used when they become teachers in vocational high schools. Blended learning patterns which aim to be internalized quickly by prospective teacher students are effective learning practices, because according [11] that the internalization process is more commonly realized through the involvement of role models. Student teacher candidates will make the lecturer as someone who can be respected and used as a role model, so that he can accept a set of norms that are displayed by example. This process is commonly named as identification, both in psychology and sociology. These attitudes and behaviors are realized through conscious learning or assimilation. Based on this opinion, it can be explained that the internalization process is more easily realized through the role of lecturers as role models (role models), one will be easier to internalize something through role models so that one can quickly accept the set of norms that are displayed. In the field of psychology it is known that the process of internalization is the process of receiving a series of knowledge and norms from other people or groups that affect him.

Student learning outcomes indicate that the use of blended learning is effective for students in obtaining better learning outcomes. These results are consistent with the statement [12] which
suggests that the Blended Learning model has a significant influence on student learning outcomes. The same opinion is also mentioned by [13] which states that students have high concept understanding learning outcomes in the use of the Blended Learning model.

4 Conclusion

Based on the results obtained concludes: (1) the process of socialization activities using blended learning for prospective vocational teachers is very effective; (2) the process of internalizing the use of blended learning for prospective teachers takes place effectively, this can be seen from the ability of prospective teachers to integrate the entire set of learning processes mixed in oneself that are ready to be used in learning in vocational schools; (3) The learning outcomes of prospective teachers are better on the use of blended learning mix compared to using blended learning, this proves that the results of developing a blended learning model are effective in its use.

5. Acknowledgements

Thank you to the Directorate of Research and Community Service of the Directorate General of Research and Technology Strengthening of the Ministry of Research, Technology and Higher Education, because of financial support so that research can be carried out properly. A thank you was also conveyed to Medan State University, thanks to the support of the facilities so that this research could be carried out well.

6. References


Virtual Fairy Tale Based on Wulangreh as a Learning Media in Javanese Lesson

S Agustin¹*, Sunardi², D Rochsantiningsih², Gunarhadi², R Perdana¹
{septiana.agustin@gmail.com, sunardi.ipuns@gmail.com, dewi_roch@hotmail.com, gunarhadi@fkip.uns.ac.id}

¹ Doctoral Program of Educational Science, Universitas Sebelas Maret, Surakarta, Indonesia
² Teacher Training and Education Faculty of Universitas Sebelas Maret, Surakarta, Indonesia

Abstract: This study aims to investigate the available virtual fairy tale based on wulangreh in primary school as one of the learning media in primary school. Data collection techniques in this study are observation and interviews in 30 primary school libraries, both public school and private school. The results showed that 30 school libraries already have fiction books, non-fiction books, teaching aids, and video teaching materials for subjects of mathematics, science, social studies, Indonesian and cultural art, while the virtual fairy tales based on wulangreh have not been found. Thus, it can conclude that the virtual tales based on wulangreh are not found. The recommendation of further research is to provide the fairy tale based on wulangreh as a learning media.

Keywords: virtual, fairy tale, learning, media

1 Introduction

Active, effective, interesting, and fun learning can be created by teachers through alternative strategies in the delivery of teaching materials (Malone, Schunn, & Schuchardt, 2018; Martin, Martinez, et al, 2018). One strategy are to utilize media, methods, and visual aids in learning activities (Darmansyah, 2011; Khanifatul, 2014; Lee & Jones, 2018) tailored to the level of student understanding (Whisken, 2017). By using various media, props and method development in learning, the learning activities will not feel saturating. Learners will be more enthusiastic, passionate, discipline, and motivated by their creativity (Dominguez, et al 2013; Thomas, 2013, Zepeda, et al, 2015). With the passion and motivation of learners, the learning activity will be increased quality of the development of learners (Egert, Fukkink, & Eckhardt, 2018; Vondel, et al, 2017).

The most important thing in improving the qualities of education is the willingness of teachers to be creative and responsible for the success of his work (Chatib, 2011). Teachers who teach with high creativity can motivate, inspire, and encourage students to have high expectations of the material they are learning about (Morris, 2006). Sometimes, the creative thinking ability possessed by the students is hampered by
the lack of resources, both the teacher as the facilitator, and the curriculum as the main means and source of learning activities (Craft, Jeffrey, & Leibling, 2001; Aldiq & Arseven, 2017). Therefore, many organized training or seminars aimed to improving the qualities of teachers in teaching (Kraft, Blazar, & Hogan, 2018).

The developments of the 21st century cannot separate from the use of virtual technology based. The virtual sense is a simulation of the real thing. With regard to virtual, current education is also enforced systems that implement about virtual learning (Nesson, Nesson, 2008). Virtual technology has a lot of potential and knowledge to apply in learning activities (Chiou, 1995). One of the cyberspace technology favored by children is the applications of The Second Life (Woods, Wentz, & Baker, 2009). Inside the application, children can choose characters that have a variety of characters and personality. Then the child can also interact with others and the environment, through the program The Second Life. Virtual classroom or so-called online environment, used by some technology-based educational institutions (Aryanwu, 2003). The online environment makes students comfortable and gives a positive impression. Students can easily interact socially, enjoy easy access to learn, and enhance their creativity and experience (Branley & Covey, 2018; Guardadao & Palladino, 2017; Loftin, Dede, & Salzman, 1995; Brelsford, 1993).

The tale is one of the best methods used to cultivate literacy to illiterate societies (Vitali, 2016) and instill noble values of children. Through fairy tales also, children learn to develop imagination, express themselves, cultivate a sense of humor, extending the imagination, sharpen emotional experience and pick up the implicit message behind the fairy tales (Agus, 2009). Fairy tales that are displaying digitally, need more detailed and complete components. In addition, learning to use digital fairy tales also requires good designs and representation of space and time (Calvert, Bizzocchi, & Wei, 2010). The utilization of digital storytelling (Tunjera, et al, 2015) is also applied for several universities especially in the primary school teacher program. Not only teachers, but prospective teachers are also given material about the method of storytelling to children. This case the application of learning media digital storytelling. When telling story processing, teachers can invite students to communicative by involving students to take part in playing the characters in the fairy tale (Palacio, 2010).

Every teacher does not necessarily have good storytelling skills, this can see from the instructional design used by teachers, who never use storytelling methods. Therefore, it needs a learning media that can help the teachers to able to deliver the fairy tales to the students. Based on the results of interviews for elementary school teachers can conclude that the form of fairy tales that fit with current technological developments is virtual video. The material of fairy tale should adjust to the technological development, but not leave the culture of the region. Therefore, fairy tale material suitable for children based on the study of regional cultural literacy
is wulangreh. Based on the above description, this article will describe the availabilities of a virtual fairy tale based on wulangreh in Javanese lesson.

Wulangreh is one of the Javanese philosophy that contains the values of moral. It packed in macapat song. This explanation contains elements of character values, ethical norms, morality, and character building. One of the uniqueness of macapat song is every song has its own character. Each song has character and values of different characters. The values of the characters of the song are useful as the principle of human life in this world.

2 Methods

The population of this study was elementary school at ambarawa. Sampling was taken from 30 elementary school principals. The sample was chosen from the principal at ambarawa because they are responsible for all programs, activities, and implementation of education in schools. Including school facilities, services, and availability of reference books in the library. The data used in this study are secondary data in the form of data collection of books and learning media in the elementary school library. Especially, about the availability of wulangreh virtual fairy tale in elementary school library. This secondary data is reinforced by the results of interviews with the principal at ambarawa. The method used in this study is descriptive qualitative. The description of the results of the survey and interview will be described in descriptive form. Instruments used: survey sheets and questionnaires for interviews. Data collection techniques are obtained by analyzing survey results, and interviews.

3 Results and Discussion

Based on the observations, it was found that libraries in 30 primary schools have fiction books, non-fiction books, visual aids, and learning videos for science materials, Social, mathematics, Indonesia language, and cultural art. The virtual tales based on wulangreh have not been found. This is reinforced by interviews for principal at core school 1 and 2. The result states that the core school has fiction, non-fiction, props, and teaching materials for language, math, science, and sports lessons. Virtual fairy tale will become the important part that should be learnt in the elementary school in Javanese class. However, virtual fairy tale for children in the elementary school is not found.

Based on the observations, it was found that libraries in 30 primary schools have fiction books, non-fiction books, visual aids, and learning videos for science
materials, social, mathematics, Indonesia language, and cultural art. The virtual tales based on Wulangreh have not been found. This is reinforced by interviews, that is:

*Interview with principal at core school 1 Ambarawa district.*

**Researchers**: Does your school have a fiction book?
**Headmaster**: Yes, we have fiction books.

**Researchers**: Does your school have non-fiction books?
**Headmaster**: Yes, we have a collection of fiction books.

**Researchers**: Does your school have props?
**Headmaster**: Yes, we have props for learning Science and Language.

**Researchers**: Does your school have a teaching material video?
**Headmaster**: Yes, we have teaching materials for science, social, language, math, and cultural arts.

*Interview with the principal at the core school 2 Ambarawa district.*

**Researchers**: Do you think the learning method is appealing to children?
**Principal**: Method based on technological progress.

**Researchers**: What do you think is the right method for child development?
**Principal**: Method based on character values.

**Researchers**: Can virtual fairytale learning be applied to children?
**Headmaster**: Yes, I think according to technological developments of interest to children.

**Researchers**: Will virtual fairytale based on Wulangreh as media learning support child development?
**Headmaster**: Yes, because Wulangreh includes values that can be useful for character development in children.

Based on the interview for principal at core school 1, it can conclude that virtual tale has not been found in primary school. Then on the results of interviews for principal at core school 2, it can concluded that virtual fairytale based on wulangreh can apply to the primary school learning. It can see from the opinions of the principal that conveyed that the virtual fairy tale based on wulangreh in according with technological developments and includes character values.

*Figure 1. The Condition of Library*
Basically, every school has a library. The contents of the library are a variety of tools and teaching materials. Almost all teaching materials are always used by teachers and students in turn. Teaching materials used by teachers so far is still the type of books and props. Other teaching materials are video. A tool that can use by teachers when giving lessons with different nuances. The learning videos were used for Math, Language, Science, Social, Citizen, and Handicraft lessons. Video content was divided into two, first is a guide for teachers while the second is a guide to students. Video that contain guides to teachers consist of introduction, object, procedure, practice questions, assessments, and evaluations. Then, the second video contain lessons for children. Teaching materials works for the developments of their knowledge. Videos for children also contain the element of entertainment. It means that the children do not feel boring when learn by video learning.

Video learning is given by the teacher according to the subject. The video on virtual fairy tales intended for children. Videos about virtual tales have not been found in school libraries. The frames and contents of the virtual tale video are different from the lesson videos. The virtual fairy tale videos framed by a short drama of about 3 minutes, while the contents of the virtual fairytale video are the macapat song. Children who watch virtual fairy tales will easily catch the message contained in the video content. In addition, children can also sing along with the song macapat sung by the characters of the drama. Thus, children will get many benefits of virtual fairy tales. They can sing with cool, happy, and enjoy. They can also learn the attitudes shown through short dramas. Thus, it can conclue that virtual tale videos are very useful for children.

The development of fables that are packaged in IT packages is very interesting for children. This is caused by educational games that provide challenges for children. Besides being able to play exciting educational games, children's insights also develop through questions about stories about the local area or environment (Masmuzidin, M, Jiang J, Wan.T, 2012).

Technology development systems that utilize computer animation can support children's learning progress (Johnston, et al, 2017). Various computer animations are made applicatively with the aim of attracting children's attention. So that children can be motivated in learning. Johnston's research supports research on virtual fairy tales in terms of utilizing computer animation to create creative learning models for children. Making virtual fairy-tale videos uses several applications through computer technology, namely: applications to adjust lighting, sound sharpness, cutting scenes, moving highlights, writing song lyrics, and merging all parts to be put together into one whole video unit.
4 Conclusions

This study resulted in a conclusion that the virtual fairy tales for children based on wulangreh have not available in elementary school libraries. This can see based on observations and interviews in 30 primary school libraries. Based on observations and interviews conducted from teachers, it can concluded that 30 primary school libraries have fiction books, non-fiction books, visual aids, and video teaching materials for subjects of mathematics, science, social studies, Indonesian language and cultural arts, while the virtual fairy tales based on wulangreh was not found. The observation data on the virtual fairy tale based on wulangreh search reinforce by the results of interviews of 30 principals who stated that the virtual fairy tale for students based on wulangreh had not available.

Based on the literature study, explained that virtual fairy tales become one of the learning media worthy to develop especially for elementary school students. The benefits of fairy tales for students, among others: open literacy insights, improve imagination, add creativity, and as inspiration. The virtual tale based on wulangreh used as one of the primary school learning media, because according to the level of child development, interesting to learn, in line with the developments of technology, build the character, and not leave the concept of local cultural literacy. Therefore, the recommendation for further research is providing the fairy tale based on wulangreh as a learning media

References

EAI Computing and Communication in Emerging Regions - CCER

The EAI Computing and Communication in Emerging Regions Series have already published proceedings from more than 20 conferences of various scopes. In line with EAI’s values of equality and openness, their mission is to give greater visibility to research and innovation from emerging regions and share the knowledge worldwide. The audience for the proceedings consists of researchers, industry professionals, graduate students as well as practitioners in various fields. CCER harnesses the Open Access platform to simultaneously guarantee free exposure and distribution, under the Creative Commons license. In addition to being available in European Union Digital Library, the proceedings are disseminated to an even wider audience by being indexed in ProQuest, CNKI, Google Scholar and EBSCO.

European Alliance for Innovation

EAI is a non-profit organization with free membership and the largest open professional society for advancing research careers through community collaboration and fair recognition. Members benefit from finding feedback and mentorship for their work and they are guaranteed to be evaluated fairly, transparently, and objectively through community.

ISSN: 2593-7650
www.aceive.unimed.ac.id
http://eudl.eu/series/CCER www.eai.eu