Development of Problem Based Learning Module in Basic Statistics for Makassar Graphic Engineering Students

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Abstract. This research aims to develop a problem based learning module in basic statistics courses for graphic engineering students at the State Polytechnic of Creative Media Makassar. This type of research is research and development. The development of learning tools in this study was developed by adapting Plomp's model development. The result of the research show that The validation of the teaching materials is 4.8 in the very valid category and Practical because the average percentage of student responses is 84.5% in the very positive category and the average percentage of lecturer responses is 96% with very positive category. This Study Effective because the average lecturer's ability observation sheets in managing learning is 4.80 in the very good category, the average percentage of student activity is 80.2% in the very good category, and the student achievement test is 90%. It concluded that the problem based learning module is valid, practical and effective.

Keywords: Development, Module, Problem Based Learning, Basic Statistics.

1 Introduction

In essence, human history cannot be separated from education. The law on the national Instruction System (Sisdiknas) appears the vital part of instruction within the arrangement of quality human resources. Concurring to the law, Indonesian human characters are anticipated to be human creatures who are steadfast and given, have respectable character, identity, progressed, shrewdly, inventive, gifted, restrained, proficient, dependable, profitable, and physically and rationally solid. Viable endeavors to shape human character like this could be done through moving forward the quality of education [1,2].

The Law of the Republic of Indonesia Number 20 of 2003 concerning the National Instruction Framework portrays instruction as a cognizant exertion to plan understudies through direction, instructing and/or preparing exercises for their future roles. The purpose of National Instruction is to teach the nation's life and create Indonesian individuals as a entire, specifically people who accept and are devoted to God All-powerful and have respectable character, have information and abilities, physical and otherworldly wellbeing, a solid and autonomous identity and a sense of social obligation and nationality [3,4].

Science and technology are two things that are interrelated in an exertion to make strides human assets in a country. One of the endeavors made to make strides human assets is to make strides the quality of instruction. Instruction is fundamentally a cognizant and arranged exertion

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made by a individual to create his identity and capacities so that changes and advancements in instruction are things that ought to happen in line with changes within the culture of life. Education is a major factor in the formation of the human person. The dynamic development of science and technology requires every individual to be able to choose, receive and manage information in order to master technology and develop science. In an effort to select, receive, and manage information, critical, logical, systematic, and creative thinking tools are needed, one of which is mathematics. Mathematics is a basic science that is able to develop the ability to communicate using numbers and use the sharpness of reasoning to be able to solve everyday problems [5-7] .

Learning within the 21st century requires the integration of learning with way of life forms, one elective is to coordinated a few areas into STEM learning (Science, Technology, Engineering, and Mathematics). Mathematics education in educational institutions aims for someone to develop their mathematical thinking skills and use them in everyday life. A person's experience with learning concepts at the elementary school is is critical to developing the beliefs and values they associate with mathematics. In a lesson, particularly arithmetic learning, the sort of learning result that's higher than information is understanding, for case clarifying in his claim sentence something he has perused or listened, giving other illustrations from what has been exemplified, or utilizing application informational in other cases. In Bloom's scientific categorization, the capacity to understand is at a better level than information. Be that as it may, it does not cruel that information does not ought to be inquired since, in arrange to get it, it is essential to to begin with know or know. According to the principles and standards for NCTM school mathematics a combination of factual knowledge, procedural facilities and conceptual understanding is required for students to use mathematics [8-11].

Universities as the highest educational institutions known as lectures, in the teaching and learning process, lecturers play an important role as facilitators to convey material so that students can understand them. One of the courses at universities, especially in the graphic engineering study program, is basic statistics. The study of basic statistics is very broad. It should be realized that the ability of each student is different, plus the learning process seems monotonous so that it makes students less interested in paying attention to the material presented by the lecturer. The use of teaching materials that have never changed from year to year is also one of the factors that students' low interest in learning has an impact on their learning outcomes.

Teaching materials as an important part to be able to improve student learning outcomes are deemed necessary to be designed in such a way that the function of teaching materials can be achieved. To realize the function of teaching materials, it is essential to pay consideration to everything that bolsters the victory of the learning handle, such as considering concepts, sorts, and steps for selecting instructing materials. The selection of certain approaches, models, strategies, and learning methods greatly influences students' attitudes and expected learning achievements. If a teacher only relies on the lecture method, it will make students bored in the learning process [12-14] .

Development is one sort of inquire about by going through a process or action carried out to produce a particular product. According to Van sanctum Akker and Plomp depict, improvement inquire about is based on two destinations, specifically: improvement to obtain a item model and the definition of methodological recommendations for the plan and assessment of the item model. Richey and Nelson characterize advancement investigate as a efficient ponder of the plan, improvement and assessment of programs, forms and learning items that must meet the criteria of legitimacy, common sense and effectiveness [15].

Teaching materials are a set of proposals or learning devices that contain learning materials, strategies, restrictions and ways of assessing which are outlined methodicallly and alluringly in

arrange to realize the anticipated objectives. With the existence of teaching materials, lecturers will have more time to guide students in the learning process, help to obtain new knowledge from all sources or references used in teaching materials and the role of a lecturer as the only source of knowledge is reduced. Problem Based Learning is an approach in learning where understudies are confronted with issues and after that usual to understanding them through their possess information and aptitudes, creating request, getting them used to building critical thinking and skillfull problem solving. The Problem Based Learning model can not only improve problem solving skills, but also improve student's scientific thinking skill, think based on scientific principles that are objective, methodological, systematic and universal [16-18].

Teaching materials can be a means of achieving competency standards and optimizing services to students through the use of teaching materials combined with a learning model, one of which is the problem based learning model. With the use of teaching materials combined with the problem based learning model, the teaching and learning process is more efficient. This is also in line with the research conducted by Siti Nurhidayanti [19] with the title "Development of Problem Based Mathematics Teaching Materials to Facilitate the Achievement of Reasoning Ability in Comparative Subjects". The results of the study indicate that based on the results of the development of teaching materials, valid, practical, and effective teaching materials are obtained. (1) The validation sheet of teaching materials (modules) used is very valid because every aspect for each type of validation sheet is at intervals of $4 \leq M \leq 5$ so that the teaching materials are said to be valid. (2) Teaching materials are also in the practical category because based on the results of observing the implementation of problem based mathematics teaching materials to facilitate the achievement of reasoning abilities, it shows that on average all components of implementation observations are in the completely implemented category (practical). (3) Effective because it has met the four criteria that become the reference, namely student learning outcomes are achieved because 85% of students achieve a score of 75, student activities are said to be ideal, because they have met the criteria for the tolerance limit for achieving the ideal time used. Research and development of teaching materials based on problem based learning has been carried out. Among the research conducted by Ridwan [20] ; Murtikusuma [21] ; Nugroho [22] ; Patri [23] they have conducted research related to the development of problem based learning teaching materials that are valid, practical and effectively applied to learning mathematics in the classroom.

2 Research Method

This type of research is the development of research, known as research and development (R&D). The development of learning in this study was developed by adapting Polmp's model development from 1997. The aim of this study was to develop based module with qualities (valid, practical and effective) that cloud improve the quality of learning mathematics. The product that will be developed in this research is teaching materials in the form of problem based learning module on Basic Statistics material. This research was conducted at the state polytechnic of creative media Makassar which is located at Jalan Perintis Kemerdekaan VI No 50 Kec. Makassar City Tamalanrea. The subjects of this research are Graphic Engineering students for the 2021/2022 academic year. The module that has been developed is tested on students of the Graphic Engineering Study Program. The material to be tested is basic statistics material. The implementation of product trials was carried out in seven meetings including the provision of student achievement test. The development model used in this study is the development model proposed by plomp which consists of several phases, namely the

preliminary investigation, the design, the visualization/construction, the test, evaluation and revision. The instruments used in this study were expert validation sheets, lecturers' ability observation sheets in managing learning, student activity observation sheets, lecturer response questionnaires, student response questionnaires, and student achievement test. The data analysis used is validity data analysis, practicality data analysis and effectiveness data analysis.

3 Results And Discussion

The development of these materials follows the phases developed by which consists of the preliminary investigation, the design, the visualization/construction, the test, evaluation and revision. Details of the activities in each phase of the development are described as follows.

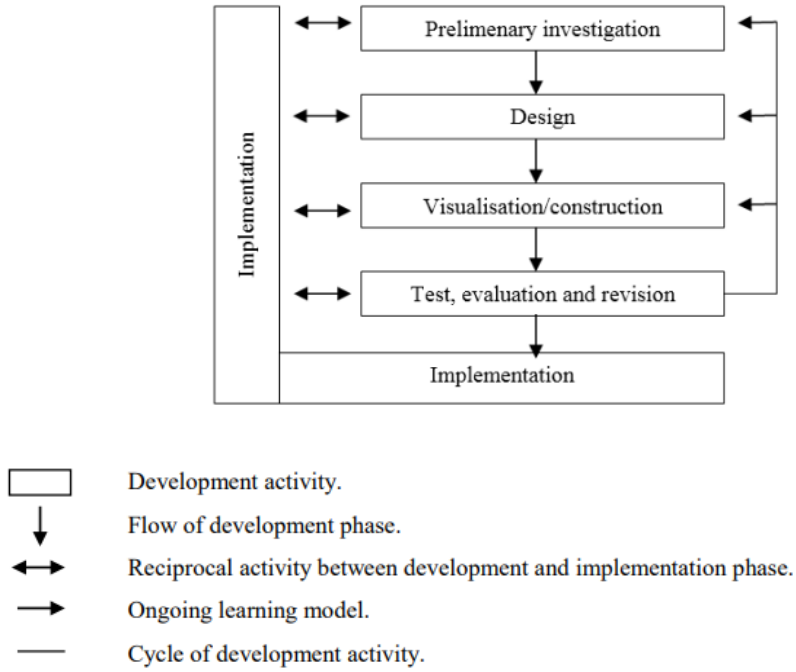

Fig. 1. The Model Development of Plomp

3.1 Preliminary Investigation

The preliminary investigation is the first phase of this research. The initial investigation phase is carried out to determine the the basic problems needed in developing the problem based learning module. The activities carried out at this stage are analyzing the theory of supporting teaching materials, analyzing students and analyzing teaching materials by collecting and analyzing supporting information to plan activities that will be carried out in the next stage. At this stage, an analysis of the material taught in the basic course of statistics is carried out by

identifying, refining and systematically collating the main material the student has studied. The material is then organized in a systematic way consisting of basic statistical concepts, data presentation, centering size, location size, the size of the standard deviation, population, sample, and the research hypothesis.

3.2 Design

In the design phase, researchers designed problem based learning module teaching materials on basic statistics and other research instruments. The design of problem based learning module teaching materials begins with selecting the title of the teaching material developed, then designing the cover and content design and listing the materials that will be included in the module teaching materials. This module is equipped with 5 problem based learning learning syntaxes which are poured into modules consisting of observing problems, let's discuss, dig up information, make reports and let's share. This is the characteristic of the problem based learning module teaching materials produced in this study which are quite different from the modules used in previous students. In addition, at this stage the preparation of semester learning plans and student achievement test is also carried out. The preparation of the semester learning plans contains the steps that will be taken during the learning process while the preparation of the student achievement test as an evaluation tool used by lecturers in measuring the success of the learning process. Furthermore, the preparation of research instruments consisting of aspects of validity, practicality and effectiveness was carried out.

3.3 Visualisation/Construction

The next phase is the visualisation/construction phase. The visualisation/construction phase aims to produce a problem based learning module on basis statistical material that has been revised so that it is suitable for use in research to be further tested in the next phase. The activities carried out at this stage are expert validation and testing.

3.4 Test, Evaluation And Revision

In this phase, the validation tests, practicality tests and effectiveness tests of teaching materials are carried out. The validation test was carried out by asking for expert judgment, namely 2 lecturers consisting of material experts and design experts. The validation test was carried out on 4 aspects, namely aspects of graphic validity, language validity, construct validity and module view. Based on the validation test using the validity assessment sheet instrument, the following results were obtained:

Tabel 1. Module Validation Test Results

Measured Stages	Score	Interpretation
Graphic Validity	4,9	Very Valid
Language Validity	4,6	Very Valid
Construct Validity	4,9	Very Valid
Module View	4,8	Very Valid
The Total Of Average	4,8	Very Valid

From table 1 above, it shows that in the aspect of graphic feasibility, a score of 4,9 is obtained. For the language feasibility aspect, it is 4,6. For the content feasibility aspect it is 4,9 and for the presentation feasibility aspect is 4,8 so that the average value of the problem based learning module validity test results is 4,8 with very valid criteria because it is in the $4{,}0 \leq V \leq 5{,}0$. This shows that the problem based learning module produced in this study is valid, both the components of the feasibility of graphics, the feasibility of language, the feasibility of the content and the feasibility of the presentation and deserves to be tested. Thus, the problem based learning module developed meets the valid criteria.

Tabel 2. Module Practicality Test Results

Measured Stages		Score	Interpretation
Student Questionnaires	Response	84,5 %	Very Positive
Lecturer Questionnaires	Response	96 %	Very Positive

Based on table 2 above, it can be seen that from all the aspects asked, it was found that the average percentage of student responses to learning activities was 84,5%. This figure is in the $80\% \leq RS \leq 100$ interval, which means that student responses to learning activities using problem based learning modules are in a very positive category. While the average percentage of lecturer responses to learning activities is 96%. This figure is in the $80\% \leq 100$ interval, which means that the lecturer's response to learning activities using the problem based learning module is in the very positive category. Based on the two practical components above, namely the student response questionnaire and the lecturer response questionnaire, it showed a very positive response to the problem based learning module used. Thus, the developed problem based learning module meets the practical criteria.

Tabel 3. Module Effectiveness Test Results

Measured Stages	Score	Interpretation
Lecturer's Ability Observation Sheets In Managing Learning	4,80	Very Good
Student Activity	80,2%	Very Good
Student Achievement Test	90 %	Very Good

Based on table 3 above, it can be seen that the results of data analysis on the ability of lecturers in managing learning are obtained the average score is 4.80. This figure is in the $4{,}5 \leq TKD < 5{,}0$ interval with very good criteria. This shows that from all aspects which include initial activities, core activities and closing activities have been carried out very well. For the results of the analysis of student activity data obtained a percentage of 80,2%. This figure is in the $80\% \leq P < 100\%$ with a very good category. This shows that during the learning process using the problem based learning module, students are actively involved so that the dominance of the lecturer in learning can be reduced. This figure is in the $80\% \leq P < 100\%$ with a very good category. This shows that of the 20 students who took the test, 18 students passed the test and 2

students did not pass the test. So that. Thus, the developed problem based learning module has met the effective criteria.

4 Conclusion

Based on the results of the research and discussion, it can be concluded that the problem based learning module developed using the plomp development model includes the preliminary investigation, the design, the visualization/construction, the test, evaluation and revision to produce teaching materials on basic statistics that meet the valid, practical and effective criteria. Valid criteria can be seen based on the results of the validation of teaching materials which show that the average value of the problem based learning module validity test results is 4.8 with very valid criteria because it is in the $4{,}0 \leq V \leq 5{,}0$ interval. This shows that the problem based learning module produced in this study is valid, both the components of the graphic validity, language validity, construct validity and modul view and deserves to be tested. Thus, the problem based learning module developed meets the valid criteria. The results of the analysis show that the average percentage of student responses to learning activities using problem based learning modules has a value of 84.5%. This figure is in the interval $80\% \leq RS < 100\%$ with a very positive category. Meanwhile, from the overall aspects asked, it can be seen that the total response of lecturers to learning activities using problem based learning modules has a value of 96%. This figure is in the $80\% \leq RS \leq 100$ interval with a very positive category. Effective criteria can be seen based on the results of the analysis of the ability of lecturers in managing learning, student activities and student achievement tests. The results of the analysis show that the data on the ability of lecturers to manage learning using the problem based learning module in the trial obtained an average score of 4,80 which is in the criteria $(4{,}5 \leq TKD < 5{,}0)$ which is in the very good category. In addition, obtained the percentage of student activity during learning is 80, 2% is in the interval $80\% \leq P < 100\%$ with very good category. For the results of the analysis of student achievement test tests obtained a percentage of 90%. This figure is in the 80% interval $80\% \leq P < 100\%$ with a very good category. Thus, the problem based learning module developed have met the valid, practical and effective criteria.

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