The Development of Blended Learning Model to Improve Students Learning Outcomes in Drawing Technique and AutoCAD

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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

ACEIVE 2019, November 16, Medan, Indonesia

DOI 10.4108/eai.16-11-2019.2293139

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

Ho : $\mu 1 = \mu 2$ Ha : $\mu 1 > \mu 2$

Where :

$\mu 1$ = 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

No	Category	% Average	Criteria
1	Aspects of learning materials Quality	93,33	Very Good
2	Aspects of technical/display Quality	89,52	Very Good
	Average	91.43	Very Good

Table 2. The average percentage of the results of an assessment of e-learning media using Google classroom in small group trials

No	Category	% Average	Criteria
1	Aspects of learning materials Quality	91,39	Very Good
2	Aspects of technical/display Quality	95.87	Very Good
	Average	9363	Very Good

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

No	Category	% Average	Criteria
1	Aspects of learning materials Quality	97,84	Very Good
	Aspects of technical/display Quality	98,08	Very Good
	Average	97.96	Very Good

Table 4. The e-learning media assessment score uses Google classroom in field trials of the quality aspects of learning material

No	Rating Indicator	Score					%	Criteria
		1	2	3	4	5		
1	Clarity of instructions learning				6	52	97,93	Very Good
2	Clarity of study instructions				3	55	98,97	Very Good
3	Ease of understanding the text				13	45	95,52	Very Good
4	Ease of understanding learning				10	48	96,55	Very Good
5	The accuracy of the order of presentation				5	53	98,28	Very Good
6	Adequacy of exercise				13	45	95,52	Very Good
7	Clarity of feedback					58	100	Very Good
8	Help students learning with programs					58	100	Very Good
Average							97,84	Very Good

Table 5. The e-learning media assessment score uses computer-based Google classroom in field trials on aspects of technical quality or appearance

No	Rating Indicator	Score					%	criteria
		1	2	3	4	5		
1	The interest of the display					58	100	Very Good
2	Text Readability					58	100	Very Good
3	Image quality and animation				5	53	98,28	Very Good
4	Color composition				15	43	94,83	Very Good
5	Navigation				9	49	96,90	Very Good
6	Carrying capacity of music				8	50	97,24	Very Good
7	Interaction				2	56	99,31	Very Good
	Average						**98,08**	Very Good

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

No.	Interval Class	Absolute Frequency	Relative Frequency	Cumulative Frequency
1	65 – 70	1	3.4	3.4
2	71 – 75	2	6.9	10.3
3	76 – 80	7	24.1	34.5
4	81 – 85	9	31.0	65.5
5	86 – 90	7	24.1	89.7
6	91 – 95	3	10.3	100
	Total	**29**	**100**	

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:

$$x = \frac{total\ score\ obtained}{ideal\ number\ of\ score} \times 100\%$$

$$x = \frac{350}{435} \times 100\%$$

= 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: $x = \frac{total\ score\ obtained}{ideal\ number\ of\ score} \times 100\%$

$$x = \frac{312}{435} \times 100\%$$

= 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

No	Respondent	% average	criteria
1	Material expert	93,83	Very Good
2	Learning design expert	88,55	Very Good
3	Software engineering expert	94,10	Very Good
4	Students on individual trials	91,43	Very Good
5	Students on a small group trial	93,63	Very Good
6	Students on field trials	97,96	Very Good
	Average	**93,25**	Very Good

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.

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