



Effect of Learning Outcomes on the Use of Modules in Technical Drawing

Hendri Nurdin¹(✉), Ambiyar², and Nurhasansyah²

¹ Mechanical Engineering Department, Faculty of Engineering, Universitas Negeri Padang, Padang, Indonesia

hens2tm@ft.unp.ac.id

² PTK Postgraduate Program, Faculty of Engineering, Universitas Negeri Padang, Padang, Indonesia

Abstract. Implementation of learning conducted by the teacher still uses the lecture method, so students who are lazy to write and do not understand the material will have difficulty learning, especially in the subject of Technical Drawing which requires direction and order in practice. This can have an impact on learning outcomes that are not optimal. Efforts to be implemented are in the form of using modules to facilitate the implementation of learning Technical Drawing subjects. This study aimed to describe the effect of implementing the module on learning outcomes in the Technical Drawing subject at SMKN 1 West Sumatra. The Quasi-Experimental Research method was used with the Nonequivalent Control Group Design. The result obtained increased student learning outcomes by using this module in the experimental class on the Technical Drawing subject. Where pre-test value the average is 50.77 and post-test value the average is 78.40. While in the control class that did not use the module obtained learning outcomes pre-test value average of 43.64 and a post-test value average of 55.15. The percentage of students who passed the post-test from the experimental class increased by 87% of students who passed. The students who use the Technical Drawing module compared to conventional learning methods have differences in the value of learning outcomes. Thus that the module has an effect on learning outcomes in technical drawing subjects at SMKN 1 West Sumatra.

Keywords: Modules · Learning Outcomes · Students · Technical Drawings

1 Introduction

Education is an effort to develop individual abilities so that it becomes a factor that can determine the progress of a nation. Human Resource Development (HRD) quality can be improved through formal and informal education. Education is universal, accessible and owned by all children of the nation. In improving the quality of learning, it can be done by updating the relevance of teaching method approaches by using the modules. The selection of the proper learning methods can support the material well conveyed to students [1]. SMKN 1 West Sumatra as a place of education in human resource development that has succeeded in producing skilled graduates in the field of Mechanical

Engineering. Infrastructure that supports the learning process consist of various facilities such as multimedia rooms, machining workshops, bench workshops, fabrication workshops. Teachers at SMKN 1 West Sumatra take various efforts to the quality of education with the aim of being able to balance science and technology. Advances in industrial technology require educational institutions to be able to compete in order to create graduates who are ready to work.

The success of students in achieving the essential competencies taught by the teacher is influenced by the sources of learning. Instructional problems and student behaviour occur so quality learning is needed from the teacher so that problems can be overcome and successful [2]. To achieve learning objectives and produce graduates who can have high competitiveness, improvements in the learning process are very necessary to be implemented [3]. The learning media used by teachers of technical drawing subjects at SMKN 1 West Sumatra are in the form of appropriate reference books, laptops and infocus to display electronic teaching materials. During the Technical Drawing learning process, in explaining the material the teacher uses a very short lecture method before the Engineering Drawing lesson begins. This causes students to become passive and less responsive in learning and not all students listen well, causing the information conveyed by the teacher cannot be received by students optimally. Teachers are required to provide summary notes for students. The hope is that it will have an impact on better student learning abilities. The learning outcomes of class X students in the Engineering Drawing subject, there is still much that has not been completed. Of the total students, only 65% passed the Minimum Completeness Criteria (MCC). From this condition, it can be seen that there are still many students who do not understand in completing Technical Drawings. What's more, it turns out that the AutoCAD application in technical drawing can also improve learning activities and student learning outcomes [4]. Learning achievement in Technical Drawing subjects using E-books and Program application is will relate to student learning outcomes so that they are more compatible [5]. The use of learning modules in Technical Drawing subjects can affect student competence. Learning by using modules makes students have better competence [6]. Implementation of Project-based learning (PBL) can significantly improve cognitive skills, group work, and communication skills [7]. Project Based Learning (PBL) is applied in learning in engineering, showing this method helps in increasing students' understanding of basic concepts.

The effort to improve the understanding of classroom learning on the 2013 curriculum by applying learning modules so as to train students to think critically [8]. Students are able to study this module as a whole in their environment. By using this learning module, it is hoped that students can learn from the experiences around them, be active, critical, enthusiastic, and have the opportunity to learn independently. Knowledge Based Tutoring System (KBTS) of in Technical Drawing is approach which model a student in the teaching learning use modules to enhance the effectiveness of process [9].

Based on the discourse above, a study is needed on the use of the Technical Drawing module quoted from the internet and related subject books as an effort to improve student outcomes. The research aims to examine effect of using the module on outcomes in technical drawing subjects. By learning with the use of modules independently at home, the teacher hopes that students will master the material provided.

2 Research Method

This research is a kind of experiment. An experimental research methods research methods used to find a treatment effect against the other under conditions of control [10]. Experimental research in this case to see whether there is a causal relationship. the type of research that I use is experimental pseudo (Quasi-Experimental Research). Quasi-experimental research Sugiyono added “this study is used to overcome the difficulties in determining the control group in the study”.

The quasi-experimental design was carried out on the control class model and the experimental class. Before being given treatment, both classes were given a pre-test, to know the conditions of the classes before treatment. Then after that, the two classes were given a post-test, to find out the state of the class after being given treatment. The experimental class used modules learning in the form of a Drafting module made by researchers and validated by instructors with a focus on Overflowing Drafting. Treatment was not given to the control class, meaning that it used conventional methods, namely methods commonly used by teachers in the learning process with lectures.

Population use Class X Machining Engineering (ME) of SMKN 1 West Sumatra amounted to 39 people. The experimental class of 22 people as a sample is Class X ME-2. Class X ME-1 became the sample for the control class, totaling 17 people.

The statement that has been put forward is that the quality of research instruments that will produce quality data can be in the form of objective tests [10]. The research instrument used was an objective test to determine the outcomes of cognitive aspects in the sample class. The objective tests are arranged based on the syllabus and lesson plans which total 30 questions to be analyzed. Before the objective test is used in the data collection process, it is necessary to test the instrument. Instrument trials were carried out in other classes with the same characteristics and had received Technical Drawing subjects. Instrument trials were the Difficulty Index of Questions, Power of Different Questions, Function Distractors, Validity tests, and Reliability tests.

1. The Difficulty Index Problem

The number indicates the level of difficulty of the index of a question. Questions that are not too difficult and not too easy can be said to be good questions. The formula used is as follows [12]:

$$P = \frac{B}{J_s}$$

Information:

P = Difficulty Index

B = Students who answered correctly

J_s = Student participants test

Calculation the difficulty index of test items, which amounted to 30 questions, obtained 5 difficult questions, 15 moderate questions and 10 easy questions.

2. Power of Different Questions

The ability to discriminate questions on students' abilities is called the Power of Different Question. The number that shows the magnitude of the difference is called the discrimination index (D). The equation used to calculate the discriminating power of the question is as follows [12]:

$$D = \frac{Ba}{Ja} - \frac{Bb}{Jb}$$

Information:

D = The discrimination index

Ba = The number of the upper group who answered correctly

Bb = The number of the lower group who answered correctly

Ja = Number of participants in the upper group

Jb = Number of lower group participants

To calculate in Power of Different Questions, the first step is done by grouping the highest to lowest value data. From the group that got the high score, 27% were taken and likewise from the group that got the low score, 27% were also taken. Calculation of difficulty index of grains the test questions which amounted to 30 questions obtained 6 very good questions, 11 good questions and 13 easy questions.

3. Function Distractors

The distractor function is the distribution of students in terms of making choices on multiple choice questions. The distractor function is also known as the answer pattern or the distractor function. This distractor function is obtained by counting the number of students who choose answers a, b, c, d, who do not have any choice. In terms of evaluation the distractor is called Omit (O). From the pattern of answer questions, it can be determined whether the distractor is functioning properly or not. Distractors who are not chosen at all by students mean the distractors are not good. On the other hand, a distractor can be said to function well if it has a great appeal for students who do not understand the concept or master the material. Writing about a difficulty, so that the distractors still be said to be good if at least chosen by 5% of students [11]. A distractor can be treated in three ways, namely:

- a. Because it has been well received
- b. Rejected because it is not good
- c. Written back because of poor

Data analysis showed that of the 30 items, the ones that functioned well were 25 items and the ones that didn't function well were 5 items.

4. Validity Tests

Validity is an essential requirement in the evaluation instrument/test. The test is said to be valid if it can measure what it should measure. The statement that "the validity is

a measure that indicates the level validity or validity of something instruments” [11]. Validity can be obtained and acknowledged by the parties outside the research team so that accountability is guaranteed researcher. Calculation of the validity on the test using the formula Biserial Correlation Coefficient (γ_{pbi}) [11]:

$$\gamma_{pbi} = \frac{M_{pi} - M_t}{s_t} \sqrt{\frac{p_i}{q_i}}$$

Information:

γ_{pbi} = Correlation Coefficient biserial

M_{pi} = The mean scores of subjects who responded well to the validity of the items sought

M_t = Mean total scores

S_t = Deviation of standard the total score

p_i = Proportion of students who answered correctly

$$p_i = \frac{\text{many students answered correctly}}{\text{total number of students}}$$

q_i = Proportion of students who answered incorrectly ($Q = I - p$)

The test questions that have been carried out by the number of trial participants, $N = 39$, and the level of 5% signifikan obtained $r_{table} = 0.301$, so the item about as valid if $r_{count} > 0.301$ (r count larger than 0.301). From 30 test items, 24 valid items and 6 invalid items were obtained.

5. Reliability Tests

Reliability is the precision of a test when tested to the same subject [11]. In determining the reliability of the question, the Kuder and Richardson (KR-20) formulas are used [10].

$$r_{11} = \left(\frac{k}{k - 1} \right) \left(1 - \frac{M(k - M)}{kV_t} \right)$$

Information:

r_{11} = Reliability instruments

k = The number of items or the questions

M = Average scores

V_t = Variance Total

Analysis of the details about this research is all about having a reliability test $0.40 < r_{11} \leq 1.00$ with sufficient criteria, high, and very high. Calculation of the reliability coefficient obtained $r_{11} = 0.81$ of 30 items. So it can be stated that this mechanical drawing subject matter is reliable, because it has a correlation coefficient value at intervals of 0.8–1.0 which includes very high criteria.

Data Analysis Technique

The learning outcomes between the experimental class and the control class were compared using data analysis techniques in Technical Drawing class X Machining Engineering of SMKN 1 West Sumatra. Data analysis is an activity after data from all

respondents or other sources has been collected [10]. The collected sample data must pass the requirements as data to be analyzed by homogeneity-test, normality test's, and hypothesis-test.

a. **Normality Test**

The normality test aims to see whether the data sample is normally distributed. The data normality test is included in the statistical subclass, using Kolmogorov–Smirnov statistics [13]. Test Normality calculations using the test of Kolmogorov-Smirnov normality were calculated with SPSS version 24 [14].

b. **Homogeneity Tests**

Test homogeneity determines or sees the two groups of samples having a homogeneous variance. Homogeneity test used is the ANOVA test with SPSS version 24. The assumptions used in these tests if the quantitative type of data, either interval or ratio, normal distribution of data, and the data are few. Homogeneity tests involve quantity estimates that measure some aspect of the frequency distribution, and verify it is consistent with the homogeneity hypothesis. [15].

c. **Test the Hypothesis**

Test the hypothesis in the study need to be tested to prove the truth of the formulated hypothesis previously. In testing this hypothesis the researchers used a test independent sample t test with SPSS version 24. The hypothesis test used to compare the averages of two groups that are not related to each other is the Independent sample t-test [16]. It aims to determine whether the two groups have the same average or not.

3 Results and Discussion

A. Data Description

The research was conducted at SMKN 1 West Sumatra. The results of the research conducted in both classes (experimental and control) were used to test the research hypothesis. The results showed that the ability of students' learning outcomes increased by using modules in the Technical Drawing subject.

1. Experiment Classroom Learning Outcomes Data

The learning outcomes carried out in class X ME 2 (experimental class) using the module in Engineering Drawings are shown in Fig. 1.

Learning in the experimental class was initially carried out with a pre-test with 30 questions items, the value of learning outcomes average was 50.77. The pre-test was conducted to determine the initial abilities of each student. And after being given treatment, it was followed by giving a Post-test with an average number of learning

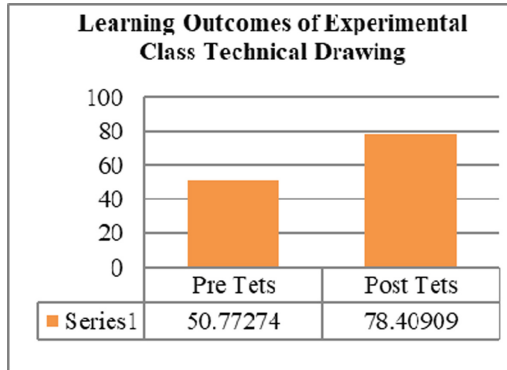


Fig. 1. Graph of Experiment Class Learning Outcomes Grades

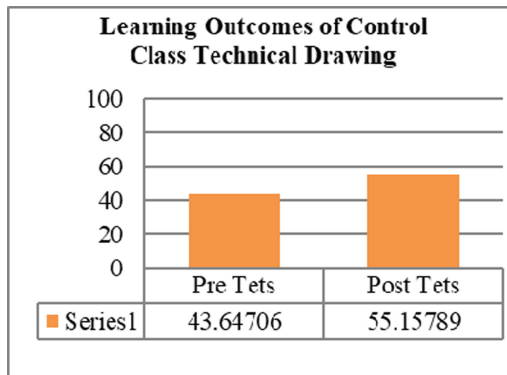


Fig. 2. Graph of Control Class Learning Outcomes Grades

outcomes of 78.41. This condition indicates a significant increase in student learning outcomes.

2. Control Classroom Learning Outcomes Data

The learning outcomes carried out in class X ME 1 (control class) using the lecture method and question and answer (conventional method) are shown in Fig. 2. The implementation of learning in this class was initially carried out with a pre-test with a total of 30 questions. The value of learning outcomes obtained the Pre-test an average of 43.64. Next students received repeated treatment and were given a post-test where the value of learning outcomes an average obtained was 55.16.

B. The difference data Learning Outcomes Class Experiments (X ME 2) by Class Control (X ME 1)

Table 1. Normality Test Result

Group	Sig	Conclusion
Pre-test experimental class	0.085	Normal
Post-test experimental class	0.134	Normal
Pre-test control class	0.074	Normal
Post-test control class	0.091	Normal

Table 2. Homogeneity Test Result

Class	F _{count}	Sig	Information
Pre test	0.373	0.858	Homogeneous
Post test	2.085	0.137	Homogeneous

1. Prerequisites Testing Analysis

Before conducting data analysis, a prerequisite analysis test must be carried out. The prerequisite test for data analysis is the normality test and homogeneity test. In the following, the results of the analysis prerequisite test are presented.

a. Normality test

In seeing that all variable data are normally distributed, it is necessary to test for normality. With the Kolmogorov-Smirnov formula in calculations using SPSS V-24 the normality test can be carried out. If sig > 0.05 then it is normal. Table 1 are shown the calculation obtained.

Based on Table 1, it can be said that the results of the pretest and posttest of the experimental class and the control class have sig > 0.05. So that the data can be declared normally distributed.

b. Homogeneity Test

The homogeneity test used the ANOVA test formula in calculations using the SPSS version 24. To determine the level of similarity of variance between the experimental class and the control class, a homogeneity test was carried out. If the value is sig > 0.05 then it can be accepted. Table 2 are shown the results of the homogeneity test.

Homogeneity test results obtained F_{count} value in the Pre-test was 0.373 with a significant of 0.858. While the value post-test F_{count} 2.085 with a significant of 0.137. From the calculation results, it is obtained that the significant value of Pre-test and Post-test data is sig > 0.05. This shows that the results in Table 3 have a homogeneous variance.

Table 3. Summary of Test Results t Pre Test Experiment Class and Control Class

Class	Average	t_{count}	t_{table}	P
Class Experiment	3.040	15.439	5.079	0,000
Classroom Control	3.010			

Table 4. Test Results Summary t Post Test Experiment Class and Control Class

Class	Average	t_{count}	t_{table}	P
Class Experiment	14.122	23.251	1,646	0,000
Classroom Control	13.877			

c. Hypothesis Test

The effect of use of modules on learning outcomes in Technical Engineering class X Machining Engineering Department of SMKN 1 West Sumatra. The analysis used the t test with SPSS version 24.

1) Hypothesis Testing Pre Test

In the experimental class and control class, pretest and posttest t-tests were carried out. This is done to find out whether there are significant differences in the pretest scores of the experimental class and the control class. If $t_{\text{count}} > t_{\text{table}}$ at a significant level of 5% and $p < 0.05$, it is said to be significant. Table 3 shows the pre-test summary t test experimental class and control class the following.

Summary of the t test in Table 3 shows pre-test average results of experimental class learning of 3.040 and an average of learning outcomes control class is 3.010. So it can be concluded that the average yield of 0.03 experimental class learning is greater than the control class. From the table it is known t_{count} amounted to 15.439 with 0.000 significant in the can t_{table} of df 39 at the 5% significance level was 5.079. So $t_{\text{count}} > t_{\text{table}}$ ($15.439 > 5.079$) and the value is very significant because $p = 0.000 < 0.05$. It can be concluded that there is no significant difference in the scores of students in the experimental class and the control class.

2) Hypothesis Testing Post Test

Analysis t-test to post-test in the experimental class and control class aims to determine whether there is a significant difference in the value of the post-test in both classes. The conclusion was significant when $t > t_{\text{table}}$ at significant level 5% and the value of $p < 0.05$. The summary of the t-test post-test experimental class and control class is shown in the following Table 4.

Summary of the t test in Table 4 is known post-test average results of experimental class learning at 14.122 and an average of learning outcomes control class is 13.877, so concluded that the average results of experimental class learning is 0.245 higher than that of control class. Based on the above table are known t_{count} amounted to 23.251 with 0,000 significant in the can t_{table} of df 39 at the 5% significance level is 1.646. So the value of $t_{\text{count}} > t_{\text{table}}$ ($23.251 > 1.646$) and the value is very significant because $p = 0.000 < 0.05$. The conclusion is that there are very significant differences in student learning outcomes in the experimental class and the control class.

This study set out on the test results before pre-test either the experimental class and control class. Further studies were conducted using a quasi-experimental studies that provide different treatment between both class. Grades given to the experimental class treatment such as the use of learning media control module while classes are not. Furthermore, the research was carried out using a quasi-experimental study, namely giving different treatments between both class. Grades given to the experimental class treatment such as the use of learning with module while classes.

In the learning process, it is known that by using learning module media, student learning outcomes become better because they are able to activate and increase student motivation in the teaching. Learning outcomes are something that is expected at the end of learning by students/students [17]. Learning outcomes of students who use the module to be better because the students do not get bored. In contrast to the activeness of students in the control class, the level of attention was not settled so there was no focus on learning. This is due to less conventional learning encourages students to the spirit of learning. Students become easily bored and tired of the conventional learning activities, only certain students who pay attention and follow the lesson well. The difference of the two classes of learning outcomes in this case due to differences in the level of instructional media and student attention on the material projections are given. The more effective use of instructional media will be higher student learning outcomes. One of the benefits of teaching aids in the learning process students are learning materials will be more clearly understood by students [18], so that students can master the educational objectives and can achieve learning outcomes higher.

The percentage of students who pass the pre-test results of the experimental class and control class is 0%. While the percentage of students who passed the post-test results of the experimental class experienced a significant increase with 87% of students who passed. In the control class, the percentage of students who passed the post-test results was the same as the pre-test results, meaning that there was no increase. The influence of the actual module is only partially percent way to increase learning outcomes in mechanical drawing. Almost half of the students (49%) agree that with the understanding of learning to use the module consistently, effective learning outcomes can be obtained [19].

4 Conclusion

The conclusions obtained from this study include the learning outcomes of students use the module in the experimental class (X ME-2) in the mechanical drawing subject which has Pre-test score an average of 50.77 and Post-test score an average of 78.40. The

percentage of students who passed the post-test from the experimental class experienced a significant increase of 87%. The ability of student learning outcomes using learning modules on Technical drawing with this learning method, they get a significant increase in learning outcomes. From this study, it can be concluded the use of the module affects the learning outcomes of class X Students in Technical Drawing at Machining Engineering of SMKN 1 West Sumatra.

References

1. D. Pernanda, M. A. Zaus, R. Wulansari, and S. Islami, "Effectiveness of instructional media based on interactive cd learning on basic network at vocational high school: improving student cognitive ability," in *International Conferences on Educational, Social Sciences and Technology*, 2018, pp. 443–447.
2. J. Cox and R. Sagor, *At risk students: Reaching and teaching them*. Routledge, 2013.
3. E. Indrawan and N. Jalinus, "Review project based learning," *International Journal of Science and Research (IJSR)*, vol. 8, no. 4, pp. 1014–1018, 2019.
4. A. Ambiyar, R. Refdinal, W. Waskito, F. Rizal, and H. Nurdin, "Application of Assessment for Learning to Improve Student Learning Outcomes in Engineering Drawing Using CaD," 2018.
5. M. Jou, R. D. Tennyson, J. Wang, and S.-Y. Huang, "A study on the usability of E-books and APP in engineering courses: A case study on mechanical drawing," *Computers & Education*, vol. 92, pp. 181–193, 2016.
6. S. Syahril, R. A. Nabawi, and F. Prasetya, "The Instructional Media Development of Mechanical Drawing Course Based on Project-Based Learning," *International Journal of Innovation, Creativity and Change.*, vol. 11, no. 4, pp. 309–325, 2020.
7. E. H. Fini, F. Awadallah, M. M. Parast, and T. Abu-Lebdeh, "The impact of project-based learning on improving student learning outcomes of sustainability concepts in transportation engineering courses," *European Journal of Engineering Education*, vol. 43, no. 3, pp. 473–488, 2018.
8. W. Waskito, A. Azmi, and H. Nurdin, "Implementation of Authentic Assessment on Mechanical Technology Subjects," *International Journal of Innovation, Creativity and Change*, vol. 11, no. 4, pp. 299–308, 2020.
9. A. K. AA and D. Brahadeeswaran, "DEVELOPMENT OF KNOWLEDGE BASED TUTORING SYSTEM ON BASIC CONCEPTS OF ENGINEERING DRAWING".
10. D. Sugiyono, "Metode penelitian pendidikan pendekatan kuantitatif, kualitatif dan R&D," 2013.
11. A. Suharsimi, "Dasar-dasar evaluasi pendidikan," *Jakarta: Bumi Aksara*, 2009.
12. A. Suharsimi, "Prosedur Penelitian suatu Pendekatan dan Praktik," *Dokumentasi. Jakarta: Graha Pustaka*, 2012.
13. Z. Hanusz and J. Tarasińska, "Normalization of the Kolmogorov–Smirnov and Shapiro–Wilk tests of normality," *Biometrical Letters*, vol. 52, no. 2, pp. 85–93, 2015.
14. R. D. Yockey, *SPSS® Demystified: A Simple Guide and Reference*. Routledge, 2017.
15. A. Viglione, F. Laio, and P. Claps, "A comparison of homogeneity tests for regional frequency analysis," *Water Resources Research*, vol. 43, no. 3, 2007.
16. C. A. Willard, "Two-Sample t Test: Independent Samples Design," in *Statistical Methods*, Routledge, 2020, pp. 147–159.
17. S. Adam, "An introduction to learning outcomes." Citeseer, 2006.

18. A. Arsyad, "Media pembelajaran, edisi 1," *Jakarta: PT. Raja Grafindo Persada*, vol. 36, 2002.
19. S. Brooks, K. Dobbins, J. J. Scott, M. Rawlinson, and R. I. Norman, "Learning about learning outcomes: the student perspective," *Teaching in Higher Education*, vol. 19, no. 6, pp. 721–733, 2014.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

