The Effect of Use of E-Learning on Competency Learning Outcomes Doing Work with Lathe Machine in Mechanical Engineering Education Student UNNES

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Abstract: This study aims to determine the effect of the use of E-learning on the competence of doing work using a lathe on students of Mechanical Engineering Education UNNES. The type of E-learning used is Google Classroom which is a product of Google for Education. In addition to knowing the effect on student learning outcomes, this study also aims to determine student responses to learning using Google Classroom. The research method used in this study is the experimental method. The design used in this study is the Randomized Control Group Pre-test-Post-test Design. The implementation of this research is in the Department of Mechanical Engineering UNNES with a population of Mechanical Engineering Education study program students who are currently taking the Machining Process course. The samples taken are group 1 and group 2 with the number of 20 participants each as an experimental class and class control. Retrieval of student learning outcomes data from each class is done by combining test results and project results. Data analysis in this study used the Independent t-test. The next step is to compare the average of the two groups' tests. The results of the study indicate that the use of google classroom can increase student knowledge on the material doing work with a lathe.

1   INTRODUCTION

The development of the education system so that it can realize the atmosphere of learning and the learning process so that students actively develop their potential has been set by the government in Law No. 20 of 2003. Efforts to implement the concept of education have also been implemented namely from curriculum development since 2001, KTSP 2006 and 2013 curriculum. However, this development still occurs in problems related to learning methods that are still teacher-centred.

Responding to that, along with the development of information technology (IT), various technological innovations have been developed as examples in the business world known as e-business or e-commerce, while in the world of government is known as e-government. The presence of information technology (IT) in the world of education is also very important, the need for a concept and mechanism of teaching and learning based on information technology (IT) becomes the main thing in improving learning. This technology is known as e-learning.

E-Learning is a learning method that utilizes web-based information technology (IT) that can be accessed remotely so that learning is not only fixed in the classroom and in certain hours but can still be done anytime and anywhere. As revealed by Dahiya (2012) who mentioned that E-learning is information and communication technology to enable students to learn whenever and wherever. The beginning of the emergence of e-learning has begun in the 1970s (Waller and Wilson, 2001). Since then various terms have been used to express opinions/ideas about electronic learning, including online learning, internet-enabled learning, virtual learning, or web-based learning. The innovation of e-learning learning is a new learning model in education which provides a role and great function for the world of education.

Some of the benefits of e-learning include Rohmah (2016) (1) with e-learning, it can shorten learning time and make study costs more economical

(2) E-learning facilitates interaction between students and material, (3) Students can share information and can access learning materials at any time and repeatedly, with such conditions students are more able to strengthen their mastery of learning material (4) With e-learning the process of developing knowledge is not only happening in the classroom, but with the help of computer equipment and networks, students can be actively involved in the teaching-learning process. By seeing these various benefits, it is expected that e-learning can address the disadvantages and weaknesses of conventional education (education in general) including the limitations of space and time in the conventional education process. Information technology (IT) which has a standard internet platform can be a solution to these problems because of the nature of the internet which allows everything to be connected, inexpensive, simple and open so that the internet can be used by anyone (everyone), anywhere (everywhere), anytime (every time) and free to use (available to everyone). (Keban & Taufik, 2015).

Existing learning is still prioritizing face-to-face meetings so that it can hinder the development of students' knowledge and skills. This is partly due to the limited time available for lecturers and students to carry out meetings in the classroom. These time limitations can also hamper the delivery of material from lecturers to students. To overcome these problems, an E-Learning (Sukamto, 2012) was made.

This condition also occurs in the Mechannical Engineering Department of UNNES, especially in the Machining Process I course, where the course is a practical course and is carried out in full in the machining workshop. Because before attending the Machining Process I course students have not yet received a Machining theory course, so in the implementation of the practice students are still experiencing difficulties, especially students who come from high school, or Vocational Schools in addition to Vocational Engineering Machinery. Based on this, we need a learning method that can facilitate students to be able to obtain machinery theory material but does not interfere with the implementation of practical lectures. One solution offered by researchers is to use Google Classroom.

The rapid development of education that exists throughout the world, making Google which is one of the largest companies and the most popular search sites in the World to make tools or tools in learning that are interesting to try. Google For Education is the most interesting innovation from Google because it is a product created to assist teachers and students in carrying out teaching and learning activities. As written on the official website, Google For Education has several services that are very helpful in teaching and learning in schools, such as Google Classroom, Google Mail, Google Calendar, Google Drive, and Google Docs. Google Classroom is a service that is feasible to be implemented in Indonesia because Google Classroom has the same structure as the current learning. In Google Classroom there are respective roles of both teachers and students.

Google Classroom is a product part of Google For Education which according to the author is very special, because one content product has many facilities in it such as giving announcements or assignments, collecting assignments and seeing anyone who has submitted assignments. As written on the official website, Google Classroom was first issued on August 12, 2014, but Google Classroom was only used in mid-2015. The Google Classroom site also says that Google Classroom is connected to all other Google For Education services, so educators can use Google Mail, Google Drive, Google Calendar, Google Docs, Google Sheets, Google Slides, and Google Sites in the learning process. So, when educators use Google Classroom educators can also use Google Calendar to remind students about schedules or existing tasks, while using Google Drive as a place to store learning needs such as PowerPoint, files that need to be used in learning and others. Thus, Google Classroom can help facilitate teachers and students in carrying out teaching and learning activities in more depth. This is because both students and teachers can collect assignments, distribute assignments, and discuss lessons anywhere without being bound by time limits or class hours. This makes the learning process more interesting and more efficient in terms of time management, and there is no reason for students to forget about the assignment given by the teacher.

As written on Google's official website about Google Classroom, the service is also connected to other Google For Education services. So that makes Google Classroom highly recommended for use as a medium in the implementation of learning because it can be used by students to study outside of class time. The use of smartphones is now a lot among students, so the application of Google Classroom Tools is very likely to produce effective and innovative learning.

Seeing the various conveniences that can be obtained from using Google Classroom, the author is

interested in applying it in lectures of machining practices were one of the competencies that must be mastered by students is doing work with a lathe. Because the lecture is a practical course, it should be supported by theoretical material that must be obtained by students before carrying out the practice. But in reality, the theoretical material has not been obtained by students, so there are students who have not mastered the basic theories of machining practices, including the competence of doing work with a lathe.

Seeing the background of the research above, the objective to be achieved from this research is to create an appropriate learning design to be applied to the competence of doing work with a lathe by utilizing Google Classroom products, as well as to know the effect of using Google Classroom on the learning outcomes of competence doing work with a lathe . The contribution of this research is to be able to create an effective learning method for competence in doing work with a lathe. In addition, it can provide references to lecturers and students as prospective teachers about diverse learning methods.

2   RESEARCH METHODS

The research method used in this study is an experimental method, which according to Arikunto (2006: 3) experimental research is a way to find a causal relationship between two factors that are intentionally caused by researchers by eliminating or reducing or eliminating other factors that interfere. Experiments are always carried out with a view to seeing the effects of treatment.

The design used in this study is the " Randomized Control Group Pre-test-Post-test Design " depicted in Table 1.

Table 1. Research Design

Group (*group*)	Initial Test(*pre-test*)	Treatment(*treatment*)	Final Test (*post-test*)
E	X1	T	X2
K	Y1		Y2

Information:

E = symbol for the experimental group

K = symbol for the control group

X1 = initial test symbol for the experimental group

X2 = final test symbol for the experimental group

T = treatment in the form of learning using e-learning in the experimental group

Y1 = initial test symbol for the control group

Y2 = final test symbol for the control group

Each group was given a different treatment, one group used Google Classroom Tools as a media and aids in learning, and one only used conventional learning. After getting a different treatment each group was given another test to see the results of the implementation of Google Classroom Tools, the test conducted after receiving the usual treatment is called the post-test.

The location of this research is in the Department of Mechanical Engineering, Semarang State University Faculty of Engineering. The population of this research is the students of the Mechanical Engineering Education study program which is currently taking 4 Machining I course, totalling 4 classes. From the 4 groups then 2 groups will be selected which will act as the experimental group and the control group. The next steps are as follows:

a. Test the validity of the instrument, Test validity is a measure that shows the level of validity of an instrument. Test the validity of the instrument applied to each item items. In this study using comparative validity in which the test given as a measurement is given within the same period of time has correctly been able to show a direct relationship between the first test with the next test (Sudijono, 2006: 177).

b. Test normality, a test of normality is intended to determine whether the data were normally distributed or not. To determine the distribution of data obtained normality test is done by using the Chi-square formula.

$$X^2 = \sum_{i=1}^{k} \frac{(O_i - E_i)^2}{E_i}$$

description:

X²: Chi-squared

O i: Frequency of observation

E i: The number of times that expected

k: number of interval groups

(Sudjana, 2005: 273)

Further price x 2 Data were obtained compared with x 2 table with (df) = k - 1 and the level of significant 0.05. The data distribution tested will be normally distributed if x 2 data < x 2 tables.

Table 2. T-Test Results *Pre-Test* Value

Variant source	Average	dk	t count	t table
Experiment Group	60	38	1,762	2,024
Control group	59			

c. Test of homogeneity, the test is used to determine whether a group of experiments and group control has a degree of variance are equal or not, so it can be used to determine the formula test the hypothesis that will be used. For α = 5% with dk numerator = n-1, dk denominator = n-1, Ho is accepted if $F_{count} < F_{table}$ which means that both groups have the same variance (Sudjana, 2005: 249-250)

d. T-test, the final stage of this study was to analyze the data of the two groups after being treated. A comparison of the average post-test of the two groups was carried out t-test to determine the difference in quality between the two groups so that the more effective group would be answered. To test the truth of the hypothesis, the right-side t-test is used.

The hypothesis being tested is: there is an increase in the learning outcomes of competencies doing work with a lathe after obtaining learning using e-learning based on Google Classroom. The test criteria used are accepted hypotheses if $t_{count} > t_{table}$ with degrees of freedom (dk) = (n1 + n2-2) and α = 5%

3 RESEARCH RESULTS AND DISCUSSION

3.1 Early Stage Analysis

Before the treatment was given to the experimental group, both groups were given a pre-test. The pre-test in this study was used to determine the initial ability of the groups that were given e-learning learning using Google Classroom (the experimental group) and the group that was given the lecture learning (the control group).

After the pre-test data are obtained then a t-test is performed to determine differences in the initial ability of the two groups. T-test results for grades pre-test between the experimental group and the control group could be seen in Table 2.

From Table 2, it was found that the t-test results on learning outcomes for the Pre-Test $t_{count\ (0.975:\ 38)}$ = 1,762 < $t_{table\ (0.975:\ 38)}$ = 2.024, so it can be concluded that H0 is received or the experimental group and the control group are at the same initial ability.

3.2 Final Stage Analysis

3.2.1 Descriptive Analysis

Descriptive analysis in this study aims to determine differences in learning outcomes when using lecture learning compared to lecture learning that is complemented by the use of Google Classroom. The steps taken for this purpose are to compare the average learning outcomes of the two methods.

The average pre-test and post-test learning outcomes of the experimental and control groups can be seen in Table 3.

Based on Table 3, it appears that an average increase in student learning outcomes in the competency of making picture pieces after obtaining learning using Google Classroom. The average value

Table 3. Results of the Average *Pre-Test*, *Post-Test* and Improved Results in the Experiment and Control Groups

Group	Average value *Pre-Test*	Average *Post-Test* scores	Enhancement	Percentage Enhancement
Experiment	60	81	21	35,00%
Control	59	70	11	18,64%

obtained in the pre-test is 60 becomes the average value of the post-test is 81, thus an increase of 19.63 point or 35%.

In Table3 also seen that learning lecture also has improved the learning outcomes of student's incompetence makes the image pieces, from the average value of the pre-test is 59 into the average value of the post-test 70, thus an increase of 11 point or 18,64 %.

From the increase in the average learning results, it can be concluded that the improvement of learning outcomes of students in the competence of doing work using a lathe with the help of Google Classroom, 16,36 % higher than on learning lecture.

3.2.2 Normality Test

Test normality is intended to determine whether the data normally distributed or not. Data must be normally distributed as a condition for doing hypothesis testing. Therefore, before hypothesis testing is carried out on the post-test score, it is necessary to know the normal distribution of data from the two groups. The test used is the Chi-Square formula, the test criteria are that the sample comes from a normally distributed population if the calculated x 2 value is smaller than the x 2 tables.

Normality Test with Chi-squared in the control group obtained x^2_{counts} is 1,6744. At a significant level of 5% and dk = 5 obtained x^2_{tables} is 11.07. Based on the results of these calculations can be concluded that the sample normal distribution for x^2_{counts} is smaller than x^2_{tables}.

The normality test in the experimental group obtained x^2_{counts} is 3,2924. At a significant level of 5 % and dk = 5 obtained x^2_{tables} is 11.07. So, the sample also comes from populations that are normally distributed because x^2_{counts} are smaller than x^2_{tables}.

Table 4. Test Results Normality *Post-test* scores

Source of Variation	Control	Experiment
x^2_{count}	1,6744	3,2924
dk	5	5
x^2_{table}	11.07	11.07
Criteria	Normal	Normal

3.2.3 Homogeneity Test

This test is used to determine whether the experimental group and the control group have the same level of variance or not so that it can be used to determine the hypothesis test formula that will be used. The test criteria are for α = 5% with $dk_{numerator}$ = n-1, $dk_{denominator}$ = n-1, Ho is accepted if $F_{arithmetic} < F_{table}$ which means that both groups have the same large variance.

Based on the analysis, the F_{count} is 2,36 < F_{table} is 2,53 with dk = n-1 = 19. The conclusion of this homogeneity test is that the population of this study has the same variance or both groups are included in the homogeneous criteria.

Homogeneity test results of the *post-test* data between the control group and the experimental group can be seen in the following table.

Table 5. Summary of Variance Homogeneity Test Results

Group	Variance	Dk	F_{count}	F_{table}
Experiment	146,32	19		
			2,36	2,53
Control	62,11	19		

3.2.4 T-test

The t-test is the most recent test, where the final average of the control group and the experimental group is tested to find out if there are differences in the average between the two groups. The test used is the right-hand t-test with criteria, the proposed hypothesis is accepted if $t_{count} > t_{table}$ with degrees of freedom (dk) = ($n_1 + n_2$ -2). The results of the t-test analysis can be seen in Table 6.

Table 6. T-Test Results *Post-Test* Values of Experiment and Control Groups

Variant source	Average	dk	t_{count}	t_{table}
Experiment Group	71			
		38	22,17	2,024
Control group	81			

From Table 6, the average score of the *post-test* experimental group was 77.78 and the average score of the *post-test* control group was 71. After t-test of the two averages, it was found that t $_{count}$ = 22,187 and t $_{table}$ = 2,024 with α = 5% and dk = 38.

So, because the t$_{count}$ is in the area of acceptance of Ha, there is an increase in the average post-test compared to the pre-test value between the experimental group and the control group. In this case, the increase in the average of the experimental group was higher than the control group.

So, because the t$_{count}$ is in the area of acceptance of Ha, there is an increase in the average post-test compared to the pre-test value between the experimental group and the control group. In this case, the increase in the average of the experimental group was higher than the control group.

3.3 Discussion

Implementation of learning must be done in such a way that attitudes, ways of thinking, and results obtained by students in accordance with specified objectives. One way to do this is to use e-learning assistance through Google Classroom. The results of descriptive analysis of pre-test and post-test of the experimental group showed an increase in student learning outcomes in the competence of doing work with a lathe from the beginning the average learning outcome was only 60 to 81, or an increase of 35%. The results of the descriptive analysis also showed that compared to the increase that occurred in the control group, the increase in the learning outcomes of competence doing work on the lathe in the experimental group was higher, because in the post-test results the control group only increased by 18.64% only, namely from pre-test average 59 becomes an average post-test value of 70. This shows that learning outcomes using e-learning in the experimental group are better when compared to learning outcomes using ordinary lectures in the control group, then the use of e-learning is more able to improve student learning outcomes on the competence of doing work with a lathe.

The use of e-learning can provide more understanding and motivation for student learning because the material can be accessed anytime and from anywhere. This is in accordance with the opinion of Dahiya (2012) who said that E-learning is information and communication technology to enable students to learn whenever and wherever. The existence of e-learning will certainly strengthen the understanding of students because, during the implementation of practical lectures, they do not get special time to study theory. In the course of this lecture so far students only get a little time to study the theory because it directly implements practice according to the given jobsheet. With the help of e-learning, it will help students understand the material that they did not previously understand. It also can support practice implementation. In accordance with the opinion of Nadziroh (2017) which states that E-learning is effective in improving the quality of learning because the learning process is not only fixed at one time and in the room. Because with good mastery of theory, students can carry out practices in accordance with the given SOP and the worksheet can be completed well, correctly, and on time.

4 CONCLUSIONS
4.1 Conclusions

Based on the results of the study, the conclusions that can be obtained are as follows. The use of google classroom can increase student knowledge on material doing work with a lathe. This can be seen from an increase in student learning outcomes in the competence of doing work with a lathe by 35%. Besides that, the e-learning also makes it easier for students to access material from various places and at any time. Due to the course being followed is practice, so students can access material from home before carrying out practice, and when practice focus on work to complete the given worksheet.

In addition, the use of Google Classroom can facilitate communication between students and lecturers. With the features provided, lecturers can give quizzes and tests to assess the extent of student understanding of the material provided. Furthermore, students can provide feedback on the assignments given by the lecturer quickly.

4.2 Suggestion

Suggestions to be conveyed by researchers are so that the use of e-learning google classroom can be extended to other materials so that it will facilitate lecturers and students in conducting lectures because it can be accessed from anywhere as long as there is

an internet connection. However, to improve students' skills in machining practices, it must be done in an adequate machining workshop.

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