Comparison of student learning outcomes that given online learning and conventional learning in electrical measurement course

Y S Nugroho*
Electrical Engineering, Faculty of Engineering, Universitas Negeri Surabaya, Surabaya, Indonesia

*yulinugroho@unesa.ac.id

Abstract. The purpose of this study is to compare student learning outcomes, given online learning and conventional learning. This study uses a quasi-experimental method; the researcher divides students into two classes, namely the experimental class and the control class. Experimental classes are given online learning, and control classes are given conventional learning or face to face with lecturers. Before starting the learning, all classes are given a pre-test and given a post-test after the learning period ends. It is to determine the initial and final state of students so that the effects of learning can be seen. The pre-test and post-test results show that both classes have increased learning outcomes, but the increase in learning outcomes in the experimental class is higher than the control class. Furthermore, conducting unpaired t-test using SPSS to find out whether there are significant differences between the two classes. From the calculation results, it can be concluded that there is a significant difference between the learning outcomes of Electrical Measurement students who are taught online and students who are taught conventionally so that online learning in the Electrical Measurement course is declared effective.

1. Introduction

One of the primary needs of humans today is education because education is part of the process of forming behavior that allows them to grow and develop in line with the inherent potential of each individual. Someone who is highly educated has the potential to have the knowledge, which is undoubtedly better than that of those with lower education.

Various models are used to support the learning process, one of which is online learning. At present, not all courses have books that are following the material being studied. Not all campus libraries provide books according to the required lecture material adequately. This lack of learning motivation causes students to be lazy to learn in conventional media. Due to the lack of conventional learning resources, students tend to use the internet, whose truthful information cannot be guaranteed.

In some tertiary institutions, books that are suitable for lectures are rarely provided by lecturers, because the number of students taking specific courses tends to be limited so that it takes a mature economic calculation to write and produce books for certain subjects with a small amount [1].

Advanced online technologies are gradually decreasing the barriers of traditional distance education comprised of interactive or communication problems [2]. Along with the development of technology,
online learning resources become mandatory for students. Besides, not all lecturers provide handbooks for the courses taught. The price of printed books is also quite high for the 4.0 era as it is today.

Education is a discipline in the context of solving learning problems based on a series of approaches, therefore, the need for the use of various learning resources and learning systems that are in accordance with the conditions of students. Consequently, it is necessary to have an appropriate solution to the problems faced, in particular, providing a suitable learning model for students by the times.

When teachers are unable to attend the learning process, independent online learning can be a choice that can be made by students so as not to stop learning. Apart from online learning, e-learning and distance learning environment are often used. There also seemed to be a difference in how each term was used from continent to continent. There was a difference in usage from country to country [3].

Decision students of their capabilities to complete an online course is critical for their satisfaction with an online course [4]. Online learning needs to be done because it can help students achieve the level of mastery learning independently. Educators can direct and see the achievement of learning goals by utilizing technological advances. Students can choose the material to be studied, or continue the next learning material even though it has not yet reached the level of completion in the previous learning material. Likewise, students can choose to complete a study material then proceed to the next learning material. Instructors ask to see the extent to which students can complete their learning activities.

Learning must place students as subjects who can plan their learning, explore, and interpret the learning material needed and evaluate the implementation and learning outcomes. In this case, the lecturer functions more as a facilitator.

Thus it is necessary to conduct research comparing student learning outcomes using online learning with conventional learning. The conclusion in the previous study said that the effect of online learning could vary across individual courses, largely affected by how the Online Learning Environment (OLE) is integrated into the course as a whole [5].

Distance learning via web instruction is a viable opportunity to increase the availability of statistics instruction, and students taking statistics on the web learned as much as students in a traditional face-to-face course [6]. Learning outcomes depend on self-efficacy, collaborative learning, team cohesion, technology fit, learning engagement, self-regulation, interest etc [7]. Mobile learning as learning media with android for the basis of using App Inventor 2 is very good for the conclusion and can be used in alternative energy course learning process [8].

2. Research method
This study uses a quasi-experimental method with the type of One-Group Pretest-Posttest Design. The students are divided into two different learning models, each class is given a pre-test and post-test, pre-test before being given treatment, and also given a post-test after being given treatment. It is intended to determine the initial and final state of students, so that differences in learning outcomes from online learning and conventional learning can be known clearly.

The population and sample in this study were all students of the Electrical Engineering Study Program, Universitas Negeri Surabaya class of 2019. This research was conducted in an odd semester of the 2019/2020 school year.

The design of this research is to divide students into two classes. The first class is the experimental class. This class is a class that gets treatment in the form of online learning. The second class is the control class; this class is not given online learning or is called conventional learning.

In this study, there are two variables, namely the independent variable and the dependent variable. The independent variable in this study is online learning, while the dependent variable is the learning outcomes of Electric Measurement course.

The instruments used in this study include the Learning Implementation Plan, pre-test, and post-test in the form of a multiple-choice question to determine student learning outcomes cognitively. This study uses an independent sample correlation test. Understanding the unrelated or unpaired sample is a sample whose existence does not affect each other. An unpaired t-test is used to test the significance of the difference in the average pre-test and post-test scores of the experimental and control classes. It
determines whether online learning used has proven to be effective. In this test, researchers conducted t-test statistical tests using the SPSS program.

A test or instrument is declared valid if the test/instrument measures correctly the object to be measured. The researcher initially made 60 items that were intended to be used as pre-test & post-test instruments, while the questions passed through construct validation in terms of content by material experts. After completing the instrument and has been validated by an expert, a trial is carried out. Trials were conducted on students as respondents, totaling 30 people at random. The results of the trial are then tested for validity using the SPSS program.

The validity test criteria are if the value of r count> from r table at α = 0.05, then the problem is declared valid. Previously the researcher had made 60 items tested to 30 respondents so that it was known r table = 0.361. The results of the validity test of 60 items that have been tested using the SPSS program found 10 invalid items were eliminated, so that in the pre-test and post-test tests only used 50 items.

In addition to testing the validity, the researchers also tested the level of difficulty and distinguishing power. After testing the validity, several items were invalid so that the questions were not used. To find out the reliability of the problem that has been declared valid, then the reliability test needs to be done. In this study, researchers conducted a reliability test using the SPSS program. The calculations show the amount of 0.948, which means it falls into the category (0.800 - 1.000). Then the instrument was concluded to have very high reliability.

3. Results

To measure the effectiveness of online learning conducted by researchers using experimental methods, researchers provide pre-test and post-test to 2 classes, namely the experimental class or class A (online learning class) and the control class or class B (conventional learning). Pre-tests are both given before the course learning begins. After that, the experimental class is given online learning for 7 times or half a semester, while the lecturer is teaching face-to-face in the control class. After that, the two classes were given a post-test.

3.1. Experimental class

Class A is an experimental class. This class is given a pre-test and then is given online learning and ends with a post-test. The following results are the average of pre-test, formative test, and post-test.

| Test               | Average of score |
|--------------------|------------------|
| Pre Test           | 63.54            |
| Formative Test 1   | 88.08            |
| Formative Test 2   | 89.62            |
| Formative Test 3   | 88.08            |
| Formative Test 4   | 89.62            |
| Formative Test 5   | 89.62            |
| Formative Test 6   | 86.73            |
| Formative Test 7   | 89.42            |
| Post Test          | 76.62            |

From the above results, it can be seen that the increase in the average value of the pre-test, which was 63.54 to 76.62 when the post-test, after being given online learning consisting of 7 materials, and at each end of the material given formative tests. The normality test results of the experimental class can be seen in the table below.
Table 2. Test normality of experimental classes.

|          | Kolmogorov-Smirnov | Shapiro-Wilk |
|----------|--------------------|--------------|
|          | Statistic | df | Sig. | Statistic | df | Sig. |
| Experimental | .136 | 26 | .200 | .948 | 26 | .204 |

3.2. Control class

Researchers also provide pre-test and post-test to other classes, namely class B or the so-called control class; this class is not given online learning as a learning model. The results of the pre-test and post-test average scores in the control class can be seen below.

Table 3. Average pretest, and posttest in control class (Class B).

| Test         | Average of score |
|--------------|------------------|
| Pre-test     | 61.82            |
| Post-test    | 67.55            |

From table 3, can be seen that the control class increased in value from 61.82, pre-test to 67.55 while the post-test. This class is not taught online but taught conventionally by the lecturer. Control class normality test results can be seen in the table below.

Table 4. Normality control class test.

|          | Kolmogorov-Smirnov | Shapiro-Wilk |
|----------|--------------------|--------------|
|          | Statistic | df | Sig. | Statistic | df | Sig. |
| Control  | .088 | 22 | .200 | .956 | 22 | .406 |

3.3. Significance test

To find out the comparison of learning outcomes of Electrical Measurement measured based on the results of the post-test of each class, namely the experimental class and the control class, as shown in the table below.

Table 5. Average posttest values.

| Class     | Learning outcomes |
|-----------|-------------------|
| Experimental | 76.62             |
| Control    | 67.55             |

From the above results, it can be seen that the experimental class pre-test results are higher than the control class. The unpaired t-test is used to find out if there are significant differences between the two classes. The results of this t-test will determine whether online learning is proven effective for students or not.

The experimental class consisted of 26 students, and the control class consisted of 22 students. To create a homogeneous balance in the number of students in the two classes, then in the experimental class, which had amounted to 26 students, only 22 students will be taken randomly. Electrical Measurement learning outcomes data obtained by experimental class learning outcomes are, on average higher than the control class.

The research hypothesis proposed is: "There is a significant difference between the learning outcomes of Electrical Measurement students who given online learning towards students who study conventionally with the lecturer."

Statistical Hypothesis

$H_0: \mu_1 \leq \mu_2$
H1: \( \mu_1 > \mu_2 \)
The hypothesis statement is:
H0 = There is no significant difference between the learning outcomes of Electrical Measurement students who given online learning towards students who study conventionally with the lecturer
H1 = There is a significant difference between the learning outcomes of Electrical Measurement students who given online learning towards students who study conventionally with the lecturer

3.4. Independent t-test (unpaired)
The effectiveness test conducted by researchers is to use SPSS, before testing, it is necessary to know firsthand the value of \( db \) and the requirements for acceptance of the hypothesis.

\[
db = n_1 + n_2 - 2n
\]
\[
db = 22 + 22 - 2 = 42
\]

In their journal, Wahyuni et al explain the conditions of influence with the analysis of the data used using the \( t \)-independent test with the help of the SPSS for Windows version 16 program [9]. It showed a Significant (2-tailed) \( p \)-value <0.05. Which means, if:
- Significant (2-tailed) \( \geq 0.05 \) means H0 is accepted
- Significant (2-tailed) <0.05 means H0 is rejected, and H1 is accepted
The following is a significance test conducted using SPSS. Significant (2-tailed) = 0.005 <0.05.

4. Discussion
From the calculation, it is stated that H0 = rejected, H1 = accepted. So that it can be interpreted that there are significant differences between the learning outcomes of Electrical Measurement. Those are students who are taught online, and students who are taught with conventional learning conducted by lecturers. So, online learning in the Electrical Measurement course is declared effective.

From the results of the t-test, it is known that there are significant differences between the learning outcomes of Electrical Measurement. Those are students who are taught online, and students who study conventionally with the lecturer. So the application of online learning for Electrical Measurement courses is also declared effective.

Several previous studies support the improvement of student group learning outcomes provided by online learning. E-learning technologies offer learners control over the content, learning sequence, pace of learning, time, and often media, allowing them to tailor their experiences to meet their learning objectives [10]. Factors influencing transfer achievement of trainees, including learning motivation, the content of the training program, support from supervisors, and learning achievement [11].

Little contrast with the results, a study said Ninety-six percent of the online students found the course to be either as effective or more effective in their learning than their typical face-to-face course [12]. Similarly, By comparing student performance measures and assessments of learning experience from both online and traditional sections of a required graduate public administration research methods course taught by the same instructor [13]. This paper provides evidence that student performance, as measured by grade, is independent of the mode of instruction.

5. Conclusion
E-learning system allows the teacher to manage two-tier diagnostic assessments, dynamic assessment (instructional assessment), and e-learning material content [14]. Online learning allows students to learn independently. They are free to choose the material being studied to be completed in advance, or start learning with further material. Online learning allows students to learn anytime and anywhere without having to wait for attending the teacher as in conventional learning.

From the results of the study, both online learning, and conventional learning, students obtain increased value in learning outcomes. In the test found that there are significant differences in learning outcomes of Electrical Measurement students who are given online learning towards students who study
conventionally or lecturer methods so that the provision of online learning is declared effective to support the learning process. Lecturers are still tasked with monitoring students, even though the learning provided is in the form of online learning. Still, students are also given the freedom to learn from other sources that have not been prepared by the lecturer.

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