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Application of PSIM Software-Assisted Demonstration Method in Basic Subjects and Electricity Measurement Class X Titl at SMK Negeri 2 Banda Aceh

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Abstract

This study examines the application of the demonstration method assisted by Psim Software to improve the learning outcomes of class X TITL students at SMK Negeri 2 Banda Aceh. The study was motivated by the ineffectiveness of the teaching and learning process and the low learning outcomes of many students. This quantitative research employed a pre-experimental control-group pretest-posttest design. Data were collected through pretests, posttests, and questionnaires, and analyzed using an independent-samples t-test with SPSS. The results indicate a significant difference in student learning outcomes before and after the implementation of the demonstration method. The average posttest score of the experimental group was higher than that of the control group (74.66 compared with 59.33). The equality of variance test showed that the two groups had homogeneous variances. Furthermore, the significance value of the two-tailed t-test was 0.03, which was lower than the significance level of 0.05. Therefore, the null hypothesis was rejected. These findings demonstrate that the demonstration method assisted by Psim Software can effectively improve the learning outcomes of class X TITL students at SMK Negeri 2 Banda Aceh.

Keywords Demonstration Method, Psim Software. Electrical Basics and Measurements

INTRODUCTION

The concept of education basically makes students have graduation competencies according to the school level, namely knowledge, values, attitudes, and the ability to carry out tasks or have the ability to get closer to the natural environment, social environment, cultural environment, and regional needs. Vocational High School (SMK) is a vocational education institution that aims to prepare students to be able to compete in the world of work productively, and professionally. Vocational education is an effort to realize students to become productive human beings, to fill the needs for roles related to increasing the added value of the community's economy.

Vocational High School (SMK) Negeri 2 Banda Aceh is part of a vocational education institution that has used the 2013 curriculum. Based on initial observations in the field, the

researcher obtained data on the teaching and learning process carried out in class X of SMKN 2 Banda Aceh showing that the learning process of Basic Subjects and Electricity Measurement is in accordance with the 2013 curriculum. However, in the implementation process, there are many obstacles faced by students, including students who are not ready to receive the material presented, students feel bored, students do not pay attention to the teachers who teach, and student activeness is very lacking so that the teaching-learning process becomes ineffective.

In an effort to overcome these problems, teachers are expected to be able to choose the right learning model, so that students can actively learn and educational goals can be achieved. This can be done by applying demonstration method learning. Demonstration methods that can be learned directly by demonstrating tools and materials or an item. As for the demonstration method using a learning medium, it can be assisted by simulation software, which is an application that is able to attract the attention of students so that students can respond to a teacher's way of learning. One type of media that can be used in the learning process is computer media. The ease of use is to help the role of teaching staff in providing subject matter. The media that can be applied is based on application software so that it is in the teaching and learning process. Teachers can display more subject matter interesting and not boring. PSIM Software applications can be used as a learning medium based on computer multimedia technology. PSIM software applications are simulation software for various characteristics of electronics and electrical power systems. The help of this application software can help students in alternating current analysis material which will later be used as calculation and measurement material for electrical components. Therefore, to produce an effective teaching and learning process, the researcher applied a research entitled "Application of Psim Software-Assisted Demonstration Method in Basic Subjects and Electricity Measurement Class X TITL SMK Negeri 2 Banda Aceh".

METHODS

The type of research used is the type of quasi-experimental research or pseudo-experiment is a method used to get a control group or class, because in reality in research it is difficult to get a control group. The quasi-experimental method is a quantitative research method used to determine the influence of independent variables (treatment) on dependent variables (outcomes) under controlled conditions. In order for conditions to be controlled, experimental research uses control groups and often experimental research is carried out in the laboratory. The population in this study is all odd-semester TITL X students at SMK Negeri 2 Banda Aceh with a total of 90 students in the 2018/2019 school year. Sample selection is taken by systematic random sampling, that is, researchers randomly select a sample or a certain period using certain intervals in sequence. In this case, it is based on the recommendations of teachers in the field of Electrical Power Installation Engineering, and the selected sample is 30 students

The initial (pre-test) and final (post-test) tests are tests given to students before and after the learning process with the Demonstration model on Current and Voltage

Measurement material. This test aims to find out the learning outcomes after applying the Demonstration model assisted by PSIM Software. The researcher used a test sheet consisting of pretests and postes. The number of questions for each test is 10 questions in alternative form. The questionnaire in this study contains the students' response to the PSIM Software-assisted demonstration learning model that has been implemented. It consists of 10 questions with alternative answer options SS (Strongly Agree), S (Agree), TS (Disagree) and STS (Strongly Disagree) at the end of the study.

The test validity test used is the content validity test. Content validity is often used in measuring learning outcomes, the purpose of which is to find out the extent to which students master the subject matter that has been delivered by the researcher, and what psychological changes arise in the student after experiencing a certain learning process.25 For the validity test of the test content, an assessment of the question items carried out by the supervisor is carried out. Error *of measurement* refers to the extent to which inconsistencies in measurement results occur when measurements are repeated on the same group of samples.27 Testing the reliability of instruments can be carried out externally or internally. Externally, testing is carried out with a test-retest (stability), equivalent, and a combination of both. Meanwhile, internally the test is carried out by analyzing the consistency of the items on the instrument with certain techniques.

The initial stage of the research began with recording students and observing their learning methods, and dividing students into 2 groups, namely the control group and the experimental group. The author prepares a reference for the learning material and a learning plan. To start the learning process, the researcher starts by giving the first test, namely the pretest. Next, it provides an explanation of the material on Current and Voltage Measurement. The research was continued with learning activities in the experimental class using the demonstration model assisted by PSIM software while the control class was using the conventional method. The next stage after the teaching and learning process is completed, students are given a post-test to find out the cognitive aspects that have been achieved in the control class using the conventional learning model of Current and Voltage Measurement material and in the experimental class using the Demonstration learning model assisted by Psim software.

The steps prepared in the experimental class with the Psim Software-assisted Demonstration method learning model is 1) The researcher prepares materials and instruments for Current and Voltage Measurement; 2)Before starting learning, the researcher first gives a pretest to students; 3) the researcher explained the material on Current and Voltage Measurement; 4) After students finish learning Current and Voltage Measurement, then students prepare a laptop and install the Psim Software application; 5) After students finish installing the Psim Software, students are given an Introduction to the Psim software and its components. 3) After students finish learning the introduction of Psim Software components, students are given an example of how to make a circuit and measure the current and voltage in the circuit with Psim Software; 4) The researcher gives

questions to individual students who are tuned with Psim Software; 5) The researcher evaluates and closes the learning.

The questionnaire in this study uses a closed questionnaire, in the form of a checklist. This questionnaire aims to find out the learning outcomes of SMK Negeri 2 Banda Aceh students in learning Sarus and Voltage Measurement. In this questionnaire, the Likert scale is used with alternative answers provided as in table 3.3.

Table 1 Alternative Guidelines for Answers Using the Likert Scale

Alternative Answers	Score
Strongly Agree (SS)	1
Agree (S)	2
Disagree (KS)	2
Strongly Disagree (STS)	4

The research stage was to conduct initial observations at SMK Negeri 2 Banda Aceh and the researcher found problems in class X TITL of the Basic Electricity Measurement subject. The data analysis in this study uses quantitative descriptive analysis techniques. Quantitative descriptive data analysis is used to analyze quantitative data, such as test results. Quantitative data in the form of student learning outcomes scores obtained using descriptive statistical analysis techniques, for example, looking for average scores

In this study, learning outcomes are carried out through a written learning outcome test and are carried out at the end of the learning process. The test was given after the teaching and learning activities were carried out by applying the Psim Software-Assisted Demonstration learning model to the experimental group and conventional learning in the control group. The test in this study is in the form of questions in the form of electives consisting of 10 questions. To perform further analysis, the final test data must first be tested to see if the data is normally distributed or not. The normality test was carried out using SPSS with the Shapiro Wilk normality test. The homogeneity test is carried out to be able to determine the difference between two conditions or pollution whether the sample being studied is homogeneously distributed or not. The homogeneity test was carried out using SPSS. In the design of this experimental study, the t-test was also used to test the significance of the mean difference. This calculation is only carried out on the results of the calculation of the student's final test data (post-test) and on the results of the student's initial test data (pre-test). The t-test was conducted using SPSS.

"As for the formula used for the number of samples (N) ≤ out of 30, then".

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s^2}{N_1} + \frac{s^2}{N_2}}}$$

X = mean of both samples (experiment and control) N =
number of samples
S = standard deviation

"Hypothesis testing was carried out at a significant level of 5% or (α = 0.05), and df = (Nx + Ny) – 2 plus odds (1- α), provided that H0 is accepted if tcalculates ≤ ttable and H0 is rejected if tcalculates ≥ ttable".

"The criteria for assessing student learning outcomes in the learning process according to Suharsimi can be seen in the following table".

Table 2 Learning Outcome Assessment Criteria

No.	Value	Rating categories	Remarks
1	80-100	Very good	Conclusion
2	70-89	Good	Conclusion
3	60-79	Enough	Incomplete
4	40-59	Less	Incomplete
5	< 40	Fail	Incomplete

The students' responses were used to measure the level of students' ability to master and understand the Current and Voltage Measurement material after being given treatment. The criteria for the percentage of student responses are as follows:

SS > 50% = satisfactoryS > 50% = successful TS
> 50% = less successful
STS > 50% = unsuccessful

The student response percentage is calculated using the following equation:

$$r = \frac{f}{N} x\ 100\%$$

Description: P = Percentage of student response
f = frequency of students who chose
n = number of students

The value obtained after being analyzed with SPSS is achieved if it meets the minimum completeness criteria (KKM) for the material "Current and Voltage Measurement", which is 80

RESULTS AND DISCUSSION

Analysis of Research Results

The results of this study will explain the overview of the data collected during the study. The data from the results of this study included pretest scores, postes, and response questionnaires from 30 students which were divided into two groups, namely 15

experimental groups and 15 control groups used as a sample of the total student population of SMK Negeri 2 Banda Aceh. To determine the assessment for each student, it can be adjusted by using the assessment criteria for student learning outcomes as in table 4.4. Next:

Table 3 Learning outcome assessment criteria

No.	Value	Rating categories	Remarks
1	80-100	Very good	Conclusion
2	70-89	Good	Conclusion
3	60-79	Enough	Incomplete
4	40-59	Less	Incomplete
5	< 40	Fail	Incomplete

Pretest and Poster Results Data

The learning outcomes of the control group students can be said to be the lowest pretest score achieved by the student is 40 and the highest score is 70. The number of students declared to be incomplete. Furthermore, the results of the postes control group with the lowest score achieved by the students were 40 and the highest score was 80. The number of students who were declared complete was 2 people, and none were 13 people. Then the learning outcomes of the students of the Experiment group are based on table 4.5. It can be said that the lowest pretest score achieved by students is 40 and the highest score is 80. The number of students who were declared to be incomplete, then the results of the experiment group postes the lowest score achieved by the students was 50 and the highest score was 100. The number of students who were declared complete was 7 people, and those who were incomplete were 8 people. The two groups obtained different average scores, namely the experimental group using the Psim Software-assisted Demonstration method with an average score of 74.66% with the criterion of "Good" while the control group using the conventional learning model obtained an average score of 59.33% with the criterion of "Less".

Data Normality Test

The results of the normality test using the Shapiro wilk technique, can be seen from the acquisition of significant results, namely:

1. In the pretest control group of significance: 0.531 > 0.05, the study data were normally distributed
2. In the control group of the significance posts: 0.534 > 0.05, the research data was normally distributed
3. In the significance pretest experimental group: 0.533 > 0.05, the research data was normally distributed
4. In the post-significance experimental group: 0.599 > 0.05, the research data was normally distributed

Homogeneity Test

Based on the results of the homogeneity test, Ho was accepted because the significant value was greater than (α). So it can be concluded that at the significance level of α = 5%, the control group and the experimental group had the same (homogeneous) variant.

Independent sample t- test

Control Class and Experimental Class Pretest Pretest Data

The significance value is 0.871, because it is greater than the alpha value of 0.05, it can be said that the average pretest score of students in the control class with the clase. The experiment is the same, so it can be concluded that the initial ability of the control class students with the experimental class is the same

Experimental Class Postest Data and Control Class Pretest

The significance value is 0.003, because it is smaller than the alpha value of 0.05, it can be said that the average posttest score of the control class students with the experimental class is not the same, so it can be concluded that the final ability of the control class students and the experimental class is not the same. Significant at ϱ < 0.05

The minimum (mean) score for the control class was 59.3% and the experimental class was 74.6%. The difference between these two classes is significant at the level of α = 0.05. This can be interpreted as the average (minimum) value of the experimental class is higher than that of the control class.

Uji Hypothesis

The hypothesis formulated in this study is:

1. H0: There was no improvement in learning outcomes between before and after the application of the Psim Software-assisted demonstration method in the subjects of Basic and Electrical Measurement
2. Ha: There was an increase in student learning outcomes between after and before the application of the demonstration method assisted by Psim Software in the subjects of Basic and Electrical Measurement

Ho rejected: "If the significance ϱ < α = 5% or 0.05", in the t-test column for equality of means we see in the column "sig. 2 tailed" with Equal variances assumed. Why, because in the conclusion with the variance similarity test, it was found that both control and experimental groups had the same variant. The value of "sig. 2 tailed" i.e.: 0.003 then it can be decided that Ho is rejected because the value of t(15) = -5.6; ϱ =0,003; sig. By 0.003 < α = 0.05, so it can be concluded that the significance level (α) = 5% of the control group and the experimental group did not have the same mean value

Student Response Questionnaire Data

The results of the student response questionnaire filled out by 15 students after participating in the Basic and Electrical Measurement learning by applying the demonstration method assisted by Psim software on Current and Voltage Measurement material at SMK Negeri 2 Banda Aceh, the percentage of student responses to the application of the demonstration method who answered strongly agree (SS) was 88%,

agreed (S) as much as 8%, disagreed (TS) as much as 4% and strongly disagreed (STS) as much as 0%. From these results, it can be concluded that the application of the Demonstration method in the subject of Basic and Electrical Measurement is included in the good criteria.

Discussion

Learning Outcomes

From the results of data analysis, the average score of the pretest control group was 56 and the postes were 59.33. Meanwhile, the pretest experimental group was 56.66 and the postes were 74.66. From the data, it can be concluded that the average value of the group's learning outcomes. The students' experiments have increased considerably, although there is not too much difference. The difference in learning outcomes between pretests and postes is caused by several factors that support learning, especially the subject in question. In addition, student learning outcomes at SMK Negei 2 Banda Aceh are also influenced by the mastery of mathematics smoothly and precisely. In this study, the researcher did not need to explain the material repeatedly at the first meeting before applying the demonstration method assisted by Psim Software until students could understand how to calculate voltage and current. In addition, students are also given exercises to get used to answering questions correctly and precisely.

In the second meeting, the researcher demonstrated the material Current and Voltage Measurement which included how to arrange a circuit, measure voltage, current and resistance in each circuit. After being demonstrated with Psim Software, the Current and Voltage Measurement material and recording the results obtained on the measurement instrument. Here, the researcher becomes a tutor to direct the learning measurement process. At the end of the demonstration learning assisted by Psim Software, the researcher again gave 10 multiple-choice questions (postes) to find out the extent to which students were able to understand learning, as well as to see an improvement in student learning outcomes. In the end, the researcher collected data on student learning outcomes, both pretests and postes, then processed, analyzed and obtained results, that the application of the demonstration method assisted by Psim Software in learning the Basics of Electrical Measurement of Current and Voltage Measurement material was stated to improve student learning outcomes, as described at the beginning of this discussion.

Student Response

Based on the results of the students' responses with the application of the demonstration method assisted by Psim Software on the Current and Voltage Measurement material, it is known that students have been able to demonstrate the Current and Voltage Measurement material with Psim Software very well. This is proof that the demonstration method assisted by Psim Software is able to affect student learning outcomes. This can be seen from the student response questionnaire with a percentage of strongly agree (SS) as much as 88%, agree (S) as much as 8%, disagree (TS) as much as 4% and strongly disagree (STS) as much as 0%. The highest percentage was dominated by strongly agreeable

responses (SS) = 87%. From this we can find out that the demonstration method assisted by Psim Software is a learning method that is preferred by students.

CONCLUSION

Based on the research findings and data analysis, the author concludes that the application of the demonstration learning model assisted by Psim Software has a significant effect on student learning outcomes in the subject of Basic and Electrical Measurement. This is evidenced through the t-test hypothesis, which yielded a significance value greater than 0.05, indicating that H0 is rejected and Ha is accepted. Furthermore, the demonstration method assisted by Psim Software is highly preferred by students, as shown by the student response questionnaire using the Likert scale, where 88% of students strongly agreed, 8% agreed, 4% disagreed, and 0% strongly disagreed. These results confirm that the application of the demonstration method in Basic and Electrical Measurement subjects falls into the very good category.

Based on the conclusions drawn from this research, the author offers several recommendations for the advancement of the learning process. First, educators are encouraged to apply the Psim Software-assisted demonstration method in the learning process, as it has been proven effective in improving student learning outcomes. Second, this research contributes to vocational schools by providing an alternative learning approach that can be applied particularly in Electrical Engineering subjects. The use of Psim Software not only offers varied learning options but also actively involves students in the learning process, thereby developing multiple aspects of student abilities beyond problem-solving. Third, future researchers are encouraged to explore the use of Psim Software in other Electrical Engineering lessons to further expand its applicability and benefits in educational settings.

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