Effectiveness of Project Based Learning Model on Learning Outcomes in The Subject of Network System Administration of Grade XI TKJ SMK Bina Banua Banjarmasin

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Abstract. This research aims to determine the effectiveness of the project-based learning model on learning outcomes in the Network Systems Administration subject class XI TKJ SMK Bina Banua Banjarmasin. This type of research is quasi-experimental. The population of this study was all students in class XI TKJ. The sampling technique uses saturated sampling. The type of research instrument is multiple choice questions. The data analysis technique used was descriptive and statistical analysis via SPSS 25 with the Shapiro-Wilk normality test, homogeneity test and Mann-Whitney test. Based on the research results, the average learning outcome score for the experimental class was 89.41 while the control class was 53.82. After carrying out the Mann-Whitney test, the Sig (2-tailed) = 0, 000 < 0.05. This shows a significant difference in average values. So, it can be concluded that the project-based learning model is effective on student learning outcomes in network system administration subjects with material evaluating and configuring DHCP Server.

Keywords: Model project-based learning, learning outcomes

1. Introduction

Improving the quality of education in Indonesia can be realized through the effectiveness of the learning process. One factor that directly affects the effectiveness of the learning process is the learning model used by the teacher, in addition to mastery of the material that the teacher aims to deliver.

Learning effectiveness is a measure of the success of the relationship process between students and students with teachers in learning conditions in order to achieve learning objectives. The effectiveness of learning can be seen from student activities during learning, student responses to learning and mastery of each student's material (Yulianto & Aninditya Sri Nugraheni, 2021).

A learning model is a description of the learning process that has been designed, used and evaluated systematically by educators with the goals to be achieved in the learning process. The learning model is also interpreted as an example of a description of the learning process carried out from beginning to end that has been presented by educators in the classroom. Implementing a learning model is very much influenced by basic competencies, a learning objective at least has steps or stages that must be understood by students through educational guidance (Rokhimawan et al., 2022).

The Project Based Learning model is an innovative learning model that is centered on students and places teachers as motivators and facilitators, where students are given the opportunity to work independently to construct their learning (Martiani, 2021). Learning activities in the PjBL model in the PjBL model are centered on students (student-centered learning) so that children are more proactive in learning activities. Students are required to be independent in solving problems or completing tasks faced. In addition, this model can also improve children's abilities in terms of cognitive, group work skills, learning motivation, teamwork, and student creativity (Sari et al., 2023). Based on the analysis of the subject teacher of Network System Administration Class XI TKJ SMK Bina Banua Banjarmasin,

the less-than-optimal student learning outcomes are due to the application of conventional learning models that are monotonous and boring. Based on the evaluation results in the Network System Administration subject, many students obtained learning outcomes below the KKM. The Minimum Completion Criteria (KKM) set at SMK Bina Banua Banjarmasin is 70.

Seeing from the problems above, teachers need to apply a learning model that can help students understand the material presented by the teacher optimally so that later students get maximum learning outcomes. There are several implementations of learning models that can be used as alternatives. One of them is the project-based learning model. With the Project Based Learning learning model, students not only seek knowledge independently, but students are also able to solve concrete problems in the material taught so that the learning process leads students to be active in class. Based on the above, the author is interested in researching "The Effectiveness of the Project Based Learning Model on Learning Outcomes in the Network System Administration Subject of Class XI TKJ SMK Bina Banua Banjarmasin"

2. Research Methods

The type of research used by the researcher in this study is quasi-experimental research. Sugiyono defines experimental research as research used to find the effect of certain treatments on others under controlled conditions (Sugiyono, 2009). Population is the entire object of research from all objects or individuals who have certain characteristics. The population in this study was class XI TKJ totaling 35 students. The sample is part of a population. The sampling technique in this study was carried out using saturated sampling. So, the samples to be taken in this study were class XI TKJ 1 (experimental class) totaling 17 students using the Project Based Learning model and class XI TKJ 2 (Control class) totaling 18 students using the conventional learning model.

The data collection techniques used in this study were: (1) Interviews, conducted to find the problems to be studied and also to deepen the problems to be studied. The problems in question are that in the learning process the teacher is more dominant in class and the lack of student participation during the learning process; (2) Observation, conducted to find out about the school to be studied such as obtaining school data, student data, school conditions, classes, classroom learning processes, student responses to the learning process, the curriculum used and other things related to the research; (3) Tests are used to measure students' ability to understand the material or teaching materials presented. The test in this study was used to measure students' abilities in the cognitive domain after learning. The test used was in the form of multiple-choice questions. From this test data collection technique, data will be obtained in the form of student learning outcomes in the subject of network system administration, the material for evaluating and configuring DHCP servers. The instrument used was a learning outcome test question, the questions were made and developed by the researcher (with consideration from the subject teacher) and adjusted to the topic to be taught. The questions used in this study were in the form of multiple-choice questions. These questions were made to measure student learning outcomes in the cognitive domain. The questions will be given to the experimental class and the control class that had been given treatment. Before being used, the questions were first validated by expert lecturers and material experts after the questions were validated, the questions were tested in the field to measure the validity and reliability of the instrument. The learning instruments used in this study were the Learning Implementation Plan (RPP) and Student Worksheets (LKPD).

Before conducting the study, the researcher first conducted a trial of the instrument with 40 questions tested. The results of the instrument trial were then analyzed using a validity test with the product moment formula. After testing the validity of the test questions, the reliability test was carried out using the split-halt method. Then the test questions were analyzed for their level of difficulty and their distinguishing power. To determine the validity, reliability, level of difficulty and distinguishing power, the researcher used SPSS 25 software.

The data analysis techniques used in this study were descriptive analysis and hypothesis testing. Descriptive analysis in this study was to calculate the average value of the learning outcome test. While the hypothesis test used the Mann-Whitney test. The t-test was conducted to determine the differences in learning outcomes obtained by students. Before conducting the t-test, the prerequisite analysis test was first carried out. The prerequisite analysis tests carried out were the normality test and the

homogeneity test. The Mann-Whitney test is an alternative to the independent sample t-test if the data is not normally distributed or the data does not have homogeneous variance.

3.   Results and Discussion

This study aims to determine which is more effective between the Project Based Learning and conventional learning models on student learning outcomes in the material Evaluating and Configuring DHCP Server in class XI TKJ SMK Bina Banua Banjarmasin. Based on this objective, this study was conducted using an experimental class and a control class. The experimental class is a class that receives learning treatment using the Project Based Learning model on the material Evaluating and Configuring DHCP Server, while the control class is a class that receives learning treatment using the conventional model on the material Evaluating and Configuring DHCP Server.

After conducting the research instrument test, the results of the test of the validity of the question items can be seen in Table 1 below.

Table 1. Instrument Validation

Question Item Number	Information
2, 5, 6, 11, 13, 16, 17, 18, 19, 21, 23, 24, 28, 29, 30, 31, 34, 37, 38, 39	Valid
1, 3, 4, 7, 8, 9, 10, 12, 14, 15, 20, 22, 25, 26, 27, 32, 33, 35, 36, 40	Not Valid

Based on Table 1, there are 20 valid questions and 20 invalid questions. Meanwhile, the results of the reliability of the questions are 0.797 or a high interpretation value so that the questions can be used. The results of the reliability test of the questions can be seen in Table 2 below.

Table 2. Question Reliability

Guttman Split-Half Coefficient	0,797

Table 2 above provides information on the reliability of the test items as a whole. The table above shows the Guttman Split-Half Coefficient correlation value of 0.797 with the interpretation of a high reliability value. So it can be concluded that the test items for the test competency variable as a whole are declared reliable. The results of the difficulty test level can be seen in Table 3. As follows:

Table 3. Level of Question Difficulty

Difficulty Level	Question Number	Total Number
Easy	2, 5, 6, 11, 13, 17, 18, 23, 24, 28, 29, 34	12
Currently	16, 19, 21, 30, 31, 37, 38, 39	8

Based on Table 3. above, the questions that have an easy level of difficulty are 12 questions, the questions that have a medium level of difficulty are 8 questions. The results of the calculation of the discriminatory power of the question items can be seen in Table 4. as follows:

Table 4. Distinguishing Power

Question Number	Distinguishing Power Criteria	Number of Questions
13, 17, 18, 23, 28, 29	Very Good	6
2, 5, 6, 11, 16, 19, 24, 30, 31, 34, 37, 38	Good	12
21, 39	Sufficient	2

Based on Table 4. above, the results of the discriminatory power test can be seen that there are 6 questions that have very good discriminatory power, 12 questions have good discriminatory power, and 2 questions have sufficient discriminatory power. After conducting the item analysis test, the next

step is to conduct a prerequisite analysis test including a normality test and a homogeneity test. The results of the normality test can be seen in Table 5. as follows:

Table 5. Results of the Normality Test for the Experimental and Control Classes

Class	*Shapiro-Wilk*	Conclusion
XI TKJ 1 (Experimental)	0, 128	Data is normally distributed
XI TKJ 2 (Control)	0, 219	Data is normally distributed

The statistical analysis conducted in this study was the Shapiro-Wilk test calculated using the SPSS 25 program. The Shapiro-Wilk test is used if the number of samples used is less than 50. The results of the test of class XI TKJ 1 (experimental) from the learning outcome test based on Table 5. obtained a significance value in the Shapiro-Wilk test of 0.128> 0.05, so Ho is accepted and Ha is rejected. Testing class XI TKJ 2 (control) from the learning outcome test based on Table 4.6 obtained a significance value in the Shapiro-Wilk test of 0.219> 0.05, so Ho is accepted and Ha is rejected, so the data is normally distributed. It can be concluded that the experimental and control class learning test score data are normally distributed. The test results with SPSS 25 obtained the results of the homogeneity test of the experimental and control class learning outcome scores which can be seen in Table 6. below:

Table 6. Homogeneity Test

Levene Statistic	Df1	Df2	Sig	Conclusion
14, 766	1	33	0,001	Data is not homogeneous

The determination of the hypothesis Ho is the variance of the two samples (experimental class and control class) is the same, and Ha is the variance of the two samples (experimental class and control class) is different. The basis for making decisions with a significance level of 5% is if the significant value (Sig)> 0.05 then Ho is accepted, and if the significant value (Sig) <0.05 then Ha is rejected.

By using a 95% confidence level, it is known that the Sig. value is 0.001 <0.05, then Ho is rejected and Ha is accepted. The learning outcome test score data for the two samples have different variances or are not homogeneous at a 95% confidence level.

The following is a description of the learning outcome values obtained, which can be seen in Table 7. As follows:

Table 7. Description of Learning Outcome Data for Experimental Class and Control Class

Data Description	Eksperiment Class (XI TKJ 1)	Control Class (XI TKJ 2)
Number of Students (N)	17	18
Mean	89, 41	53, 82
Lowest Value (*Min*)	80	35
Highest Score (*Max*)	100	75
Standard Deviation	5, 832	12, 441

Based on the results of the analysis of the description of learning outcome data in Table 7, it shows that the average value of learning outcomes for the experimental class is 89.41 while the control class is 53.82. Hypothesis testing in this study uses the Mann-Whitney test. Because the data is not homogeneous, the Mann-Whitney test is used to test the hypothesis. To see the results of the hypothesis test, see Table 8. Below.

Table 8. Mann-Whitney Test Values

Test Statistics	
	Learning outcomes
Mann-Whitney U	0,000
Wilcoxon W	171.000
Z	-5.082
Asymp. Sig. (2-tailed)	0, 000

Determination of the hypothesis Ho there is no significant difference in the average value of the experimental class and control class learning outcome tests, while Ha there is a significant difference in the average value of the experimental class and control class learning outcome tests. The basis for making decisions with a significant level of 5% is if the Sig. (2-tailed) value ≥ 0.05 then Ho is accepted and Ha is rejected, and if the Sig. (2-tailed) value <0.05 then Ho is rejected Ha is accepted. The results of the Mann-Whitney test can be seen in the Test Statistics in Table 8. Based on the test results in Table 8 it can be seen that the Sig. (2-tailed) value is 0.000 <0.05 so that Ha is accepted and Ho is rejected, from these results it can be concluded that there is a significant difference in the average value of the learning outcomes of students in the experimental class and control class on the material Evaluating and Configuring DHCP Servers at SMK Bina Banua Banjarmasin. Based on the hypothesis test (Mann-Whitney test), the Sig.(2-tailed) value is obtained = 0.000 <0.05, which means Ha is accepted and Ho is rejected, there is a significant difference in learning outcomes between the experimental class and the control class. Then seen from the average value of student learning outcomes in class XI TKJ 1 (experimental class) which is 89.41, and the average value of student learning outcomes in class XI TKJ 2 (control class) which is 53.82. So, it can be concluded that student learning outcomes using the project-b a s e d learning model are more effective than student learning outcomes using the conventional model.

These results are in accordance with the research conducted by Astri Ayu Ramadianti "Effectiveness of the Project Based Learning Model on Elementary School Mathematics Learning Outcomes". The results of the study showed that the project-based learning model is more effective in improving student learning outcomes than the conventional model in mathematics subjects.

4. Conclusion

Based on the results of the research that has been conducted, it can be concluded that the project-based learning model is effective for student learning outcomes. The results of hypothesis testing using the Mann-Whitney test obtained a Sig. (2-tailed) value = 0.000 <0.05, which means that Ha is accepted and Ho is rejected. So, it can be concluded that there is a significant difference in the average value of student learning outcomes in the Network System Administration subject in the material evaluating and configuring DHCP Server using the project-based learning model with the conventional model, which means that the project based learning model is effective for student learning outcomes in the Network System Administration subject in the material evaluating and configuring DHCP Server.

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