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The Effect of Project Based Learning (PJBL) Models and Creativity on the Learning Outcomes

Sonalia, Yasdinul Huda

Electronic Engineering Department, Faculty of Engineering, Universitas Negeri Padang, Padang, Indonesia

*Corresponding Author: sonalia2108@gmail.com

Abstract **- This research is based on the problems found in class XI Computer Network Engineering State Vocational High School 1 Bukittinggi for the 2024/2025 school year, based on the results of observations carried out, it can be seen that during the learning process, the learning model used by the subject teacher for installing network device configurations using the Cooperative Learning Model with the demonstration method causes the learning process to become monotonous, students are less interested in the subject caused by the monotonous learning process, resulting in low student learning outcomes. This study aims to reveal How much influence does the PJBL learning model and Creativity have on the learning outcomes of students in class XI TKJ in the subject of Network Device Configuration Installation at SMK N 1 Bukittinggi. This study is a quantitative research using the Experimental method with a Pretest-Posttest Control Group Design research design. The subjects of this research are all students of grade XI TKJ for the 2024/2025 academic year. The results of data analysis showed that Fcal > Ftabel (89,927 > 3.15) then Ho was rejected and Ha was accepted, so it can be concluded that the independent variables (Project Based Learning Models and creativity) together affect the dependent variable (learning outcomes). When viewed from the results of the presentation of the influence, the PJBL learning model variables and creativity on learning outcomes amounted to 74.7%, this shows that both simultaneously almost 75% of the variation in student learning outcomes.**

Keywords **- Project Based Learning, Creativity, Learning Outcomes.**

I. INTRODUCTION

Education is a conscious and planned effort to create a learning atmosphere and learning process in such a way that students actively develop their potential to achieve religious spiritual strength, self-control, personality, intelligence, noble morals and skills necessary for themselves and society[1].

Education is an effort taken by humans in order to change their behavior so that they become good individuals and are able to develop their knowledge[2]. Therefore, to achieve the development of knowledge in humans, a curriculum is needed in education.

Therefore, the curriculum functions as a foundation and guideline for learning in an educational institution to achieve national education goals. The curriculum is defined as a tool that must be prepared by educational institutions before carrying out the desired teaching practice[3]. The goal of the independent curriculum is to maximize the equitable distribution of education in Indonesia with free tuition to develop student potential. The independent curriculum will be implemented in stages starting from the 2021/2022 school year and can be fully applied to all elementary and secondary school levels, namely stages A-F.

The curriculum structure of Vocational School consists of 2 phases, namely phase E for class X and phase F for classes XI and XII. In the Independent Learning policy, changes have been made to the curriculum in Indonesia. In terms of education, the standard approach of independent learning regulations is abandoned and an approach with diverse or different types of characteristics is chosen that is more complete, so as to allow educators and students to explore the increasingly advanced world of science. With an emphasis on student-centered education, the curriculum made with independent learning regulations is characterized by flexibility, skills-based, centered on character or moral development as well as non-technical campaigns, and responsive to the needs of DU/DI.

Current curriculum requirements expect students to have cognitive skills, real-world skills, noble character, and be more active in learning. The Independent Curriculum strengthens the orientation on character and competency development through simplifying content and providing flexibility, this curriculum strengthens curriculum practices based on the context of educational units that have been regulated in the previous curriculum[4]

One of the learning models that can be developed and adopted to place students as the center of learning and increase creativity is the application of the Project Based Learning (PJBL) model. The project-based learning model is a learning model where students work independently to develop the power of mind, critical thinking, and overcome the problems they identify.

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The project-based learning (PJBL) learning model is a learning model that includes focusing on meaningful questions and problems, problem solving, decision-making, the process of finding different sources, opportunities for members to collaborate and summary activities. presenting the results of your work [5]. PJBL focuses on product development or activities, where students usually carry out activities: organizing group learning, learning or research, problem solving and knowledge synthesis. Learning is not only collaborative, but PJBL is also innovative, unique and focused in solving problems related to student life or the needs of local communities or industries[6]. PJBL develops various basic skills that students must have, including thinking, decision-making skills, creativity skills, problem-solving skills, and at the same time is seen as effective in students' self-development, self-confidence and self-control[7].

SMK Negeri 1 Bukittinggi is one of the vocational schools that aims to prepare graduates who are skilled and professional in their fields. Currently, SMK Negeri 1 Bukittinggi has applied the Merdeka curriculum at the grade X, XI and XII levels, which in the teaching process requires the role and active participation of students. SMK Negeri 1 Bukittinggi has various expertise programs, including Computer Network Engineering and Telecommunications (TJKT). The TJKT expertise program has various competency standards, all of which are used as subjects, including the Installation of Network Device Configuration (PKP).

Based on the results of observations made at SMK Negeri 1 Bukittinggi in the subject of Network Device Configuration Installation (PKP), students are less interested in participating in the teaching and learning process because the process of delivering material by teachers is still not effective by using the Cooperative Learning Model with a demonstration method where teachers directly show how to perform a certain task, skill, or procedure to students that causes the process learning becomes monotonous so that learning outcomes are less effective.

This can be seen from some students who do not pay attention to the material being taught by the teacher, students actually talk to friends, daydream or are sleepy so that they do not pay attention to the lesson. This results in students not being able to complete the tasks given by the teacher when the lesson is over. Based on the results of the discussion with the teacher of the Network Device Configuration Installation (PKP) subject at SMKN 1 Bukittinggi, it was stated that students were less active in participating in teaching and learning activities. This shows that students rarely ask questions or express opinions. Some students also rarely concentrate on participating in teaching and learning activities. This condition certainly makes the learning process hampered and learning outcomes decrease.

TABLE I
MIDTERM EXAM SCORES

Class	Number of student	Midterm Exam Score			
		KKTP > 80		KKTP < 80	
		Number of student	%	Number of student	%
XI TKJ 1	35	16	45.71%	19	54.28%
XI TKJ 2	35	12	34.28%	23	65.71%

Based on the data of table 1, it can be seen that class XI TKJ 1 with 35 students obtained a complete score of 16 students or 45.71% of 35 students and incomplete 19 students or 54.28% of 35 students and class XI TKJ 2 with 35 students obtained a complete score of 12 students or 34.28% of 35 students and incomplete 23 students or 65.71% of students of 35 students.

The learning outcomes in learning to install the practice of configuring network devices are very important for vocational school students, students are required to have a basis in learning skills before directly entering the world of practice. Because learning outcomes are one of the things that determine the success of students in the learning process in the classroom or in the laboratory. Learning outcomes have an important role in the learning process. This is because learning outcomes can be used as a benchmark to find out how far students have changed after receiving their learning experiences that can be observed and measured in the form of knowledge, attitudes, and skills.

Student learning outcomes are achievements that students achieve academically through exams and assignments, actively asking and answering questions that support the acquisition of these learning outcomes[8]. Learning outcomes are something that students achieve or obtain thanks to effort or thought which is expressed in the form of assignments, knowledge, and basic taste contained in various aspects of life[9]

This study aims to reveal 1) How much influence does the PJBL learning model and Creativity have on the learning outcomes of students in class XI TKJ in the subject of Network Device Configuration Installation at SMK Negeri 1 Bukittinggi, 2) How much influence does the PJBL learning model have on the learning outcomes of class XI TKJ students in the subject of Network Device Configuration Installation at SMK Negeri 1 Bukittinggi, 3) How much influence does Creativity have on the learning outcomes of students in class XI TKJ on the subject of Network Device Configuration Installation at SMK Negeri 1 Bukittinggi.

II. METHOD

This study uses a quantitative approach with an experimental method. The experimental method aims to see the influence of two or more variables. Experimental research methods can be interpreted as research methods used to find the influence of certain treatments on others under controlled conditions [10]

The research "The Influence of Project Based Learning (PJBL) and Creativity Learning Models on the Learning Outcomes of Class XI Students of SMK Negeri 1 Bukittinggi" is a type of quantitative research. This study uses an experimental research method, so this type of experimental research uses a Pretest-Postest Control Group Design research design as designed according to the following table 2.

TABLE II
MIDTERM EXAM SCORES

Class	Pre-Test	Treatment	Post-Test
Experiment	O1	X	O2
Control	O3	-	O4

Information:
O_1 : Pre-Test of experimental class group
O_2 : Post-Test of experimental class groups
O_3 : Pre-Test group control class
O_4 : Post-Test of experimental class group
X : Treatment of the experimental class using the variables studied

The results of table 4 show that the design of this study has two research groups, namely the experimental group and the control group, where both groups are given an initial test (pretest) and a final test (posttest)[11]. The population in this study is all students of class XI TKJ consisting of 64 students and spread across 2 classes in the 2024-2025 school year. The sample selection technique that will be used in this study is Purposive sampling where the researcher deliberately selects population members based on certain considerations that are considered relevant to the research objectives[10]. In this study, the sample to be used is class XI TKJ 1 as an experimental class and XI TKJ 2 as a control class that studies the subject of Network Device Configuration Installation at SMK Negeri 1 Bukittinggi.

Data collection instruments are tools used to collect data must have good validity and reliability so that the data results obtained are reliable[12]. Before the test questions are used, a test of the questions will be carried out to determine the validity, reliability, difficulty level of the questions, and the distinguishing power of the questions. The data collection technique in the study is carried out through tests, in the context of learning, tests are usually used to measure the ability of students after the subject matter is given and questionnaires, questionnaires are data collection techniques that are carried out by giving a set of questions or written questions to respondents to be answered[13]. The Likert scale used in this study is a minimum score of 1 and a maximum score of 5, because it will be known for sure whether the respondent's answer tends to agree or disagree, so the results of the respondent's answer are expected to be more relevant [14].

The data analysis technique used is a prerequisite for an analysis test consisting of a normality test, a homogeneity test, a linearity test, and a multicollinearity test. The next data analysis technique is a hypothesis test, then a test of the significance of the influence of independent variables (X_1) and (X2) on variables bound to the F test where the F test or model feasibility test shows whether all independent or established variables used in the regression model have an influence on the rebound variables together and the t test is used to test how much influence the independent variables have on the dependent variables partially, assuming other variables are considered fixed.

III. RESULTS AND DISCUSSION

A. Instrument Trial

1) Validity Test

Validity is a measure that indicates that an instrument is legitimate or valid[15]. Based on the validity test conducted from 30 pretest questions, 26 were declared valid and 4 questions were declared invalid, for posttest questions out of 30 questions there were 25 valid questions and 5 invalid questions, for the creativity questionnaire from 35 statement items, 27 were valid, 8 were invalid.

2) Relialbility Test

If the value of r_{11} > Cronbach's alpha value means reliable, and vice versa if r_{11} < Cronbach's alpha value means that it is not reliable[16].

$$r_{11} = \left[\frac{k}{(k-1)}\right]\left[1 - \frac{\sum \alpha^2 b}{\alpha^2 t}\right]$$

For *pretest*

$$r_{11} = \left[\frac{26}{(26-1)}\right]\left[1 - \frac{\sum 5.39}{37.4}\right] = 0.890$$

For *posttest*

$$r_{11} = \left[\frac{25}{(25-1)}\right]\left[1 - \frac{\sum 5.416}{38.48}\right] = 0.895$$

For creativity questionnaires

$$r_{11} = \left[\frac{27}{(27-1)}\right]\left[1 - \frac{\sum 38.112}{407.5}\right] = 0.941$$

Based on calculations with Microsoft Excel 2016, it can be concluded that r_{11} > Cronbach's Alpha value which means it is declared[16]

3) Difficulty Test

Based on the results of the difficulty test of the questions in the calculation of the 30 pretest questions that have been tested, there are 19 questions in the easy category, 9 saol in the medium category and 2 questions in the difficult category and the results of the difficulty test of the questions in the calculation of 30 posttest questions that have been tested there are 19 questions in the easy category, 9 question in the medium category and 2 questions in the difficult category.

4) Difference Test

Based on the results of the difficulty test of the questions in the calculation of the 30 posttest questions that have been tested, there are 19 questions in the sufficient category, 7 questions in the bad category and 4 questions in the bad category, the results of the test of the difficulty of the questions in the calculation of the 30 posttest questions that have been tested are 19 questions in the fair category, 6 questions in the bad category and 5 questions in the bad category.

B. Data Analysis Techniques

1) Prerequisites for alnallyticall tests

a. Normality Test

The implementation of the normality test can be carried out using the Kolmogorov Smirnov Test (K-S) which is carried out by making H0 for normally distributed data and Ha for data that is not normally distributed, where if the Sig value is > 0.05 then the data is normal and if the Sig value < 0.05 then the data is not normally[16]

Based on the test results, it was explained that the results of the normality calculation for the control class data got significance for pretest 0.200, posttest 0.114 and questionnaire 0.063 or greater than 0.05 so that the data was said to be normally distributed, while for the experimental class data obtained significance for pretest 0.200, posttest 0.114 and questionnaire 0.200 or greater than 0.05 so that the data was said to be normally distributed. This means that both the control class and the experimental class are at the normal distribution value

b. Homogeneity Test

The homogeneity test showed that the homogeneity test results for the X1 and X2 variables in the table based on mean had a significance value of 0.754 for X1 and 0.232 for X2. The significance value > 0.05, therefore it can be concluded that the data vary equally or homogeneously[16]

c. Linealrity Test

This linearity test aims to find out whether the two variables have a significant linear relationship or not. The significance value of the PJBL learning model – learning outcome is 0.000, while the significance value of creativity – learning outcome is 0.046. If the significance value is < than 0.05, then there is a linear relationship between the variables, and vice versa, if the significance value is > than 0.05, then there is no linear relationship between the variables. Because in the significance table of the two variables, which is less than 0.05, the variables have a linear relationship[16]

d. Multicollinealrity Test

The multicollinearity test is a test conducted to check the extent to which the regression model finds a correlation between independent variables.

- If the Tolerance value > 0.100 and the VIF < 10.00, then there are no symptoms of multicollinearity
- If the Tolerance value < 0.100 and VIF > 10.00, then symptoms of multicollinearity occur[17]

In the collinearity statistics section, it shows the Value Inflation Factor (VIF) score for the two independent variables, namely the PJBL learning model and creativity of 1,034. If the VIF value > 10 is generally considered to indicate a very high multicollinearity, but these two variables have a value less than 10, then there is no multicollinearity problem found in the regression model.

2) Hypothesis Test

Hypothesis testing uses a regression test together (Test F) and a partial regression test (Test t) for the second and third hypotheses by looking at the significance.

a. First Hypothesis

The first hypothesis is that there is a joint influence between the PJBL learning model and creativity on the learning outcomes of class XI TKJ students at SMK N 1 Bukittinggi. Based on the previous hypothesis, the following hypothesis is made:

Ho = There is no joint influence between the PJBL and Creativity learning models on the outcomes of grade XI TKJ students at SMK N 1 Bukittinggi.

Ha = There is a joint influence between the PJBL learning model and Creativity on the learning outcomes of grade XI TKJ students at SMK N 1 Bukittinggi.

Based on the F test in table 26, the value of Fcal = 89,927 with a significance of 0.000, while Ftable = 3.15. Based on the distribution table F for dfnumerator = 2, dfdenominator = 61 and the significance value of 0.05 is 3.15. If it is seen based on the decision that Fcal > Ftabel (89,927 > 3.15) and the significance value < 0.005 (0.000 < 0.05), then Ho is rejected and Ha is accepted, meaning that the PJBL (X1) and creativity (X2) learning models together have an effect and significance on learning outcomes (Y).

Furthermore, to find out the percentage of influence of variables, meaning that the PJBL learning model (X1) and creativity (X2) together have an influence and significance on learning outcomes (Y), it is determined that the derteminant that r square (r2) can be seen as an r square value of 0.747, then the magnitude of the influence given is, r2 x 100% = 0.747 x 100% = 74.7%.

b. Second Hypothesis

The second hypothesis is that there is an influence of the PJBL learning model on the results of class XI TKJ students at SMK N 1 Bukittinggi. Based on the results of the previous hypothesis, the following hypothesis is made:

Ho = There is no effect of the PJBL learning model on the results of class XI TKJ students at SMK N 1 Bukittinggi.

Ha = There is an influence of the PJBL learning model on the results of class XI TKJ students at SMK N 1 Bukittinggi.

Based on the value of tcount = 3.363 with a significance of 0.001, while ttable = 1.999. tcount > ttable (3.363 > 1.999) and significance <0.05 (0.001 < 0.05), so it can be concluded that Ho is rejected and Ha is accepted, meaning that the PJBL model (X1) partially has a significant effect on learning outcomes (Y).

Furthermore, to find out the percentage of influence of the PJBL model variable (X1) on learning outcomes (Y), a derendezvous was carried out which can be seen in the table obtained an r value of 0.864, then the magnitude of the influence given is r2 x 100% = (0.864)2 x 100% = 0.7464 x 100% = 74.64%.

c. Third Hypothesis

The third hypothesis is that there is an influence between creativity on the learning outcomes of class XI TKJ students at SMK N1 Bukittinggi.

Ho = There is no influence of creativity on the results of class XI TKJ students at SMK N 1 Bukittinggi.

Ha = There is an influence of creativity on the results of class XI TKJ students at SMK N 1 Bukittinggi.

Based on the table, it was obtained that tcal = -1,536 with a significance of 0.130, while ttable = 1,999, tcount < ttable (-1,536 > 1,699) and significance >0.05 (0.130 > 0.05), so it can be concluded that Ho accepted Ha rejected meaning that creativity (X2) partially had no effect on learning outcomes (Y). With the result of the percentage of creativity on learning outcomes r of -0.248, then r2 x 100% = (-0.248)2 x 100% = 0.061 x 100% = 6.1%.

TABLE 2
PARTIAL CORRELATION TEST

Correlations

		Model PJBL	Kreativitas	Hasil Belajar
PJBL Model	Pearson Correlation	1	-.250*	.864**
	Sig. (2-tailed)		.046	.000
	N	64	64	64
Creativity	Pearson Correlation	-.250*	1	-.248*
	Sig. (2-tailed)	.046		.048
	N	64	64	64
Learning Outcomes	Pearson Correlation	.864**	-.248*	1
	Sig. (2-tailed)	.000	.048	
	N	64	64	64

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

C. Discussion

This study revealed 64 people and their students who were used as a sample where the experimental class was 32 people and the control class was 32 people by answering tests in the form of pretest questions totaling 26 posttest questions

totaling 25 questions and a questionnaire questionnaire totaling 27 statements in an effort to find the influence of the PJBL learning model on learning outcomes, looking for the influence of creativity on partial learning outcomes, and to look for the influence of the PJBL learning model and creativity together on learning outcomes.

The Effect of PJBL Learning Model and Creativity on the Learning Outcomes of Class XI TKJ Students at SMK N 1 Bukittinggi Based on the results of the hypothesis test that has been carried out in the first hypothesis, it turns out that together there is a significant and positive influence between the PJBL learning model and creativity on learning outcomes. The results of data analysis showed that Fcal > Ftabel (89,927 > 3.15) then Ho was rejected and Ha was accepted, so it can be concluded that the independent variables (PJBL learning model and creativity) together affect the dependent variable (learning outcomes). When viewed from the results of the influence presentation, the variables of the PJBL learning model and creativity on learning outcomes amounted to 74.7%, which shows that both are simultaneously almost 75% variation in student learning outcomes.

The Effect of the PJBL Learning Model on the Learning Outcomes of Class XI TKJ Students at SMK N 1 Bukittinggi Based on the results of the hypothesis test conducted in the second hypothesis test, there is an influence between the PJBL learning model on learning outcomes. The results of data analysis show that the variables of the PJBL learning model have a significance of <0.05 (0.001 < 0.05), so it can be concluded that Ho is rejected and Ha is accepted, meaning that the PJBL model (X1) partially has a significant effect on learning outcomes (Y). When viewed from the results of the influence presentation, the variable of the PJBL learning model on learning outcomes was 74.64%.

The Influence of Creativity on the Learning Outcomes of Class XI TKJ Students at SMK N 1 Bukittinggi Based on the results of the hypothesis test conducted in the second hypothesis test, there is an influence between creativity and learning outcomes. The results of the data analysis showed that the creativity variable had a significance of >0.05 (0.130 > 0.05), so it can be concluded that Ho accepted Ha rejected meaning that creativity (X2) partially had no effect on learning outcomes (Y). When viewed from the results of the influence presentation, the variable of creativity on learning outcomes was 6.1%.

Based on research that has been conducted using the PjBL model on the subject of Keppler's law at SMA Negeri 1 Gubug, it is concluded that the PjBL model is effective on the creativity ability and learning outcomes of class XI students [18] in line with the results of the study that the project-based learning model affects learning outcomes.

IV. CONCLUSION

The PJBL learning model and creativity together have a significant influence of 74.7% on the learning outcomes of class XI TKJ students at SMK N 1 Bukittinggi. This shows that the variables of the PJBL learning model and creativity together affect learning outcomes. The PJBL learning model has a significant influence of 74.64% on the learning outcomes of grade XI TKJ students at SMK N 1 Bukittinggi. This shows that the variables of the PJBL learning model partially affect learning outcomes. Creativity has a significant influence of 6.1% on the learning outcomes of students in class XI TKJ at SMK N 1 Bukittinggi. This shows that the variable of partial creativity according to the third hypothesis test has no effect on learning outcomes

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