



Analysis of Creativity Level of Learning Based on Problems on Learning Outcomes in Machine Design and Drawing Subjects in Vocational School

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Abstract. This activity is to observe learning outcomes in students by using problem-based learning (PBM) types and hands-on learning and observing learning achievements from students who have creativity levels. By paying attention to learning outcomes at a high level of creativity and low learning outcomes in the design and drawing subjects of machines at SMK PGRI 1 Surabaya. The results of the creativity level test in the experimental group were average of 80.10. Test results creativity level control group with an average of 79.60. Cognitive learning outcomes of experimental classes using learning based on problems weigh an average of 85.00. Meanwhile, control classes that use direct learning, cognitive learning results, obtained an average score of 83.03. The affective Achievements learned from experimental classes were obtained an average of 83.43. While the average affective learning outcome control group using direct Learning gets 81.43. Psychomotor learning results in experimental classes were obtained an average of 84.03. In this case, the results of the control class psychomotor learning were 82.37, There is the lowest score of 77, There is the highest score of 88. The conclusion obtained is learning outcomes in students who study to use problem-based learning models, have much higher student learning achievements that apply hands-on learning, and high-creativity students have cognitive learning outcomes, affective realms, and psychomotor realms, High students and students with low level of creativity in design subjects and machine drawing.

Keywords: Analysis · Creativity · Machine design and drawing

1 Introduction

The development of students' skills and creativity, especially vocational schools, continues to be improved, in order to create quality resources. This development begins with the existence of teaching procedures using various learning models. Creativity has been identified as the primary goal of education and a key ability in the 21st century [1]. The development of creativity and innovation to create a design presentation can be obtained from knowledge, experience, based on the pieces of images, image views, or

projections of images used. Creativity today is a success of creative people in personal and professional life [1].

An example of an innovative this learning pattern Problem-Oriented Learning. This types of learning invites participants for investigate a problem. PBM is a complete approach and is used by educators in helping students in finding solutions to problems that are not routine [2]. Problem-Based Learning becomes learning with model that can develop all aspects of learning, including cognitive, affective, and psychomotor aspects [3]. That problem-based learning is perfect for helping participants in producing thinking skills [4]. During the learning process, students can work together to get answers to diverse problems [2]. Problem-based learning is well-known learning and growing learning model [5].

Based on the results of observations in reality, Basic Design learning with a direct learning model, students are less interested in exploring creative ideas and less expressing creativity in making interesting presentation designs. This becomes an issue that will result in students not being encouraged to develop thinking skills, which students should be directed to be more creative and innovative [6–8]. The success of direct learning applied to class X design and machine drawing depends on the creativity of the teacher, the teacher's experience, the preparation of teaching devices, and the grammar used by the teacher. The limitations of the Direct Learning Model are: 1) The success of learning depends on the teacher [4]. If the teacher is less prepared, less sure, lack of enthusiasm, then students will be saturated, lack of concentration, and hampered by learning. 2) The demonstration depends largely on the student's ability to observe. Unfortunately, many students are not good observers, as a result of which they can miss what the teacher intended [9–12]. This research aims to analyses the inequality between student learning outcomes given teaching by using Problem based Learning models and direct learning and analyses learning outcomes for students whose creativity levels are high and student learning outcomes whose creativity is low in design subjects and machine drawings at SMK PGRI 1 Surabaya.

2 Materials and Methods

This research was made by quasi-experimental methods. This method aims to gain inequality from learning outcomes in the subjects of design and machine drawing given by teaching by using the PBM model and direct learning with its free variables, namely the learning model. The research was conducted, using Factorial Design, where subjects were divided into two groups, namely experimental groups that learned using problem-based learning models, and control groups were given teaching with direct learning. This research is influenced by several variables, namely: creativity levels, which are grouped into two levels, namely high creativity levels and low creativity.

Students of SMK class X Department of Mechanical Engineering, in the subjects of design and drawing of machines at SMK PGRI 1 Surabaya, are 60 students into population. Sampling is using simple random sampling techniques, with class X majoring in Mechanical Engineering in the subjects of design and machine drawing. Class XI TM-1 numbered 30 students as an experimental group, and class XI TM-2 numbered 30 students as a control group. To collect data using learning and observation results. The

learning outcome tests are used in determining the level of participants creativity and cognitive learning outcomes in experimental classes and control classes. Then, observations are made to measure the learning outcomes of the psychomotor realm as well as the results of learning the affective realm carried out during the implementation of teaching.

Tests are performed in order to measure learning outcomes, in the form of writing tests of description form and multiple choice. The cognitive realm is measured using multiple choice questions and descriptions, and to find out the level of creativity used questions in the form of descriptions. Furthermore, two teachers in the field of study and the head of the Department of Mechanical Engineering as observations. The test questions in the cognitive field are 45 items, with details consisting of 40 items are multiple choice questions, and 5 items in the description question model.

The test is done to find out the level creativity as much as 7 items with details of 5 questions. With a description and 2 questions done by practice, with a duration of 40 min.

3 Results and Discussion

3.1 Learning Device Validation Results

The learning devices used, consisting of: syllabus, RPP, LKS, and learning outcome evaluation sheets in the cognitive, affective, and psychomotor realms. The results of verification of learning devices this is shown in following Table 1.

By paying attention to Table 1, the average syllabus validation result can be obtained is 4.7; for RPP reaches 4.8; and LKS with an average of 4.7; so that all learning devices are declared very valid. While on the evaluation sheet the learning outcomes of the affective realm, and psychomotor reached an average of 4.9 and 4.6 in the category is very valid. On the assessment sheet the cognitive learning results get an average of 4.4 classified into valid categories and creativity level test sheets get an average of 4.7 classified as very valid.

3.2 Pre-test Results and Creativity Level Tests

3.2.1 Experimental Class and Control Class Pre-test Analysis

Pre-test assessment, using Independent Sample t-test statistics, so that the data is distributed normally and homogeneously. Different test results in independent samples, test against the experimental class as well because in the control group showed significance 0.715. The error rate used is 0.05, so the significance level of 0.715 bigger 0.05. This means that H_0 will be accepted and H_1 not accepted. Therefore, the subjects of designing and drawing of machines. it can be interpreted that at the initial ability from experimental groups Participants and control groups is no different.

3.2.2 Creativity Level Test Result Analysis

The results of the experimental class creativity level test received an average of 80.10, with the lowest score of 68 and the largest at 89. The results of the control class creativity

Table 1. Learning Device Validation Results

No	Learning Devices	Assessment Results Validator			Average	Information
		I	II	III		
1	Syllabus	4.5	4.9	4.7	4.7	Very Valid
2	RPP	4.8	4.8	4.8	4.8	Very Valid
3	LKS	4.5	4.8	4.9	4.7	Very Valid
4	Assessment Sheet a. Cognitive Realm	4.0	4.6	4.7	4.4	Valid
	b. Affective Realm	4.9	4.9	4.9	4.9	Very Valid
	c. Psychomotor Realm	4.7	4.8	4.4	4.6	Very Valid
5	Level Test Sheet Creativeness	4.6	4.8	4.8	4.7	Very Valid

Table 2. Analysis of Cognitive Realm Learning Outcome Scores Based on Learning Models

Source	Type III Sum of Squares	Df	Mean- Square	F	Sig.
Corrected Model	276,938 ^a	3	92.313	10.680	.000
Intercept	414367.694	1	414367.694	47938.888	.000
Level of Creativity	128.827	1	128.827	14.904	.000
Learning Model	36.427	1	36.427	4.214	.045
Learning Model* Level of Creativity	90.094	1	90.094	10.423	.002
Error	484.045	56	8.644		
Total	424289.000	60			
Corrected Total	760.983	59			

level test were obtained an average of 79.60, with the smallest score of 71 and the highest at 87.

3.3 Student Learning Outcomes

The average post-test of cognitive achievement of learning outcomes used in assessing learning outcomes. Furthermore, assessment of affective learning outcomes and psychomotor learning outcomes was used on average at 5 learning sessions.

Cognitive aspect learning outcomes in experimental classes taught with problem-based learning models were obtained an average of 85.00; where the smallest value is 76 and the largest value is 90. All students in the experimental class were declared complete, because they had a score above KKM, which was 75. In group control given

by teaching with direct learning, the learning outcome of the cognitive realm, reaching an average score of 83.03; with the smallest score 77 and the largest score 88.

The use of problem-based learning models in experimental classes, resulting in an average learning outcome in the affective realm of 83.43; The smallest score is 75 and the highest score is 90. Affective realms in the apply control group the direct learning model were obtained an average of 81.43; with the smallest score of 76 and the largest score 86.

The psychomotor realm in the experimental class average of 84.03 with the smallest score of 79 and the largest score of 88. Meanwhile, the psychomotor learning results in the control class amounted to 82.37 which had the smallest score of 77 and the largest score of 88.

3.4 Hypothesis Test

3.4.1 Testing the Outcome Hypothesis Based on the Learning Model

Testing of cognitive learning outcomes based on learning models, with SPSS, obtained the following results in Table 2.

In Table 2, data was obtained that the learning outcome in the cognitive realm with an F value was calculated at 4.214, with a significant level of 0.045. This can be interpreted that the results of learning in the cognitive realm by using PBM, with real higher than learning results that use direct learning.

This activity, the learning outcomes of the cognitive realm of students who are given teaching by using PBM are better than using direct learning models. The presentation design produced by the experimental class is very unique and diverse. While in the control class, students only follow the activities ordered by the teacher, the design of the dish that is produced is almost the same as his friends.

Affective domain testing using SPSS, obtained F-count of 4.725 and significance of 0.034. It has meaning score of affective learning outcomes by applying problem-based learning-model.

Psychomotor testing using SPSS, obtained F counted at 4.276 with a significant level of 0.043. This means that the score of psychomotor learning outcomes with PBM is significantly higher than that of learning outcomes with direct learning.

3.4.2 Hypothesis Testing of Student Learning Outcomes Based on Creativity Level

Testing this hypothesis to determine the difference in scores on student learning achievement based on the level of creativity in experimental classes and in control classes. Testing cognitive learning results based on creativity levels, obtained F count of 14,904 with a significance of 0.000. The resulting conclusion is that the score of learning outcomes in the cognitive realm Students who have high creativity will be higher than the score of learning results in the cognitive realm of students with low levels of creativity. Thus, there is a difference in value of learning outcomes in the cognitive realm that is very significant based on the level of creativity.

Testing of affective learning outcomes based on creativity levels was obtained by F hitung of 7,619 with a significance of 0.008. So, the conclusion is that students who are

highly creative, have higher cognitive learning results compared to students who have a low level of creativity. Testing psychomotor learning outcomes based on creativity level obtained F count of 12,037 with a significant level of 0.001. This means that the learning outcome scores of the psychomotor realm of students are high in creativity, higher than students who have low creativity.

4 Discussion

Students who were taught by using PBM in experimental classes, showed more active and creative than students in control classes who learned using direct learning. Student activities in experimental classes include: (1) students actively ask questions and discuss in the learning process; (2) students actively form study groups in preparation for receiving learning materials analyzing and making presentation designs; (3) students conduct discussions, conduct experiments applying some design presentation techniques and collecting information; and (4) students in groups present the results of experiments and conduct Q&A. While in the control group, student activities include: (1) students listening to the teacher's explanation regarding learning materials analyzing and making presentation designs; (2) students follow and imitate demonstrations of making some sort of design presentation techniques; (3) students answer the teacher's questions and record the teacher's explanation; and (4) students practice making a sequence of drawings with several techniques.

Students who study with a problem-based model have higher grades than students who are given teaching with a direct learning model [13, 14]. This can be carefully observed from results of learning results in the cognitive realm in experiment group of 85.00 and control group of 83.03. The affective learning outcome score in group experiments was 83.43 and the control group was 81.43 [15]. Furthermore, the psychomotor learning results score on variables eksperimen obtained 84.03 and in the control class 82.37.

This result as stated [4], that learning orientation problems is very good for helping students in producing thinking skills. Learning based on problems is considered more effective than direct learning when viewed from the aspects of student interest and creativity [16–18].

5 Conclusion

Students who are given teaching with the PBM model, get significantly higher grades compared to students who are given teaching by using direct learning, and students with a high level of creativity achievement higher than students with low creativity in design and machine drawing subjects.

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