Comparison of Problem Based Learning with Project Based Learning Assisted by Mobile Based Learning Media on Students' Learning Outcomes

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Article Info	ABSTRACT

This study presents the utilization of mobile-based learning media in a computer and basic networks. The use of mobile-based interactive media aims to help vocational students majoring in Computer and Network Engineering in learning productive subjects in computers and basic networks. Therefore, this study has a three purposes there are: (1) to discover the influence of Problem Based Learning (PBL) model on students' learning outcomes, (2) to discover the influence of Project Based Learning (PjBL) model on students' learning outcomes, and (3) to compare the PBL and PjBL on students' learning outcomes. The quasi experiment method is used in this research including control and experiment group with different treatment. The subject consists of 108 10th grade students of SMKN 1 Bagor. Data analysis using quantitative technique in this study. Result shows that there is good impact from PBL and PjBL model implementation assisted with mobile-based learning media on the students' learning outcome. In addition, there is a difference between PBL and PjBL implementation that the PBL give a more significant effect on students' learning outcomes.

I. INTRODUCTION

In the current era of technological developments, education are also increasingly developing and going along with existing developments. Technology now can cover and complete the deficiencies that exist in the education field. Learning is a process that involves students interacting not only with the teacher as a learning resource. Furthermore, the environment can also be said as the main source of learning, because through the environment, students can learn in a real or contextual way [1]. This is important in learning namely cognitive, effective and psychomotor changes.

The learning implementation is certainly inseparable from the elements of the media. The influence of the media in the learning process aims to make the learning process take place effectively and efficiently so that the quality of education can be improved [2].

Learning media is a tool in conveying material to students, so that it can facilitate students in receiving and understanding learning material [3]. With increasing student understanding, it also increases the quality of education. Learning media can be electronic or non-electronic. Non-electronic media can be in the form of textbooks, modules, worksheets and so on. Whereas electronic media can be in the form of PCs, Laptops, TVs, smartphones and so on. One of those technology is a smartphone that is classified in a mobile device.

The use of instructional media is important in learning, in order to convey subject matter to students [3]. Based on the level of experience there are four levels of material absorption according to the action and memory that is absorbed. Verbal with the action of listening to memory 10%, see pictures/ diagrams 30%, see video/film 30%. Then the visual action presents / presentation of 70% playing the role of 90%.

Creating interactive media as a delivery of material in the classroom is very necessary to attracting interest in learning and can also reduce student boredom due to lack of creative teachers in delivering material [4], [5]. Educators in general

only provide monotonous teaching with the only available materials.

Based on information submitted by teachers at SMK 1 Bagor, the teachers are currently using power point learning media, pdf modules and videos, so students often feel boredom and cause students to passively participate in learning. The impact at the time of the exam many of them were feel difficulties that impacted on the minimum score criteria. The possible solution is to implement a different learning model and approach to conduct a better learning activities.

The Problem Based Learning (PBL) model is student-centered learning activities [6], [7]. This model can reduce the dominance of teachers in teaching in the classroom. This learning model can get students used to solving problems given to the teacher and increase students' understanding of what they are learning.

Meanwhile, Project Based Learning (PjBL) Model is a learning model that uses problems as a first step in gathering and integrating new knowledge based on experience in real activities [8], [9]. This model designed to be used on complex problems that are needed by students in conducting investigations and understanding them.

From this background, the researchers conducted research to find out the differences in learning outcomes of Computer and Network Basic application of the PBL and PjBL learning model on students' learning outcomes.

II. METHOD

The method used in this study is quasi experiment. This method selected because the treatment given to research subjects is not completely controlled by the researcher. The population in this study were students of class X TKJ 1 Bagor in the academic year 2018/2019 consists of 108 students were divided into classes X TKJ 1, X TKJ 2 and X TKJ 3. The subject will divided into two group of control and experiment group that will give a different treatment.

The purpose sampling technique used to select and determine a data will used. The sample taken in this study based on: (1) the students' initial ability that statistically the same, obtained from the pretest results, (2) the students' characteristics who are close to the same are obtained from the consideration of the Computer and Basic Network teachers.

III. RESULT AND DISCUSSION

A. Requirements Analysis Test

First, the analysis prerequisite test is used to find out whether the data on the average competency of the experimental class and the control class are normally distributed and homogeneous before the hypothesis test. The data of students' initial ability obtained from the pretest score.

TABLE I. STUDENTS' INITIAL ABILITY

Class	Minimum score	Maximum score	Avg.
Exp 1	26	53	44,3
Exp 2	40	60	41,5
Control	26	53	46,5

TABLE II. T-TEST STUDENTS' INITIAL ABILITY

Class	N	Avg.	Asymp-Sig
Exp 1	36	54,13	0,198
Exp 2	36	42,36	0,139
Control	36	51,08	0,571

TABLE III. NORMALITY TEST STUDENTS' INITIAL ABILITY

Class	N	Asymp-Sig	Info
Exp 1	36	.084	Normal
Exp 2	36	.261	Normal
Control	36	.131	Normal

After that, the homogeneity test used to determine whether the data from the sample obtained is homogeneous or not. Homogeneity test was performed using the Levene's test with a significance level of 0.05.

TABLE IV. HOMOGENEITY TEST STUDENTS' INITIAL ABILITY (PRETEST)

Class	Asymp-Sig	Leven's	Info
Exp 1 & Exp 2	.160	2.019	Homogen
Exp 2 & Control	.729	.121	Homogen
Control & Exp 1	.729	.121	Homogen

Based on the results it can be seen that the students' initial ability in Computer and Basic Networks in experimental class 1 and experiment 2 has a significance of 0.160. This shows that the initial ability value of experimental class 1 and experiment 2 before being treated has the same homogeneous variance. Then the students' initial ability in computer subjects and basic networks in experimental class 1 and control has a significance of 0.729. This shows that the initial ability score of experimental class 1 and experiment 2 before being treated has the same homogeneous variance. And the initial ability of students in computer subjects and basic networks in the control class and experiment 1 has a significance of 0.729. This shows that the initial ability score of experimental class 1 and experiment 2 before being treated has the same homogeneous variance.

After the students' initial ability analyzed, then the final ability also analyzed with the normality and homogeneity test. Homogeneity test was carried out using Levene's test. The data tested were the students' final ability by using data scores from the posttest with a significance level of 0.05. Homogeneity test of student learning outcomes on the student's final ability.

TABLE V. FINAL ABILITY TEST

Class	Minimum score	Maximum score	Avg.
Exp 1	70	96	85,66
Exp 2	70	90	82,22
Control	73	86	79,05

TABLE VI.   NORMALITY TEST STUDENTS' FINAL ABILITY

Class	N	Asymp-Sig	Info
Exp 1	36	.158	Normal
Exp 2	36	.342	Normal
Control	36	.174	Normal

TABLE VII.   HOMOGENEITY TEST STUDENTS' INITIAL ABILITY (POSTTEST)

Class	Asymp-Sig	Leven's	Info
Exp 1 & Exp 2	.625	.241	Homogen
Exp 2 & control	.898	.017	Homogen
Control & Exp 1	.745	.106	Homogen

Based on the results of the table above, it can be seen that the learning outcomes of students in the subject Computer and Elementary Finger in the experimental class 1 and the experimental class 2 have a significance value of 0.625. This shows that 0.625> 0.05 which shows the value of the final learning outcomes of experimental class 1 and experimental class 2 after being treated has the same or homogeneous variance. Then the learning outcomes of students in Computer and basic networking subjects in the experimental class 1 and the control class have a significance value of 0.898. This shows that 0.898> 0.05 which shows the value of the final learning outcomes of experimental class 2 students and the control class after being treated has the same or homogeneous variance. Furthermore, students' learning outcomes in computer subjects and basic networks in experimental class 1 and control class have a significance value of 0.745. This shows that 0.745> 0.05 which shows the value of the final learning outcomes of experimental class 1 students and the control class after being treated has the same or homogeneous variance.

B. Hypothesis Test

TABLE VIII.   T-TEST STUDENTS' FINAL ABILITY (A)

Class	N	Asymp-Sig
Exp 1 & Exp 2	36	0,022

Based on the above table it can be seen that the learning outcomes data on the final abilities of students between experimental class 1 and experiment 2 is seen from the Sig. (2-tailed) value of 0.022. This shows that 0.022 <0.05, then Ho is rejected by Ha. So, it means that there is a significant difference between student learning outcomes in experimental class 2 using the Project Based Leaning model to experimental class 1 using the Problem Based Leaning model assisted by mobile-based learning media.

TABLE IX.   T-TEST STUDENTS' FINAL ABILITY (B)

Kelas	N	Asymp-Sig
Eksn 2 & Kontrol	36	0,031

Based on the table above it can be seen that the learning outcomes data on the final ability of students between experimental class 2 compared to the control seen from the Sig. (2-tailed) value of 0.031. This shows that 0.031 <0.05,

then Ho is rejected by Ha. Then, it means that there is a significant difference between student learning outcomes in experimental class 2 using the Problem Based Leaning model to the control class using conventional models assisted by mobile-based learning media.

TABLE X.   T-TEST STUDENTS' FINAL ABILITY (C)

Class	N	Asymp-Sig
Exp 1 & Control	36	0,000

Based on the above table it can be seen that the learning outcomes data on the final abilities of students between experimental class 1 compared to experiment 2 is seen from the Sig. (2-tailed) value of 0,000. This shows that 0.00 <0.05, then Ho is rejected by Ha. So, it means that there is a significant difference between student learning outcomes in experimental class 1 using the Problem Based Leaning model to the control class using conventional models assisted by mobile-based learning media.

C. The effect of PBL to improve learning outcomes

The first objective in this study is to reveal whether there are differences in learning models in the control class with PBL in Computer and Basic Network subjects compared to learning outcomes assisted by mobile-based learning media. With PBL, students seem to have cooperation and mutual respect for the opinions of friends even though mastery of the material is still not good because online marketing subjects are not limited to concepts [10]. In daily life, especially in the school environment problems can arise and students are required to be able to determine the solution of a problem they face. With, accustomed to solving problems so students can get used to determining solutions, especially in subjects Computer and Basic Networks.

Significant differences in knowledge competence in experimental class 1 with the control class were obtained from the posttest scores given to students after students received different treatments. The experimental class 1 get teaching with the PBL, while the control class gets teaching with the conventional model. The average value of experimental class 1 on knowledge competence reached 85.66 turned out to be higher than the average value of control class students, which is 79.05.

This study using learning media that is mobile applications that are referenced in the K13 syllabus Computer subjects and Basic Networks. Basic Competency used in this study is Evaluating Local Network Design. The results of the research after being treated using the PBL assisted by a mobile application applied to class X TKJ 1 as an experimental class 1 obtained pretest and posttest data which is the learning outcome data in Computer and Basic Network subjects. Posttest scores from learning outcomes were obtained from research during two meetings, not only that this research also requires pretest scores. Pretest scores are obtained from students who were given treatment before.

While in the conventional model, there is no emphasis on students' personal responsibility to explore their ideas towards

the problem solving process individually. Students are only given material in the same direction by the teacher and students only see it, hear it and take notes. The teacher conveys the material through direct lectures using PowerPoint assistance, explains coherently the material that must be mastered by students and provides further training to determine the level of student understanding. The direct-instruction model is only possible for students who have the ability to listen well. While some students who are not really sincere and do not fully concentrate in participating in learning activities will quickly feel bored if they have to learn by using the direct learning model. Moreover, the direct learning model is also not possible to serve the differences of each individual. Students who have a level of cognition above the average will feel bored quickly if the teacher serves students who have low levels of cognition, conversely students who have low levels of cognition will find it difficult to follow the lesson if the teacher only serves students whose cognitive levels are above average.

The effect of the application of students who were given the treatment of PBL in the experimental class 1 and conventional models in the control class was carried out during two meetings. Based on data on learning outcomes in computer subjects and basic networks of class X TKJ 1 and X TKJ 3, the average posttest given PBL model treatment was 85.66 greater than the class given conventional model treatment of 79.05, then can be seen the difference in average class of the two models of 6.51. The value obtained in the t-test to determine the significance of the effect of applying the PBL model and the conventional model is known from the Sig value (2 tailed) of 0.00 which indicates that 0.00 <0.05, which indicates Ho is rejected and Ha is accepted. This means that in this study there are differences in students who are given the treatment of PBL assisted by mobile applications compared to students who are given treatment of conventional learning models assisted by mobile applications for learning outcomes.

D. The effect of PjBL to improve learning outcomes

The second objective of this study is to reveal whether there are differences in the Learning Model in the control class compared to the PjBL assisted by mobile-based media on learning outcomes in the basic network subjects. PjBL is an approach that involves a project in the learning process.

The effect of the PjBL learning models in the experimental class 2 and conventional models in the control class was carried out during two meetings. Based on data on learning outcomes in computer subjects and basic networks of class X TKJ 3 and X TKJ 2, the average posttest given the treatment of the PjBL model was 82.22 greater than the class given the conventional model treatment of 79.05. It can be seen that the difference in class average of the two models of 2.72. The value obtained in the t-test to determine the significance of the effect of applying PjBL models and conventional models is known from the Sig value data (2 tailed) of 0.031 which shows that 0.031 <0.05, which indicates Ho is rejected and Ha is accepted. This means that there are differences in students who are given treatment models of PjBL learning assisted by mobile applications compared to students who are given

treatment of conventional learning models assisted by mobile applications for learning outcomes.

E. Differences of PBL and PjBL Implementation

The third objective of this study is to reveal the differences of PBL and PjBL implementation. The results of applying PBL can improve learning outcomes creatively where students will be more active in the learning process with learning outcomes on computer subjects and basic networks individually or in groups. By giving problems, students will understand the material and ask for materials and problems that are not understand. The PBL model consists of five steps namely: (1) There is a clear problem to be solved. This problem must grow from students according to ability. (2) Looking for data or skills that can be used to solve the problem. For example by reading books, writing, researching, asking questions, discussing, and others. (3) Establish a temporary answer to the problem. This alleged answer is of course based on the data obtained from the second step above. (4) Test the correctness of the temporary answer. In this step students must try to solve the problem so that they are sure that the answer really fits. (5) Draw conclusions. That is, students must arrive at the final conclusions about the answers to these problems. With the steps of the PBL model student learning outcomes will improve and students will find it easier to determine solutions to solving computer problems and basic networks. The statement was strengthened by previous research that PBL requires students to think creatively in developing their ideas when solving mathematical problems which unlike conventional problem solving methods [11]. PBL places more emphasis on the need to postpone judgment of ideas from solutions obtained until a final decision is made.

Based on data on learning outcomes in Computer and Basic Network subjects from class X TKJ 1 and X TKJ 3, the average posttest given PBL model treatment was 85.66 greater than the class given PjBL model treatment amounted to 82.22. Then, it can be seen the difference in class average of the two models of 3.44. The value obtained in the t-test to determine the significance of the effect of applying PBL and PjBL models is known from the Sig. (2-tailed) data value of 0.022 which indicates that 0.022 <0.05, which indicates Ho is rejected and Ha is accepted. This means that in this study there are differences in students who are given the treatment of PBL learning models assisted by mobile applications compared to students who are given treatment of PjBL learning models assisted by mobile applications for learning outcomes. The hypothesis is as follows:

Ho: there is no significant difference between student learning outcomes in the experimental class using the PBL to the experimental class using the PBL assisted by mobile-based learning media.

Ha: there a significant difference between student learning outcomes in the experimental class using the PBL to the experimental class using the PBL assisted by mobile-based learning media.

Based on the description, it can be concluded that there is a significant difference between students who are given PBL treatment and students who are given PjBL treatment towards

learning outcomes in Computer and Basic Network subjects. The difference is caused by several factors where the PBL model encourages students to be creative in solving problems that start from understanding the problem itself compared to the PjBL model which focuses on determining the solution of the project without understanding the problem. Other factors that influence include, the ability of each student in the class, motivation to learn and the condition of students in each class. However, the achievement of students was not entirely achieved by the successful application of the PBL learning model and the PjBL model. Both learning models are equally good if applied to improve student learning outcomes.

IV. CONCLUSION

Based on the results of research and data analysis, there are several conclusion. There is an improvement in learning outcomes for students who are treated with PBL assisted by mobile applications compared to students who use conventional model treatment assisted by mobile applications. The improvement is seen from the average acquisition obtained before being given experimental treatment the average learning outcomes are in the medium category. Whereas after being given experimental treatment the average learning outcomes were in the very high category. There is an improvement in learning outcomes for students who are treated with PjBL assisted by mobile applications compared to students who use conventional models for treatment assisted by mobile applications. The improvement is seen from the average acquisition obtained before being given experimental treatment the average learning outcomes are in the medium category. Whereas after being given experimental treatment the average learning outcomes are in the very high category.

In addition, there are differences in learning outcomes for students who are treated with PjBL assisted by mobile applications compared to students who use PBL assisted by mobile applications. The difference is shown in the results obtained in the following four aspects: (a) the average value, (b) completeness of learning, (c) the value of the gain score, and (d) the analysis of indicators showing that the acquisition of 4 aspects in the experimental class 1 higher than the experimental class 2.

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