Problem-Based Blended Learning in Computer and Basic Network Learning in Vocational High Schools

D I Perwitasari¹ and Soenarto ²

¹,² Informaticc and Electronics Education, Postgraduate Program, UNY, Indonesia.

E-mail: devianty.intan2016@student.uny.ac.id

Abstract. The main activity in education is teaching and learning activities where teachers learning to teach and students learn. One effort to improve the quality of education in Vocational High Schools is curriculum development and the development of learning models. The teacher in the learning process is a facilitator where the teachers master the learning model that is appropriate to the group conditions and the nature of the teaching method. Learning models that can be used by teachers is Problem-Based Blended Learning. The purpose of this research is to find out blended learning based on learning issues on computers and basic networks. This research is using experimental method. The population in this study were all students of group X SMK Negeri 1 Kasreman. The sample of this study was group X TKJ 1 and group X TKJ 2. Data collection techniques in this study were observation, questionnaires and tests. Data analysis techniques are normality test, homogeneity test, and hypothesis test (t-test) of student learning outcomes. The results show that Problem-Based Blended Learning has a significant effect on student learning outcomes and can be applied in computer and basic network learning.

1. Introduction

Education is a planned to develop all the potential abilities of students to be improved for the better skill. Education itself is organized to develop all potential students. One effort to achieve the goals of education is to organize vocational education [1]. Vocational education is education to prepare labor supply. Vocational graduates must have knowledge according to the standard of competence of vocational school graduates [2].

Daily activities in vocational education are learning activities. This shows that the success or failure of educational achievement depends on how the learning process is designed and carried out professionally. Educational achievement can be done by improving the quality of learning through updates in the curriculum [3]. SMK graduates must have knowledge according to the standard of competence of vocational school graduates. Competent vocational graduates can be achieved by carrying out learning in according to 2013 curriculum and with the cooperation of various parties, it including the teacher's role [2].
The main role of the teacher in learning is as a facilitator, which is someone who helps students to learn and has the skills needed to achieve learning goals. The task of the facilitator in the learning process is to be an active partner who asks questions, stimulates students' minds, motivates students, creates problems that contain various alternative answers, allows and encourages students to describe their ideas, describes concepts they believe in, then finally critically examines students' concepts [4]. Other skills that teachers must have as facilitators are mastering the learning model so that teachers must be able to develop learning models.

The learning model is a step-by-step procedure that brings specific learning outcomes to achieve learning goals. The teacher makes efforts to develop learning models so that learning becomes interesting, fun, and motivates students to learn independently [5].

The teacher's efforts in developing learning are accompanied by the development of information technology. One form of application of information technology is the existence of computer-aided learning as a driver for the achievement of a better learning process because information technology makes it easy to access information anywhere, anytime and is supported by the existence of internet facilities [6].

One of the uses of the internet in learning is when the implementation of blended learning that combines different types of learning techniques and technology by combining face-to-face learning and online learning activities. [7]. Blended learning is a learning model using face to face (f2f) models, using the internet, and supported by other technologies that aim to create an efficient learning environment. Implementation of Blended Learning combines online and conventional learning, technology and media for delivering material, and individual and group learning [8] to produce effective, efficient and flexible learning [9].

Blended learning aims to redesign structures and approaches in teaching and learning [10]. Other objectives of blended learning include: (1) helping students to develop learning process skills according to learning styles and preferences in learning, (2) providing practical and realistic opportunities for teachers and students to learn independently, useful and continuously developing, and (3) increasing scheduling flexibility for students, by combining the best aspects of face-to-face and online learning. Face-to-face groups can be used to engage students in interactive experiences, online groups provide students with multimedia content that is rich in knowledge at all times and anywhere as long as students have internet access[11].

Learning with blended learning transforms the paradigm of teacher centered into student centered. The best learning process is the teacher helping students to study subject matter actively. The teacher as a facilitator helps provide experience to students in designing problem solving related to the subject matter so that students are expected to be able to interact to produce solutions to problems[12]. Learning that is designed with problem solving orientation can lead to effective communication and students are able to collaborate with other students in solving a problem[13].

Problem-based learning is an development of active learning and a student-centered learning approach, which uses unstructured problems as a starting point and anchor for the learning process [14]. Problem-based learning will be able to help students to develop the ability to think and solve problems and to be independent learners [15]. There are 5 phases (stages) that need to
be done to implement PBL. These phases refer to the practical stages carried out in learning activities with PBL namely: (1) student orientation to the problem, (2) organizing students on problems, (3) guiding individual and group investigations, (4) developing and presenting work, and (5) analyzing and evaluating problem solving [16].

Problem solving in learning is a human activity that combines concepts and rules that have been obtained previously, and not as a generic skill. It implies that when someone has been able to solve a problem, then someone has a new ability. This ability can be used to solve relevant problems. The more problems a person can solve, the more he has the ability to help him navigate his daily life, including in the grouproom. [17].

Learning is a process used to direct students with conditions that help them achieve learning goals. Some learning objectives are cognitive consisting of intellectual knowledge and thinking skills, affective means that students’ feelings or values perceived by students, and psychomotor consists of skills and physical responses [18].

Learning activities have a purpose to achieve learning outcomes that achieve predetermined competencies. Learning outcomes are changes in behavior in a person that can be observed and measured in the form of knowledge, attitudes and skills. This change can be interpreted as an improvement and development that is better than before and those who do not know become aware. Learning outcomes can be interpreted as the maximum results that have been achieved by students after experiencing the teaching and learning process in studying certain subject matter. Learning outcomes are not absolute in the form of values, but can be in the form of changes or improvements in attitudes, habits, knowledge, tenacity, fortitude, reasoning, discipline, skills and so on that lead to positive change. Learning outcomes show the ability of actual students who have experienced the process of transferring knowledge from someone who can be said to be an adult or have less knowledge. So with the results of learning, people can find out how far students can catch, understand, have certain subject matter. So that teacher can determine better teaching and learning strategies [19].

One of learning strategy that can be used in learning is problem-based blended learning that combines face-to-face learning with online learning to produce effective, efficient and flexible learning. In this learning, information and communication technology is integrated with the world of education, and it can be applied on learning of computers and basic networks.

The application of problem-based blended learning in vocational schools provides students with opportunities to learn through online instruction. Problem-based blended learning facilitates students to have a deeper learning experience and shows the ease of getting information online, while the problems that are given become student stimulus [20] to develop problem solving skills in computer and basic network subjects. Problem-based blended learning also has the potential to encourage students to improve understanding and knowledge [21] and provides a learning environment to find solutions to problems using various references on the internet [22].

Computers and basic networks are one of the subjects in the 2013 curriculum for Vocational High Schools with the fields of Information and Communication Technology expertise, Computer and Informatics Engineering expertise programs, Group C (Vocational) with an allocation of two credits in semester one. Utilization of information technology and
Communication on Problem-based blended learning in computer and basic networks learning can provide challenges and opportunities for students to be educated and trained through online instruction [23]. Problem-based blended learning is implemented by considering the potential of problem-based blended learning. The results of problem-based blended learning can be seen from the learning outcomes obtained by students after participating in learning that combines online and face-to-face learning and uses problems as stimuli.

2. Method

This research is a quantitative research using quasi experimental design which is one form of experimental design. In this study requires experimental groupes and control groupes that have naturally formed in one group (one group). Both the control group and the experimental group get the same treatment in terms of objectives and content of teaching materials, the difference is in the learning method used, the experimental group with problem-based blended learning and control group with direct instruction method as usual on basic network subjects. The research design is shown in table 1.

| Group  | Pretest | Perlakuan | Postest | Learning Outcome |
|--------|---------|-----------|---------|-----------------|
| Experiment | O1 | X1 | O2 | Y1 |
| Control | O1 | - | O2 | Y1 |

Explanation:
O1 : Pre test experimental and control groups
O2 : Post test experimental and experiment groups
X1 : Learning with Problem-based blended learning
Y1 : Learning outcomes of experimental and control groups

The independent variable in this study is the learning method used. The experimental group uses a problem-based blended learning method while the control group uses the direct instruction method as usual. While the dependent variable in this study is student learning outcomes. Relationships between variables are shown in Figure 1.

Data collection in this study uses observation, questionnaires and tests. Observations are used at the time of the preliminary study with the aim to find out the learning model that is usually used by teachers in schools used for research. Questionnaires were used for validation of basic
network learning models and materials. While the test used to measure learning outcomes is an objective test.

Test instruments used to measure student learning outcomes can be said to be good if they meet two important requirements, namely valid and reliable. Validity is defined as a reference to suitability, truth, meaningfulness, and usefulness in research conducted based on data collected while reliability is the determination of a test if it is tested on the same subject.

Data analysis techniques used to test hypotheses are t-test. Before testing the hypothesis, an analysis prerequisite test is performed, namely the normality test and homogeneity test. Normality test is used to find out whether the data to be tested is normally distributed or does not use the Kolmogorov-Smirnov test with the provisions if the value of Asymp.Sig. > 0.05 then the data is normally distributed, while if the value of Asymp.Sig. <0.05, the data is not normally distributed.

3. Results and Discussion

Problem-based blended learning application in the experimental group has two stages of interconnected activities. Students can do learning activities, such as reading material, doing assignments, and discussing with teachers and other students in online groups. Face-to-face learning in group uses PBL learning steps which consist of initial activities, core activities, and closing activities. In the control group learning activities are carried out face to face using the direct instruction method as is usually done by the teacher.

The learning treatment starts after the Experiment and Control group students do the pretest. The results of the pretest showed the students’ initial ability before being treated with the learning model. The initial ability of students is then analyzed by t-test which shows that both groupes have initial abilities that are not significantly different.

The next step is to give treatment to the experimental group X TKJ 1 and control group X TKJ 2 according to the research design. After being given treatment, both groupes are given tests to find out the learning outcomes of computers and basic networks. Decryption of learning outcome data can be seen in Table 2.

| Group     | Minimum | Maximum | Average |
|-----------|---------|---------|---------|
| Experiment| 57      | 87      | 71.12   |
| Control   | 43      | 83      | 66.15   |

Before testing the hypothesis, an analysis prerequisite test is performed, namely the normality test and homogeneity test. The normality test is conducted to find out whether the data to be tested is normally distributed or not. The results of the normality test can be seen in table 3.
Table 3. Normality Test

| Group   | Sig. | $\alpha = 5\%$ | Explanation |
|---------|------|-----------------|-------------|
| Experiment | 0.109| 0.05            | normal      |
| Control   | 0.156| 0.05            | normal      |

Table 3. Shows that the significance value > 0.05, it means that both groups are normally distributed.

The homogeneity test aims to find out whether the sample comes from a homogeneous population or not. This homogeneity test is carried out using the F-test with a significance level of 5%. The homogeneity test results are presented in table 4 below.

Table 4. Homogeneity Test

| Data        | Sig. | $\alpha = 5\%$ | Explanation |
|-------------|------|-----------------|-------------|
| Learning    | 0.588| 0.05            | Homogenous  |
| Outcome     |      |                 |             |

Based on table 4, it can be seen that the value of the significance is > 0.05 so it is concluded that the two samples come from a homogeneous population. Furthermore, hypotheses was tested using a t-test. The hypothesis proposed in this study is the application of problem-based blended learning has a significant effect on student learning outcomes. The results of the t-test are shown in table 5.

Table 5. t-test Results

| Data     | Sig. | $\alpha = 5\%$ |
|----------|------|----------------|
| Learning | 0.039| 0.05           |
| Outcome  |      |                |

Based on table 5, it is known that there are differences in learning outcomes between the experimental group and the control group. Next Table 6. shows the results of the t-test with a significance value > 0.05, which means that there is a significant difference in learning outcomes between the experimental and control groups. Thus problem-based blended learning has more influence on student learning outcomes compared to learning direct instruction in the control group. Differences in the average student learning outcomes can be seen in Figure 2 below.

![Figure 2. Differences average in student learning outcomes](image-url)
Problem-based blended learning is a combination of Blended Learning with Problem-Based Learning models. Problem-based blended learning application shows significant differences in average learning outcomes between experimental groups that use Problem-based blended learning with control groups that use direct instruction which is usually done by teachers where the experimental group value is higher than the control group. It shows that problem-based blended learning has a significant effect on student learning outcomes. Students in an online group gets material, a discussion, and exercises that can be studied independently. In face-to-face groups, students gain learning experience by making unstructured problems as a starting point in the learning process.

The application of problem-based blended learning is a combination of Blended Learning with Problem-Based Learning can support each other in face-to-face learning and online learning [24][25]. Blended Learning is a learning approach with a modern scenario [26] which combines face-to-face learning experience and learning through online instruction [10]. In problem-based blended learning students can do learning independently, useful and continue to grow and provide flexibility for students to get information about the knowledge they need in learning [11][27]. Blended learning with PBL strengthens learning by providing content that is relevant to the times and using self learning materials[28].

Online learning with a combination of problem-based learning can lead students to find facts and concepts from solving authentic problems faced that relate to everyday life and be used as a stimulus to learn [29]. The application of problem-based learning can involve students actively in the learning experience, re-access the knowledge previously possessed and direct students to a deeper understanding[30]. Besides that problem-based learning will be able to help students to develop thinking and problem solving skills and make them independent and independent learners [15].

4. Conclusion and Suggestion

Based on the results of the study concluded that there are differences in the average learning outcomes of computers and basic networks that are significant between groups with problem-based blended learning and groups with direct instruction. Groups with problem-based blended learning have an average value of higher learning outcomes, namely 71.12 while the group with direct instruction 66.15. This shows that problem-based blended learning affects student learning outcomes.

Suggestions that can be given based on the conclusions obtained include: (1) problem-based Blended learning can be used by teachers to overcome the limitations of time and space in learning in Schools and can be used as an alternative learning to improve student learning outcomes, (2) The school can add facilities like the internet network to be used optimally by teachers and students in the learning process, and (3) Researchers can then try out on other subjects, develop this research more deeply by using more varied data collection techniques so that the data collected is more accurate and in-depth, and conduct research on a wider population and more samples in order to obtain better data generalization.
5. References

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