Jurnal

Guru Komputer

Journal homepage: <u>https://ejournal.upi.edu/index.php/JGrKom</u>



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ABSTRACT	ARTICLE INFO
In the learning process of informatics subjects in SMKN 11 Bandung, only two out of ten groups managed to complete making the LAN cable correctly. Meanwhile, the other eight groups were still unsuccessful. Therefore, classroom action research was created with the aim of increasing students' cognitive understanding through a problem-based learning model on computer network and internet subject competencies by making LAN cables where the number of groups is adjusted to the number of tools and grouping of students is done from pretest results or abilities. beginning. From this research, the results showed that the application of the Problem Based Learning (PBL) learning model can improve students' abilities before and after being given treatment using normalized gain test calculations by obtaining an average gain of 0.61 in the "Medium" category.	Article History: Submitted/Received 04 Jan 2024 First Revised 11 Feb 2024 Accepted 01 Jun 2024 First Available Online 01 Jul 2024 Publication Date 01 Jul 2024 Keyword: Cognitive understanding, LAN, Project Based Learning.
cognitive understanding through a problem-based learning model on computer network and internet subject competencies by making LAN cables where the number of groups is adjusted to the number of tools and grouping of students is done from pretest results or abilities. beginning. From this research, the results showed that the application of the Problem Based Learning (PBL) learning model can improve students' abilities before and after being given treatment using normalized gain test calculations by obtaining an average gain of 0.61 in the "Medium" category.	Keyword: Cognitive understanding, LAN, Project Based Learning.





1.INTRODUCTION

Education is the main foundation in developing the intellectual capacity and skills of students. Cognitive understanding of students is a benchmark for the quality of education in an institution. In facing global challenges and the complexity of the modern world, improving cognitive understanding of students is an urgent need. One of the cognitive skills that students need to learn is to compare between similar object, which will be useful in identifying which of the compared object is the better or correct one (Maknun, 2020), and it can be used in learning Computer networks subject. The limitations of practical tools and the application of differentiated learning approaches are factors that can affect cognitive understanding of students in practical learning.

Based on observations made at SMKN 11 Bandung in the Informatics subject with Computer Networks and the Internet, students' cognitive understanding is less than optimal due to a lack of practical tools, and grouping is not based on students' initial abilities. As a result, only two out of ten groups successfully completed the LAN wire creation process. While the other eight groups did not succeed. Furthermore, teachers have not fully developed each student's competency, resulting in only a few pupils participating actively in practical tasks. Studies by Ananda and Yunus (2017) also yielded the same result, which proved that there are concerning lack of understanding in LAN wire creation process.

Practical learning is fundamental when it comes to learning LAN wire creation. Fitra Yodi et al (2023) stated that through practical learning, students can learn continuously and apply them in real life. Learning facilities in schools play an important role in determining the success of students in the learning process, which in this case includes workshop facilities and the availability of tools and equipment as a means and media for student learning in vocational schools. The provision of facilities in the workshop where the practice takes place must be adjusted to the learning needs of students both in terms of quality and quantity. Complete facilities in the workshop and their good quality are good learning conditions to improve students' knowledge and skills. Insufficient and inadequate facilities will hinder the learning and teaching process. A student in carrying out learning activities requires certain encouragement in order to produce cognitive understanding as expected. One of the causes that can affect students' cognitive understanding is the workshop facilities used during the practicum process.

In addition to limited practical tools, differentiated learning is also a factor that can affect students' cognitive understanding. Differentiated learning is a learning strategy that accommodates the diversity of students based on their learning readiness, learning interests, and learning styles to ensure optimal cognitive understanding (Jayantika& Santhika, 2023). Evaluation of cognitive understanding can be used to determine student success based on predetermined standards, such as minimum completion scores. Several previous studies have provided a strong basis for the application of differentiated learning in improving students' cognitive understanding. The application of differentiated learning in mathematics subjects can increase students' interest in participating in the learning process.

One of the most determining factors in the success of the learning process is the learning model used by the teacher. Based on the results of observations, the practical learning process carried out by teachers in the classroom is still a bit monotonous and rigid because teachers only teach using lecture and demonstration teaching methods; this causes students to have a tendency to have low cognitive understanding.

Based on the temporary assumptions that have been presented, the researcher is interested in researching the influence of the use of learning models (problem-based

learning) on this informatics subject. Problem-based learning can increase student's participation, and along with that, can also increase learning outcome (Ekowati, 2023). Thus the researcher intends to conduct research with the title "Implementation of Problem-Based Learning Models in Informatics Subjects to Improve Students' Cognitive Understanding." The application of the problem-based learning model is expected to improve and make it easier for students to understand the material presented.

2. METHODS

2.1. Research Design

In this stage, the research design used is One-Group Pretest-Posttest Design. The flow of this research is that the class used in the research class (experimental class) is given a pre-test (O_1) and then continued with the provision of treatment (X), namely by grouping students based on the results of the pre-test scores, after which they are given a post-test (O_2) . Thus the results of the treatment can be known accurately because they compare with the conditions before the treatment was carried out. In simple terms, the research design can be seen in **Table 1** below:

Pre-Test	Treatment	Post-Test
01	Х	02

Information :

X = Treatment in the form of media use
O₁ = Pretest scores
O₂ = Posttest scores

2.2 Population and Sample

The population in the study that became the population was students of class X PPLG 2 SMK Negeri 11 Bandung. Sampling used non-probability sampling with a purposive sampling technique. Using purposive sampling technique because the sample selected is based on the consideration of informatics subject teachers and the results of observations that have been carried out at the school where this research is located.

2.3. Research instruments

Research instruments are one of the tools used to obtain, process, and interpret information from respondents. Several research instruments are used to obtain the required information. The instruments used in this study are observation instruments in the form of observation guidelines, test instruments in the form of a collection of multiple-choice questions, student response instruments in the form of reflection sheets, and instruments for increasing understanding in the form of test instruments.

2.4. Data Analysis Techniques

In this study, the following data analysis techniques were used:

- 1.) Analysis of field study instrument data conducted through observation.
- 2.) Analysis of question instrument data, consisting of reliability tests, difficulty level tests, and discriminatory power. For data processing using Anatest V4.

3.) Analysis of student response instrument data, using reflection sheets.

4.) Analysis of cognitive understanding instrument data using a gain test to determine whether or not there was an increase in student abilities after being given treatment.

2.5. Research Implementation Procedures

This research was conducted at SMK Negeri 11 Bandung. The students who were the subjects of this classroom action research were students of class X PPLG 2 SMK Negeri 11 Bandung. The research method used was the Classroom Action Research (CAR) method for one cycle.



Figure 1. One Cycle Classroom Research Action

2.5.1. Planning

Before conducting CAR research, researchers make a design or preparation in teaching. In terms of formulating proposed activities deemed necessary to achieve the best results, planning includes the act of selecting and connecting facts and making and using assumptions about the future. There are several steps that can be taken in this activity, namely: 1) preparing a learning plan, 2) preparing the necessary learning tools such as teaching modules, LKPD, and so on, and 3) preparing evaluation tools.

2.5.2. Implementation

After all planning activities are completed, then the implementation stage is carried out, which is the main activity in the classroom action research cycle. In the implementation of this action activity, the following activities consist of:

- a.) Initial Activities
 - 1. Greeting, greeting students, checking their readiness to learn, and checking attendance.
 - 2. Explaining the learning objectives to be achieved.
 - 3. Giving a pre-test to determine the initial abilities of students.
- b.) Core Activities

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- 1. Explaining the general description of the learning material briefly and clearly.
- 2. Divide groups based on the results of the pre-test.
- 3. Inviting students to work on the practicum together in groups.
- 4. Monitoring students' practicum activities.
- 5. Inviting students to fill out the LKPD reflection sheet.
- 6. Providing a post-test to determine students' cognitive understanding.
- c.) Closing Activities
 - 1. Guiding students to summarize the learning outcomes.
 - 2. Delivering learning materials that will be studied in the next meeting.
 - 3. Closing the learning.

2.5.3. Observation

Thoroughly review the actions that have been taken based on the data that has been collected, then evaluate in order to perfect the next action.

2.5.4. Reflection

The purpose of reflection is to evaluate the progress that has been achieved and the shortcomings or challenges that need to be overcome. The results of this reflection will be used to determine further steps in an effort to achieve the objectives of the classroom action research that have been set. In other words, reflection is an assessment of the success and failure in achieving temporary goals and determining follow-up actions in order to achieve the end.

3. RESULTS AND DISCUSSION

This classroom action research began with conducting learning observations at SMK Negeri 11 Bandung in class X PPLG 2. This activity was carried out on October 24, 2023. Students in class X PPLG 2 SMK Negeri 11 Bandung total 35 students, consisting of 26 male students and 9 female students. This study used one cycle, with computer and internet network material. The first cycle explains the definition of local networks, the function of local networks, types of cables in local networks, and the manufacture of LAN cables. This learning process is carried out 3 x 45 minutes in one meeting.

Observations were made to determine the activities of students in participating in the learning process using lecture and discussion methods and guided practice. Based on the results of observations or observations made by researchers, out of 10 groups, only 2 groups succeeded in making LAN cables. So researchers conducted a literature analysis of the causes of student failure in making LAN cables. Based on the results of the analysis carried out, several journals stated that the application of the Problem-Based Learning (PBL) learning model with the discussion method can improve students' cognitive understanding.

3.1 Cycle 1 learning action

In cycle I, the first meeting with computer and internet network material, the researcher used learning videos that aimed to improve students' understanding of the material being

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taught. Learning videos can make it easier for students to understand the material, so that it can increase students' interest in learning. Video is a medium that contains audio and visual elements. Through video media, students will be able to understand learning materials that are still abstract because of the nature of videos that can concretize messages. This will stimulate and increase students' motivation in learning. There is an increase in students' posttest and pretest scores as follows.



Figure 2. Average pre-test and post-test scores

From the **figure 2**, it can be seen that the average pretest and posttest scores increased. From this comparison, a difference of 2.41 was obtained.

To find out the increase in students' cognitive understanding of learning using the problembased learning (PBL) learning model, an n-gain test analysis was conducted. The results of the n-gain analysis can be seen in the following table.

Table 2. Gain Result			
x̄ Pretest	x̄ Posttest	x Gain	Effectiveness
60,7	84,8	0,613	MEDIUM

Based on the **table 2**, the average n-gain obtained is 0.613, which, if interpreted in the criteria of learning effectiveness, is "Moderate." The cognitive understanding of the students increased with the implementation of treatment in grouping students based on the results of the pretest. During the learning process, students were very focused and enthusiastic about learning activities, so that at the end of the lesson, students understood the reinforcement given by the educator at the end of the meeting.

4. CONCLUSION

The application of the Problem-Based Learning (PBL) learning model can improve critical thinking skills, learning activities, curiosity, and informatics learning achievements of class X PPLG 2 SMKN 11 Bandung students. This can be seen from the student-centered learning process, where students will form groups to discuss materials and problems related to the student worksheets (LKPD) given by the teacher. From the results of learning practices, students are quite able to discuss with group members in solving problems in the LKPD. Providing grouping treatment and using media in learning can improve the cognitive understanding of class X PPLG 2 students. This shows that grouping students and learning media greatly influence students' cognitive understanding. The results of improving students'

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abilities before and after being given treatment using the normalized gain test calculation obtained an average gain of 0.61 with the "Medium" category.

5. ACKNOWLEDGMENT

The researcher would like to express his deepest gratitude to SMK Negeri 11 Bandung for providing financial assistance to facilitate the research. Our gratitude goes to:

- 1. Agus Priyatmono Nugroho, S.Pd.M.Si, as the Principal of SMKN 11 Bandung.
- 2. Ani Nuraeni, M.Kom, as the PPL mentor teacher of SMKN 11 Bandung.
- 3. Rini Melati, S.Kom, as the homeroom teacher of class X PPLG 2.
- 4. Mona Marantika, S.Kom, as the teacher in charge of Informatics.
- 5. Prof. Lala Septem Riza, M.T., Ph.D., as the lecturer in charge of the PPG course.
- 6. Students of class X PPLG 2

6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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