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Effectiveness of Problem Based Learning Model Assisted by E-Modules in Science Subjects on Students' Critical Thinking Ability and Communication Skills

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ABSTRACT

This study aims to examine the use of Problem Based Learning model assisted by e-module is effective in improving students' critical thinking ability and communication skills in science learning. This research uses quasi-experimental research with quantitative data analysis. The population in this study were fifth grade students at public elementary schools in Gugus Pangeran Diponegoro, Kedungtuban Subdistrict, Blora Regency. Data collection techniques used test methods, documentation, and questionnaires. The results showed that learning using the Problem Based Learning model assisted by e-modules effectively improved students' critical thinking skills and communication skills in science learning for fifth grade students at SD 4 Ngraho and SDN 3 Kedungtuban. The data shows that the results of independent t test hypothesis testing of control and experimental classes were treated through the SPSS program where the Sig. (2-tailed) of 0.000 <0.05 then H0 is rejected, and Ha is accepted which means that the Problem Based Learning model assisted by e-modules is effective in improving students' communication skills in science learning. The results of the Mann-Whitney U test of the control and experimental classes were treated through the SPSS program where the Sig. (2-tailed) of 0.000 <0.05 then H0 is rejected, and Ha is accepted which means that the Problem Based Learning model assisted by e-modules is effective in improving students' critical thinking skills in science learning. Based on the results of the above research, it can be concluded that students' critical thinking skills and communication skills of control class and experimental class students show significant differences. This means that the Problem Based Learning model assisted by e-modules is effective for improving critical thinking skills and communication skills of fifth grade students in science learning. Suggestions related to the research results are to optimize the implementation of Problem Based Learning to further improve students' critical thinking skills and communication skills and equip students to adapt to learning in the 21st century era.

Keywords: Problem Based Learning, E-Module, Critical Thinking, Communication Skills, 21st Century Learning, HOTS

INTRODUCTION

The development of education in Indonesia can be seen from the development of the curriculum used. Merdeka Curriculum currently used in Indonesia aims to increase students' potential such as social, religious, intellectual, communication, caring and

active attitudes in realizing a more advanced nation (Wisudawati & Sulistyowati, 2022). Students are the main subject in education. All efforts are made to improve the competencies that students will achieve, especially in learning. Learning that takes place in schools is generally an interaction between teachers and students. To achieve meaningful learning, it is hoped that students will have 21st Century skills. 21st Century skills emphasize student-centered learning, including students being expected to have critical thinking skills, problem solving, metacognition, communication, collaboration, innovation and creativity and information literacy (Mardhiyah et al., 2021). So that education in Indonesia can create quality students both in terms of knowledge and skills.

The implementation of 21st century skills in science learning in elementary schools is important to implement, through science learning students recognize the basic concepts of science and develop critical thinking skills and foster curiosity about the surrounding environment. It is important for students to have critical thinking skills in science learning because according to Menyer and Godchild explain that critical thinking is a systematic and active cognitive process to assess arguments and assess facts and object relationships and look for evidence that can provide statements whether accepted or rejected (Marudut et al., 2020). So that students are expected not only to memorize concepts or material in learning but also to be able to identify and conclude from an observation. An important skill that students should also have in learning science is communication skills. Students can conclude their findings, students need to express them in various forms of representation (charts, diagrams, graph tables and so on) (Safitri et al., 2022). So that students can explain their findings or learning outcomes more clearly. In learning science, a learning model is needed that can involve students to be more active so that learning is more fun. The current learning process is also faced with the era of the industrial revolution 4.0 where learning is designed to be integrated with technology and information, one of which uses the Problem Based Learning or PBL learning model with the help of e-modules. In line with that, Williams identified that learning using the PBL model can also increase independence in learning and provide a more realistic picture of higher academic challenges, more confidence, skill in solving problems, critical thinking skills and provide improved communication skills (Karlina et al., 2021).

This is not in line with the learning of students who are in class V in science subjects in the Pangeran Diponegoro Cluster, Kedungtuban District, Blora Regency. Based on the results of observations of researchers in class V semester 1 of the 2023/2024 academic year in the Pangeran Diponegoro cluster, Kedungtuban District, Blora Regency in science subjects with the material "Heat Transfer" consisting of 263 students. It was found that students who were able to complete the assignment by working on practice questions with the material showed students who met the KKM, namely scores above 70 as many as 66 students, in other words only 25% were able to achieve KKM completeness, and as many as 197 students or 75% were not able to achieve KKM completeness with the highest score of 80 and 30 for the lowest score. From the data obtained from interviews with grade V teachers at the Class V Teacher Working Group Activity in 2023 in the Pangeran Diponegoro cluster, it shows that most teachers in grade V have not fully used student-centered learning models in the planned learning process. The problems experienced are because the teacher still implements the direct learning method, and the learning is still teacher centered.

Based on the problems described above, a study was conducted on the effectiveness of the application of the PBL model assisted by e-modules in improving the critical thinking ability and communication skills of fifth grade students in science learning. PBL

model assisted by e-module is a learning model that utilizes technology such as mobile phones or laptops in its application. Through PBL assisted by e-modules, Students can share and express arguments in solving the problems they face (Karlina et al., 2021). The application of this model is expected to make it easier for students to understand the material and learn more about utilizing internet technology, so that students' critical thinking skills and communication skills can improve.

MATERIALS & METHODS

This study used a quasi-experimental design. One of the characteristics of quasi-experimental research is that there are control classes and experimental classes, where in choosing the class is done randomly (random) (Galang Isnawan, 2020). The population in this study were all fifth-grade students in 18 public elementary schools in the Pangeran Diponegoro cluster in Kedungtuban District, Blora Regency, in the 2023/2024 school year. By choosing randomly the experimental class that applied the Problem Based Learning model and the control class that used the direct learning method were obtained. The experimental class will be represented by SDN 3 Kedungtuban, while the control class will be represented by SDN 4 Ngraho consisting of twenty students for each class. Measure critical thinking ability, a test instrument in the form of a post-test is used to measure students' critical thinking ability, while data on communication skills is collected through a questionnaire.

RESULT

Data analysis and description in this study are used to describe the results of quantitative data from instruments given to classes that are research samples using learning models to determine the effectiveness of the application of learning models that have been used (Nababan et al., 2024). This study was conducted to determine the effectiveness of the PBL model assisted by e-modules on improving communication skills and critical thinking skills at SDN 4 Ngraho and SDN 3 Kedungtuban in science learning. This is because in class V semester II in 2024, the Pangeran Diponegoro cluster, Kedungtuban District, Blora Regency in science subjects only 25% of students completed the KKM score. Learning completeness with this percentage is considered very low. After conducting FGDs in the KKG forum with fifth grade teachers in the Pangeran Diponegoro cluster, an indication was obtained that the cause of low student learning outcomes was a learning model that was not in accordance with the characteristics of students so that this also made students feel bored in participating in the process of teaching and learning activities.

Learning models along with the times are in 21st century education and the industrial era 4.0 which is characterized by the integration of technology into learning and the curriculum used in Indonesia today, namely the Merdeka Curriculum which encourages students to play an active role in learning. Based on the problems described by the researcher, the learning model applied is the PBL model assisted by e-modules as a learning model that is in accordance with current problems, with the hope that students' critical thinking skills and communication skills can improve. The PBL model is a learning model that emphasizes problem solving as the center of the learning process. In this model, students are given a real problem or situation that requires solving, then they work together in groups to find solutions to the problem. Data from all sources in this study confirm that interaction has occurred between students and students, students, and educators as well as students and content both in the classroom and using the device. So, this gives students the opportunity to play an active role in the process of teaching and learning activities which will affect communication skills and critical thinking skills. Therefore, the variables in this study are independent variables and dependent

variables. The independent variable in this study is the PBL model (X), and the dependent variable is communication skills and critical thinking ability (Y).

This research was conducted on students at SDN 4 Ngraho and SDN 3 Kedungtuban who participated in science learning materials in the 2024 school year with a total of 40 students, namely 30 students at SDN 4 Ngraho as the control class and 20 students at SDN 3 Kedungtuban as the experimental class. Before the research is carried out, there are several instruments that will be used, namely instruments by design through validation from expert judgment (someone who is professional). In measuring variable Y, students' communication skills used a questionnaire totaling 10 questions. While the instrument to measure critical thinking skills used a test question instrument totaling 5 questions. The instrument was declared valid by expert judgment and then tested with students at SDN 4 Kedungtuban. After going through the trial stage, the next step is if the instrument has been declared feasible, meaning that the instrument trial gets valid and reliable results, the instrument can be used in the control class and experimental class.

In the initial stage, the procedure used is to apply pretest questions to the control class and experimental class. This is intended to determine students' prior knowledge in understanding the material in science learning about "Single Substances and Mixed Substances". The data shows that the average communication skills of control class students before being treated using the PBL model assisted by e-modules is 26.10 with a standard deviation of 3.08. Meanwhile, the average communication skills in the experimental class after the application of the PBL model assisted by e-module was 35 with a standard deviation of 2.99. Furthermore, in the control class before using the PBL model assisted by e-modules, the data on students' critical thinking skills was 59 with a standard deviation of 27.89 and the data in the experimental class that had been given treatment was 84 with a standard deviation of 16.67. This shows that there is a difference between the results before and after the use of the PBL model assisted by e-modules.

Analysis of the improvement of communication skills and critical thinking skills of students was implemented to determine how much the treatment contributed to improving communication skills and critical thinking skills of students in the control class and experimental class. The results of the calculation of the improvement of communication skills and students' critical thinking skills can be seen in table 1.

Table 1. Improvement of Students' Communication Skills and Critical Thinking Ability

No	Class	Variable	
		Communication Skills	**Critical Thinking Skills**
1	Control	26,1	59
2	Experiment	35	84
difference (improvement)		**8,9**	**25**

Based on the average scores obtained by control class and experimental class students, it was found that the two classes had different understandings. After applying the PBL model to the experimental class, there was an increase in the average value of communication skills and critical thinking skills of students compared to the control class. Based on the data above, it shows that there is a significant difference between the improvement of communication skills and critical thinking skills in science learning. For more details, it is presented in the diagram below.

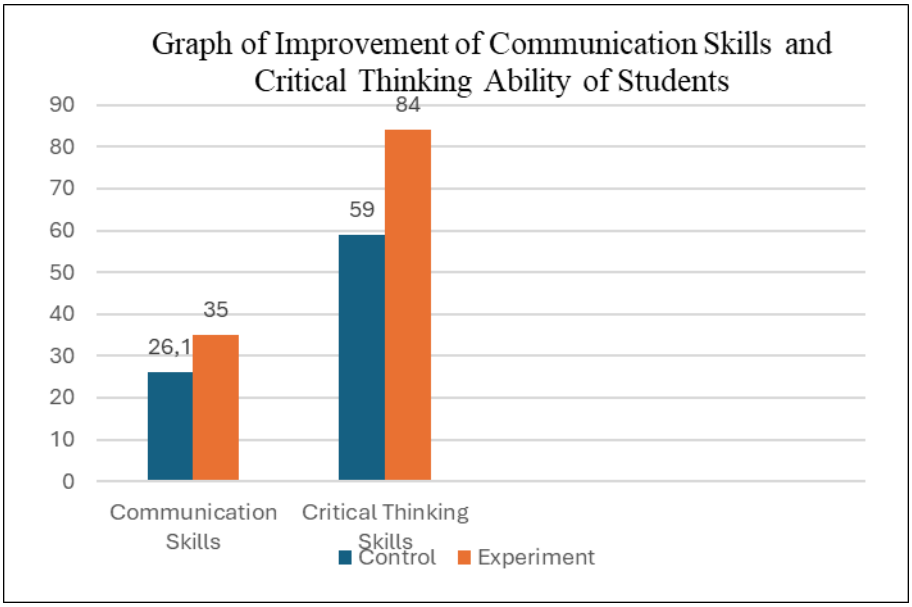

Figure 1: Graph of Improvement of Communication Skills and Critical Thinking Ability of Students

So that the application of the PBL model assisted by e-modules is effective for improving communication skills and critical thinking skills of students in science learning grade V semester 2 in the Gugus Pangeran Diponegoro Kedungtuban District Blora Regency. This is reinforced by data from independent t test hypothesis testing results of control and experimental classes through the SPSS program where Sig. (2-tailed) of 0.000 <0.05 then H0 is rejected and Ha is accepted, which means that the assisted PBL model is effective in improving students' communication skills in science learning. Then the results of the Mann-Whitney U Test using SPSS were carried out in the control and experimental classes where the Sig. (2-tailed) of 0.000 <0.05 then H0 is rejected and Ha is accepted, which means that the PBL model assisted by e-modules is effective in improving critical thinking skills in science learning.

CONCLUSION

Thus it can be concluded that learning using the PBL model assisted by e-modules is effective. (1) the application of PBL model assisted by e-module improves students' communication skills, (2) the application of PBL model assisted by e-module improves critical thinking ability, (3) the application of PBL model assisted by e-module improves students' communication skills and critical thinking ability. The improvement of students' communication skills and critical thinking skills is seen from the application of the PBL model assisted by e-modules to the material "Single Substances and Mixed Substances" in grade V students at SDN 4 Ngraho and SDN 3 Kedungtuban. This is reinforced by the data from the independent t test hypothesis testing results of the control and experimental classes that were treated through the SPSS program where the Sig. (2-tailed) of 0.000 <0.005 then H0 is rejected and Ha is accepted which means that the PBL model assisted by e-modules is effective in improving students' communication skills in science learning. The Mann-Whitney U test results of the control and experimental classes were treated through the SPSS program where the Sig. (2-tailed) of 0.000 <0.05 then H0 is rejected and Ha is accepted which means that the PBL model assisted by e-modules is effective in improving students' critical thinking skills in science learning. Furthermore, the results of hypothesis testing regarding the average difference in critical thinking skills of control and experimental class students prove that there is a significant difference, which means that

the PBL model is effective for improving students' critical thinking skills in science learning. So it can be concluded that there is a significant increase in communication skills and critical thinking skills of students by using the PBL model assisted by e-modules.

Declaration by Authors
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