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The Effect of Project Based Learning (PjBL) Model on Problem Solving Ability of Junior High School Students

Elena Dwi Nur Pratiwi[1], Fitria Eka Wulandari[2]

[1] Universitas Muhammadiyah Sidoarjo; Indonesia
[2] Universitas Muhammadiyah Sidoarjo; indonesia

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ABSTRACT

This study aims to determine the effect of project-based learning model on junior high school students' problem-solving skills. This research is quantitative research with One Group Pretest-Posttest Design. The subjects in this study were VIII grade students with 22 students. The technique used in sampling to determine the level of student problem solving is by distributing a questionnaire of 30 questions and then distributing it to 40 students at the local junior high school. To find out the effect of the project-based learning model on students' problem-solving skills, is done using a test, where the tests used are pre-test and post-test. The instruments used in this study are questions with problem solving indicators that have been validated by experts and declared valid and reliable for testing. The analysis used in this study was the N-Gain test using SPSS 26. The results showed the effect of the project-based learning model on student problem solving, as evidenced by the results of the N-Gain test on the pre-test and post-test which showed a value of 0.7011> 0.7000. Thus, the project-based learning model has a significant effect on students' problem solving ability with moderate criteria.

Corresponding Author:
Fitria Eka Wulandari
Muhammadiyah University of Sidoarjo; Indonesia e-mail@ fitriaekawulandari@umsida.ac.id

INTRODUCTION

Education has a very important role in developing students' thinking skills. In this case, students can achieve intelligence which includes spiritual, intellectual, and emotional intelligence (Santoso & Wulandari, 2020). Education also tries to form noble morals and develop the skills needed, both for themselves, society, and the environment. For this reason, it is necessary to have a school as a place to

support the achievement of these goals. In school, there is a learning process that involves educators and students in a classroom (Armandita, 2018).

The rapid development of the times in this century requires all parties involved in education to immediately improve the quality so as not to lose competitiveness with other countries (Miranti, 2016). Based on existing activities in most schools, the delivery of learning is only focused on the delivery of teacher lectures to convey the material being taught. While one of the main problems experienced by most schools today is the lack of absorption of students (Yulistiawati et al., 2019) so that it can affect the low problem solving ability of students

One way to overcome the lack of students' ability to make connections, reasoning, and communication is by providing problem-based learning that is associated with daily life. Problem-based learning has been recognized as a development and active learning with a student-centered learning approach, through problem-based learning, teachers can implement learning related to the problems around them, according to the characteristics of students and the surrounding environment (Kusharyanti et al., 2018). In addition, problem solving skills have an important role in solving complex and multidimensional problems in social life (Prastyo & Wulandari, 2023)

Problem-based learning in this case can determine students' problem solving skills in solving a problem. One of the problem solving steps is the step according to Polya. There are 4 steps in problem solving according to Polya, namely (1) understanding the problem, (2) determining the problem solving strategy plan, (3) completing the problem solving strategy, (4) re-examining the answers obtained (Hadi & Radiyatul, 2014). This learning begins with the teacher providing a phenomenon and then guiding students in understanding the problems that exist in the phenomenon, the teacher guides students to determine the solution strategy of the problem that has been determined, the teacher guides students to complete the problem solving strategy, and the last is the teacher guides students to conclude what has been done.

The 2013 curriculum is implemented as much as possible to involve learners so that they can explore to form competencies by exploring various potentials, and scientific truths (Ikhsan & Hadi, 2018). One of them is project-based learning (PjBL). The project-based learning model can invite students to play an active role in the learning process so that it is expected to improve students' abilities (Kurniawati et al., 2017). The PjBL method in this case can also facilitate teachers to be used as a solution in improving student abilities. PjBL is student-centered learning that sees students constructing their knowledge by exploring authentic problems and performing well-designed tasks (Serin, 2019)

There is a connection between problem solving and PjBL, namely problem solving focuses on solving real words while PjBL focuses on building or creating a concept from an authentic problem (Safithri & Huda, 2021). PjBL has the characteristics that learners ask and invests important ideas, the process of investigating according to their needs and interests until understanding is found, thinking creatively and creating products, skillfully investigating and critically, concluding material, and linking problems that occur in the real world (Susilawati & Sahara, 2021). One of the subjects that can develop students' ability to solve problems is science (Runi, 2021). In learning science, especially additives, there are aspects of competence that must be mastered by students, including aspects of scientific work, aspects of material, and its nature.

The results of the initial observation were carried out by the observer on 42 Nurul Huda Junior High School students, which were divided into 3 classes, including classes VII, VIII, and IX which were then taken randomly by giving a questionnaire totaling 20 questions. The question is a problem of pollution material to find out students' problem solving skills. The questionnaire was then distributed via the Google form platform. Of the total 42 students, those who filled out the questionnaire included 15 students from class VII with an average acquisition value of 15.27, 15 students from class VIII with

an average acquisition value of 13.47, and 12 others were class IX students with an average acquisition value of 12.59. From the results of these observations, it can be seen that 42 students who have been tested have not reached the standard Minimum Completion Criteria (KKM) for science subjects determined by the school, which is 65. In this case, it can be seen that the level of problem solving ability of these students is very low.

Based on the information above, this study aims to determine the effect of a project-based learning model that uses long-term activities by involving students to overcome students problems in real life. This is in line with Siska's research (Nuris, 2022). suggests that the project-based learning model is learning with long-term activities that involve students in designing, making, and displaying products to solve real-world problems. With this, the research conducted by the author is expected to get results by learning indicators and students can solve general problems, so the author expects students to be able to explore their knowledge and look for various kinds of solutions to solve these problems. Therefore, the author hopes that students will be more creative and active during the process of searching and finding science learning outcomes that will later be learned.

METHODS

This research is quantitative-based experimental research with the One Group Pretest-Posttest design research model. This research was conducted at Nurul Huda Junior High School with a research population of 42 students. Sampling was carried out using the purposive sampling technique, which is a technique for determining a sample based on certain considerations (Wulandari, 2016). Based on this technique, the sample used was 22 students of class VIII Nurul Huda Junior High School. The dependent variable in this study is problem solving ability, while the independent variable in this study is the application of the project-based learning model. In general, the research design is presented in Figure 1 below:

O_1	X	O_2

Figure 1. One Group Pre-Test Post-Test Design (Rahmazatullaili et al., 2017)

Description:

O_1 = Pre-test score

O_2 = Post-test score

X = Treatment with project-based learning model

Data collection in this study used pre-test and post-test techniques by measuring problem solving indicators, namely understanding the problem, planning to solve the problem, completing the problem solving plan, and re-examining the answer. While the instrument in this study uses problem solving questions in the form of descriptions totaling twelve items that have been tested for validity and reliability by experts. With this, students will then be grouped based on the level of problem solving ability which is divided into five groups, namely: Very good, good, good enough, less good, and not good. The percentage interval of problem solving ability is presented in Table 1.

Table 1. Criteria for the percentage of students' problem solving ability (Rohmah et al., 2022)

Interval Percentage (%)	Criteria
81–100	Very good
61–80	Good
41–60	Good enough
21–40	Not good enough
0–20	Not good

After the pre-test and post-test data are obtained, the next step is to test using the N-Gain Score using the help of SPSS 26 to find the effectiveness value of the N-Gain Score with the division of the N-Gain Score categories, namely: high, medium, and low. The N-Gain Score division categories are presented in Table 2.

Table 2. N-Gain Score division categories (Wahab et al., 2021)

N-Gain Value	Category
$g > 0,7$	High
$0,3 \leq g \leq 0,7$	Medium
$g < 0,3$	Low

Based on Table 2, it can be seen that if the N-Gain value is obtained more than 0.7 then it is included in the high category, if the N-Gain value is more than equal to 0.3 and less than equal to 0.7 then it is included in the medium category. And if the N-Gain value is less than 0.3 then it is included in the low category.

FINDINGS AND DISCUSSION

To review how effective the project-based learning model is on problem solving, it must go through an analysis and processing of data obtained from the pre-test and post-test scores that have been done by students. The results of students' pre-test and post-test are presented in Table 3 below:

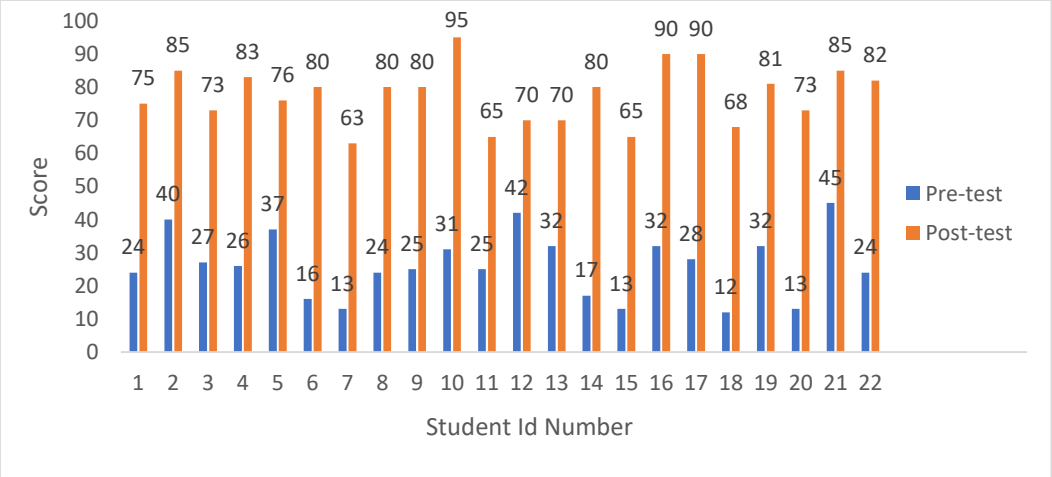

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Figure 2. Student Pre-test and Post-test Results

Figure 2 shows the value of each student as many as 22 people who have done the pre-test and post-test with the material of coloring additives in food. In the pre-test, the lowest score was 12 and the highest score was 45. While in the post-test, the lowest score was 63 and the highest score was 95. Seeing from these data, there was a significant increase in scores from the average pre-test with low scores that were included in the criteria, to the post-test with an average of high scores and included in the criteria very well. This can occur due to special treatment in the form of a Project Based Learning model for students that makes them interested because the learning system is cool and not boring. This is similar to research (Rosma, 2015) in that students who are taught with a project-based learning model become more active, more diligent, and motivated in learning, more eager to complete projects, and able to work well together. In this case, the data on the pre-test and post-test were strengthened with the N-Gain Score test using the help of SPSS 26 to be more accurate as in table 3 below:

Table 3. Descriptive Statistics N-Gain

	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
N-Gain_Score	22	.47	.83	.7011	.08630
N-Gain_Persen	22	46.55	83.33	70.1122	8.62956
Valid N (listwise)	22				

Table 3 above shows the results of the N-Gain Score test using SPSS 26 with fairly high results and it should be noted that if g> 0.7 then, there are significant results with a high category. If the results show 0.3 ≤ g ≤ 0.7 then, there are less significant results with a moderate category. Meanwhile, if g < 0.7 then, there are insignificant results or no difference with a low category. It is known that the data in Table 3 with the number of students 22 students shows an N-Gain Score of 0.7011> 0.7000. This means it can be interpreted that the provision of the Project Based Learning model can affect the problem solving skills of junior high school students, then the data is reinforced by the results of the problem solving indicator analysis in Table 4 below:

Table 4. Achievement Results of Problem Solving Indicators

Indicator	**Pre-test**		**Post-test**	
	Percentage %	**Criteria**	**Percentage %**	**Criteria**
Understand the problem	71 %	Good	87, 8 %	Very Good
Problem solving planning	7,6 %	Noot good	78, 5 %	Good
Problem solving planning completion	10,8 %	Noot good	90,2 %	Very Good

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Rechecking the answer	2,6 %	Noot good	66 %	Good

Table 4 shows the percentage of indicators from the pre-test and post-test results. where initially some indicators of pre-test problem solving ability were classified as low or not good as evidenced by the percentage value on the problem solving planning indicator of 7.6%, the indicator of solving the problem planning of 10.8%, the indicator of re-examining the answer of 2.6%, and there was one indicator of problem solving in the pre-test that showed a fairly good value, namely on the indicator of understanding the problem of 71%. This is in line with research (Sinaga et al., 2014) that the indicator of understanding the problem is the most basic thing in working on problems so if students do not understand the problem at this point, what will happen is that students will not be able to understand the next step. On the other hand, the value of each indicator in the pre-test is inversely proportional to the results of the indicators in the post-test which have a fairly high value and are classified as good criteria. This is evidenced by the percentage value on the indicator of understanding the problem of 87.8%, the indicator of problem solving planning of 78.5%, and the indicator of solving the problem solving plan of 90.2%. and the indicator of re-examining the answer of 66%.

Of the four Polya indicators, the indicators with the lowest percentage in both the pre-test and post-test were the problem-solving planning indicator and the indicator of re-examining the answer. In the problem solving planning indicator, a low percentage can occur due to students' lack of knowledge in solving a problem, causing many students to experience limitations that can only solve problems that are known. This is also in line with research (Fitriyana & Sutirna, 2022) where students are lacking in understanding of the problem and capturing information on the problem so that students only get incomplete information so that it is difficult to plan a problem solving that will be made. While in the indicator of re-checking low answers can occur due to students being less careful when checking the final answer to whether the calculation is correct or not so that students' answers are still found to be incorrect. These problems are equivalent to research (Akbar et al., 2017) where students feel no need to check and assume the answers given are correct. This is also supported by research (Zakiyah et al., 2018) which states that the indicator of checking the answer again is included in the low category as evidenced by the percentage of indicators as much as 29.17%.

CONCLUSION

Based on the research data and data analysis that has been done by researchers, it can be concluded that the provision of project-based learning models has a significant effect on students' problem solving skills. Students who initially had difficulty in understanding the problem, planning problem solving, completing problem solving plans, and re-examining answers, were finally able to improve these abilities quite well with good and very good completion criteria.

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CONFLICTS OF INTEREST

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The authors declare no conflict of interest.

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