

**Project Based Learning Assisted with Flashcard Media
and Mathematics Problem-Solving Ability
of Elementary School Students**

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Abstract

The purpose of this research is to find out whether there is an effect of Project-Based Learning assisted by flashcard media influences problem-solving ability in plane figure material for grade II students. This type of research uses quantitative research with experimental methods. The design of this study is a nonequivalent posttest-only control design. The population in this study was all grade II students at SDN Dukuh Menanggal 1/424 Surabaya, which amounted to 72 students. Through random cluster sampling selected samples of class II-A as the experimental class and class II-B as the control class. Data collection techniques in this study are using tests. The data analysis technique used is statistical tests using t-tests. The use of a Project-Based Learning assisted by flashcard media encourages students to become more active in designing a real product, easier for students to understand concepts, makes students interested in learning while playing, and active in answering questions in flashcard media. Based on the research results and discussion, it can be concluded that there is an effect of project-based learning model assisted by flashcard media on the ability to solve problems in plane figure material for grade II students at SDN Dukuh Menanggal 1/424 Surabaya.

Keywords: *project based learning, flashcard, problem-solving ability*

INTRODUCTION

Problem solving is the basis for learning mathematics and the main reason for studying mathematics (Arrahim et al., 2020; Kumalasari et al., 2022; Zahara et al., 2020). Problem-solving ability is an ability that students must have to face the challenges of life in the 21st century. Problem-solving ability is essential to develop through learning activities so that students can find and determine new things in dealing with all problems and can find many



possible answers to a problem (Yustitia, 2015). Problem-solving ability of elementary school students is still low (Khairunnisa et al., 2023; Maharani & Montessori, 2020; Widodo & Kartikasari, 2017). It is still found that students have low problem-solving abilities in elementary schools. Siswono (in Agustina et al., 2022) said that the low ability to solve problems in elementary schools is caused by students who tend to memorize and are not accustomed to working on non-routine problems. Students have difficulty when given different things problem exercises from the previous ones (Powell et al., 2020).

However, one of the problems faced by the world of education is the weak learning process. In the learning process, children are less encouraged to develop problem-solving skills. According to Sanjaya (in Syam, 2016), the classroom learning process is directed only to memorizing information; children's brains are forced to remember and hoard various information they remember to connect it with everyday life. As a result, when children graduate from school, they are only theoretically astute but cannot apply. Therefore, one of the efforts that a teacher can make is to plan effective learning models and media that can improve students' problem-solving skills students.

Aulia (2020) said that by choosing and applying a suitable learning model, for example, by providing a problem or event that can stimulate students' problem-solving abilities, students can think and solve problems independently to be remembered longer. Solving problem refers to situations in which prior experience, knowledge, and intuition have to be coordinated in an effort to determine the outcome of a situation where the procedure for determining the outcome is not known (Lester in Himmah et al., 2022). Polya (in Purba et al., 2021) explains that solving problems is a way to find a way out of difficulties to achieve goals that cannot be achieved. Polya also provides four ways or procedures for solving problems. This problem-solving has sequential ways and methods to make it easier for students to solve problems to avoid the view that is often wrong in choosing a solution strategy. The stages in solving problems, namely being able to interpret the problem, develop a solution scheme, implement the system, and review the process that has been made.

Many learning models can be used, one of which is the project-based learning model (Purnasari, 2018; Sringatin, 2022). This learning model involves students in solving problems. project-based learning model can contribute to the development of problem solving skills (Hasriyani et al., 2022). According to the Buck Institute for Education (in Silpia, 2019), project based learning is a systematic learning model involving students in

learning science and skills by investigating real problems and making various works or tasks carefully designed. With project-based learning, students learn from their experiences and then apply them in everyday life to find the information needed and gain valuable experiences that will always be remembered and not easily forgotten.

The PjBL (Project Based Learning) learning model will be more effective if combined with learning media. According to Arsyad (in Komalasari, 2016) flash cards are small cards which contains pictures or text or symbols that remind or require students to something associated with the image or text. Flashcard media is one of the media suitable for use in plane figure material. Flashcard media in learning activities can help students understand the difficult and complicated subject matter to be more easily understood (Maulidah et al., 2021).

The steps of applying the project-based learning model assisted by flashcard media are as follows. *First*, students make a project in the form of making a picture object by choosing the picture on the flashcard using folded paper which is cut according to the plane figure that will be arranged into the picture. *Second*, designing the steps to complete the project, students design the completion of the project in the form of a picture object that chooses on flashcards by determining the tools and materials needed. *Third*, in preparation for a schedule, students, accompanied by the teacher, schedule all activities designed to make the selected image object so that it becomes the same image as the one on the flashcard. *Fourth*, completion of the project with teacher facilities and monitoring, the teacher monitors the student's activities during the process of completing the project task of making the image object. The last time, the teacher monitored the making of the project. *Fifth*, preparation of reports and presentation or publication of project results, students present the results of their work in front of the class by mentioning what flat shapes are in the image objects they have made. *Sixth*, evaluation and project results, the teacher evaluates several shapes of flat shapes made by students and sees whether the project results are in accordance with the instructions given by the teacher related to the making of image objects using pieces of flat shapes from folding paper.

With the project-based learning model assisted by flashcard media, it is hoped that students can be more active in the learning process and improve students thinking and problem-solving skills in solving a problem in the learning process. From the explanation above, this research is strengthened by previous research, such as research Purnasari (2018) states that the project-based learning model based on flashcard media on students' critical thinking skills on protist material can affect the improvement of necessary thinking skills,

because the project-based learning model based on flashcard media requires students not only to listen to information from the teacher about the concepts in the book but, students are required to be able to carry out their activities, seek and obtain further information about the concept of the material being studied. So that at its peak, it produces a natural product of value.

Mardhiyah et al. (2022) research explains that the mathematical problem-solving ability of students who get the project based learning model treatment assisted by the ethnomathematics hole module is better than students who get direct learning. Rani et al. (2021) research explains that project-based learning has been carried out; there is an effect of applying the project based learning model on mathematical problem solving ability and can improve students' critical thinking skills.

While this study explains whether or not there is an effect of the project-based learning model with flashcard media on problem-solving skills in plane figure material for grade II students, based on the explanation above, the researcher is interested in testing the research entitled "The Effect of Project-Based Learning Assisted by Flashcard Media on Problem Solving Ability in Plane Figure Material of Grade II Students".

METHODS

This research is quantitative research with experimental methods. In experimental research, researchers can perform conditional manipulation by providing treatment or creating a condition or stimulus on the subject under study (Prasetyo in Ibrahim et al., 2018). This study aims to find out whether there is an effect of project based learning assisted by flashcard media influences problem solving ability in plane figure material for grade II students in elementary school. This study used a research design with a design in the form of quasi experimental design (pseudo experiment) with a nonequivalent control group design with the type "posttest-only control design" (Sugiyono, 2017). The quasi-experimental (*see* Figure 1) design identified a control group that was as similar as possible to the treatment group in terms of baseline (pre-intervention) characteristics (White & Sabarwal, 2014).

The population in this study were all grade II students of SDN Dukuh Menanggal 1/424 Surabaya, which amounted to 72 students. Sampling was done by cluster random sampling technique so that the samples of this study were class II-A as the experimental class and class II-B as the control class, each of which amounted to 36 students.

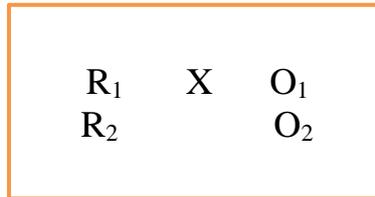


Figure 1. Research design (*nonequivalent posttest-only control design*)

The data collection technique in this study is using tests. A test is a series of questions or exercises and other tools used to measure skills, knowledge of intelligence, abilities, or talents individuals or groups possess (Arikunto, 2013). This test is a test of the problem-solving ability of plane figure material for grade II elementary school students. Expert lecturers and class teachers have validated this problem-solving ability test. Where the results of the validation of this test are the average is three, which means by the aspects of problem-solving ability. Tests measure students' ability to answer and solve problems or questions. The test questions totaled three questions in the form of essay. Through the essay, the researcher can see the sequence of answers, the logic of the answers, and the quality of the answers given (Kurniawan, 2021). Through essay, students must use all their knowledge to answer the problem, creatively organize their answers, express opinions in their own language so that researchers can see the students' way of thinking in answering the problem (Astuti, 2017).

The data analysis technique used in this study is statistical tests consisting of normality tests, homogeneity tests, and hypothesis tests using the t-test. Data analysis was assisted by SPSS 22 software with Independent Sample T-Test.

RESULTS AND DISCUSSION

This research that has been carried out by researchers at SDN Dukuh Menanggal 1/424 Surabaya by applying learning using a project based learning model assisted by flashcard media in the experimental class, while in the control class without using project based learning model and flashcard media in plane figure material for grade II elementary school students. the Project Based Learning (PjBL) learning model is an innovative learning model that provides opportunities for teachers to manage classroom learning by involving project work and focusing on the core concepts and principles of a discipline of study, involving students in problem solving investigations and activities other meaningful tasks, giving

students the opportunity to work autonomously construct their own knowledge, and culminate in producing real products (Wena in Darmayoga & Suparya, 2021). Flashcard media is a picture card designed by the researcher in accordance with the plane figure material that has been taught. This flashcard media contains pictures and explanations about the types, properties and characteristics of plane figures and is equipped with questions that can hone students' brains to think. During the learning process in the experimental class that was treated with the project-based learning model assisted by flashcard media, students were very active and enthusiastic in participating in learning, this was because they learned while playing.

During the learning process students play flashcards media by following the instructions in the game. Group representatives come forward to determine who will play first by throwing the dice, if a group rolls the dice and the number 1 comes out, the group plays first. The group that gets the chance to play will choose one flashcard to read then the other groups will listen. After that, the reading group will read the question behind it and the other group must answer. If the other group can answer, then that group will read the next material.

After playing using the flashcard media the students got a project assignment from the researcher, each group made an image object that could imitate the image on the flashcard. When working on the project they were very happy and enthusiastic because they could work according to their imagination but still with the theme set by the researcher. After completing the project, they made, each group presented their work in front of the class. After the learning process in the experimental class and control class was completed, students were asked to work on the posttest questions distributed by the researcher.

A posttest measured students' problem solving ability in experimental and control classes. After the test results of the experimental class and the control class were obtained, the student's problem-solving ability tests would later be tested to determine whether there was any influence of project-based learning assisted by flashcard media in the experimental class compared to the control class without using the project-based learning model assisted by flashcard media. The tests used in this study are the normality test, homogeneity test and hypothesis testing using the t-test. The data of students' post-test scores will be analyzed using SPSS 22. The following are the results of descriptive statistical data related to the

average, minimum and maximum values, and standard deviation from the experimental and control classes.

Table 1. Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
Post-Test Eksperimen	36	23	73	96	85.50	6.167
Post-Test Kontrol	36	30	53	83	66.08	6.942
Valid N (listwise)	36					

We can see in the table 1 above that the results of descriptive statistics show that the minimum value of the experimental class is 73 while the maximum value is 96, and the average value of problem-solving ability in the experimental class is 85,50 with a standard deviation 6,167. In the control class, the minimum value is 53 while the maximum value is 83, and the average value obtained is 66,08 with a standard deviation 6,942.

The research data were then processed with prerequisite test statistics consisting of normality and homogeneity tests, calculating the data taken from the experimental and control classes' post-test data. The normality test determines whether a t-test has a normal distribution. The provisions of normally distributed data are with Sig. > 0,05. At this stage, the normality test will be processed using SPSS 25.0 to see the results in Table 2 below.

Table 2. Posttest Normality Test

		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
Class		Statistic	Df	Sig.	Statistic	df	Sig.
Problem-Solving Ability	Experiment	.130	36	.132	.957	36	.170
	Control	.144	36	.058	.953	36	.128

Based on Table 2, the Kolmogorov-Smirnov column normality test calculation results show that the statistical value in the experimental class with 36 degrees of freedom and a significance level of 0,132, while the statistical value in the control class with 36 degrees of space and a significance level of 0,058. Because both have a Sig. > 0,05, the data is normally distributed.

The second prerequisite test is the homogeneity test to test whether the experimental and control classes' post-test data are homogeneous or not. The provision of data that is declared homogeneous is if the Sig level. > 0,05. The following are the results of the homogeneity test analysis of the post-test results of the experimental and control classes presented in Table 3 below.

Table 3. Homogeneity Test of Experimental and Control Classes

Levene Statistic	df1	df2	Sig.
.042	1	70	.839

Based on Levene's test in Table 3, it can be seen that the significance of the post-test data of the experimental class and control class is 0,839, which means Sig. > 0,05, so it can be concluded that the data from both samples are homogeneously distributed.

Based on the results of the normality test and homogeneity test that has been carried out, the data obtained is usually distributed and homogeneous so that calculations can be done with hypothesis testing or what can be called the t-test because it has met the requirements. The test carried out in this study is the Independent Sample T-Test, which tests the two averages of two data groups with a level of $\alpha = 0,05$. The researcher uses the SPSS 22.0 program with the provisions for making a decision if sig > 0,05 then H_0 is accepted. This means that there is no significant effect between the project-based learning model assisted by flashcard media on the problem solving ability of grade II elementary school in plane figure materials. Conversely, if sig < 0,05 then H_0 is rejected. This means that there is a significant influence between the project-based learning model assisted by flashcard media on the problem solving ability of grade II elementary school in plane figure materials. After processing the data through the Independent Sample T-Test, the results were obtained in Table 4.

Table 4. Independent Sample T-Test Test of Research Results

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Problem Solving Ability	Equal variance assumed	.042	.839	12.546	70	.000	19.41667	1.54759	16.33009	22.50324
	Equal variance are not assume			12.546	69.041	.000	19.41667	1.54759	16.32934	22.50400

Based on the results of the Independent Sample T-Test in the table above, Sig can be seen in the t-test for the Equality of Means column obtained. (2-tailed) with a value of 0,000 < 0,05, thus H_0 is rejected, meaning that there is an effect of project-based learning model assisted by flashcard media on problem solving skills on plane figure material for grade II elementary school students at SDN Dukuh Menanggal 1/424 Surabaya.

Theoretically, this research is in line with the opinion expressed by Restiani (2022) that the project based learning (PjBL) model can help students by increasing student motivation because this learning model can make students more diligent in completing the project work given. In addition, this project-based learning model can also help students in improving students' problem-solving skills because in learning with project-based learning models, students are required to find ways to solve the problems given so that students' problem-solving skills will increase. Not only that, but this project-based learning model can also improve student collaboration in completing project work that they do in groups. This is in accordance with Ferrero et al. (2021) that PjBL provides benefits for students, such as creating independent learners, increasing involvement in learning, or fostering meaningful learning.

To maximize the use of the project based learning model, researchers use flashcard media to help students understand learning material about plane figure in the class to be studied. According to Khulilullah (in Humaira, 2021), flashcards or cards (albishoqoh) cards are usually made of hard or thick paper, and in each of the front and back, there are words, phrases, sentences, or expressions. Flashcard is a media card that contains pictures and writing that allows students to be interested in understanding the material presented (Setiyowati et al., 2019).



Figure 1. Activities of project-based learning model assisted by flashcard media

Using a project-based learning model assisted by flashcard media can help encourage students to be more active in designing a natural product. By using flashcard media assistance, students will find it easier to understand the concept of complex material to teach so that they can design a product by the specified instructions. With the flashcard media, students are interested in learning while playing, and during the activity, students are active in answering questions in the flashcard media.

Empirically, this research is in line with a study conducted by Purnasari (2018) "Based on the results of the independent t-test analysis of critical thinking skills, it shows that Sig. (2-tailed) $0,025 < \alpha$ (0,05), then H_0 is rejected. So, this study can conclude that using the project-based learning model based on flashcard media on the critical thinking skills of class X students on protist material at SMA Muhammadiyah 2 Bandar Lampung has an effect". This effectiveness occurs because the project-based learning model based on flash card media requires students not only to listen to information from the teacher about the material in the book, but students are also required to work independently and construct their own learning so that they can improve students critical thinking skills and the achievement of learning objectives (Ping Xin et al., 2023; Ruitenburg et al., 2022). In line with that research, in this study the results obtained that the application of the project-based learning model assisted by flashcard media impacts problem solving skills on plane figure material for grade II elementary school students conducted at SDN Dukuh Menanggal 1/424 Surabaya.

CONCLUSION

The results showed that there was a difference in the average posttest score between the experimental class and the control class, where the average score of the experimental class was higher than that of the control class. Based on the results and discussion of the research above, it can be concluded that there is an effect of project based learning assisted by flashcard media on problem solving ability on plane figure material of grade II elementary school students. Through the use of a project-based learning model assisted by flashcard media students more easily understand material concepts, make students more interested in learning, and more active in answering questions. Therefore, the use of a project-based learning model assisted by flashcard media is recommended in learning. This research still has various limitations. Further research is needed on its effectiveness on other materials and at different grade levels so that it can be known when the use of the project-based learning model assisted by flashcard media should be carried out. The use of project-based learning which is applied together with other media is also interesting to study so that we can see how its advantages and disadvantages are compared to flashcard media.

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