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Comparative Analysis of Test for Improving Primary Students Mathematics Literacy Skills Through Project–Based Learning

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ABSTRAK

Kemampuan literasi matematika sangat dibutuhkan untuk menghadapi dan memecahkan berbagai tantangan kehidupan saat ini, sehingga kemampuan ini perlu diasah dari sekolah dasar. Tujuan dari penelitian ini adalah untuk menganalisis apakah peningkatan kemampuan literasi matematik siswa yang diajar dengan model pembelajaran berbasis proyek lebih tinggi dibandingkan dengan kemampuan literasi matematik siswa yang diajar dengan pembelajaran biasa. Jenis penelitian ini kuasi eksperimen dengan membagikan 2 kelompok sample yaitu sebagai sample yang kemudian diberikan intervensi diajarkan melalui pembelajaran biasa dan sample yang diajarkan dengan menerapkan model project based learning. Analisis ini menggunakan uji-t untuk membandingkan rata rata kedua kelompok sample. Sample pada penelitian ini merupakan 26 siswa yang berada di kelas 4 sekolah dasar. Hasil dari penelitian menemukan bahwa terdapat peningkatan kemampuan literasi matematik siswa yang diajarkan dengan model pembelajaran berbasis proyek lebih tinggi daripada kemampuan literasi matematika siswa yang diajarkan dengan pembelajaran biasa. Melalui kegiatan proyek, siswa dapat memberikan pemahaman yang kaya akan konsep dan ide.

ABSTRACT

Mathematical literacy skills are very necessary to face and solve various challenges in today's life, so these abilities need to be honed from elementary school. This research aims to analyze whether the increase in the mathematical literacy skills of students taught using a project-based learning model is higher than the mathematical literacy skills of students taught using regular learning. This type of research is quasi-experimental by dividing 2 sample groups as samples that are taught through regular learning and samples taught by applying a project-based learning model. This analysis uses the t-test to compare the means of the two sample groups. The sample in this study was 26 grade 4 children at state elementary school 064967 Medan, North Sumatra. The results of this research were the increase in the mathematical literacy skills of students taught using a project-based learning model was higher than the mathematical literacy abilities of students taught using regular learning. Through project activities, students can provide a rich understanding of concepts and ideas.

1. INTRODUCTION

Mathematics is a required subject at all levels of education. Mastery of mathematics lessons is recognized as a basic skill for mastering other sciences. As one of the compulsory subjects, mathematics is expected to not only prepare students with the ability to use formulas or calculations but also to prepare students to involve their reasoning and analytical skills to solve problems in everyday life (Ahsyansyah, 2019; Çelik & Özdemir, 2020). This kind of ability is called mathematical literacy. Furthermore, mathematical literacy is defined as a person's ability to formulate, apply, and interpret mathematics in various contexts (Goos & O'Sullivan, 2023; Tang et al., 2022). Based on the definition above, mathematical literacy includes mathematical reasoning abilities and the application of concepts, facts, procedures, and mathematical tools in an effort to describe, explain, and predict phenomena.

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Mathematical literacy is important to develop, It's best to sharpen it from elementary school (Chen et al., 2020; Rizki, L. M., & Priatna, 2019; Rusdiana et al., 2023; Shim & Kim, 2023). It is so important for students because it can help them succeed in life (Rosmawati, 2020; Wang et al., 2020). Mathematics is not just knowledge, but also the ability to use mathematical skills effectively (Jannah, R., Budi Waluya, S., 2021; Novytska, 2019). Mathematical literacy refers to the ability to understand and use mathematics in everyday life. Someone who has good literacy skills can make predictions, interpret data, solve everyday problems, reason in numerical, graphic, and geometric situations, and communicate effectively with mathematics (Muslimah & Pujiastuti, 2020; Muzaki & Masjudin, 2019). Mathematical literacy skills are needed by students to face and solve various challenges in contemporary life (Meiningrum et al., 2021; Vitantri & Syafrudin, 2022; Zahroh et al., 2020). According to the Organization for Economic Co-operation and Development (OECD, 2014), mathematical literacy skills refer to students' ability to use mathematics in real-world contexts and reason mathematically based on concepts and procedures. To measure the mathematical literacy abilities of students in Indonesia, it can be seen from the PISA (Program for International Student Assessment) scores. The results of the 2018 PISA survey show that Indonesia is ranked 72nd out of 79 participating countries, with a score of 379 in mathematical literacy skills (OECD, 2019). Indonesian students' mathematical literacy abilities are still low and far behind other countries. If these results cannot be improved, the literacy abilities of students in Indonesia will certainly deteriorate further.

Based on the researcher's initial observation data with mathematics teachers at SD N 064967 Medan, North Sumatra, it was found that teachers rarely use learning activities that involve student involvement. Learning that is often carried out is still teacher-centered, not student-centered. Teachers rarely involve the surrounding environment as a learning tool in understanding the mathematics material being taught. So far, teachers rarely give questions that require higher-level thinking processes or other higher thinking skills (HOTS). Teachers are used to giving abstract questions and rarely give contextual questions. One way to help students improve their mathematics skills is to use a project-based learning model. This type of learning helps students develop real-world skills while providing opportunities for adults to prepare for careers in the field.

Project-based learning helps students explore and solve problems while maintaining the focus on the students themselves and their interests (Farida & Rasyid, 2019; Meng et al., 2023; Zhao & Wang, 2022) The learning process will be interesting and varied, making it easier for students to understand the material they are studying (Maysarah et al., 2023; Nurmi et al., 2020). Activities will be structured based on projects, helping students learn more effectively and remember what they have learned (Anggraini & Wulandari, 2020; Ratnasari et al., 2018). The PjBL model is a student-centered learning model that integrates real-world problems, where students play an active role while the teacher provides support (Bosson & Arıcı, 2021; Guo et al., 2020; Markula & Aksela, 2022). This is reinforced by research conducted that mathematical literacy can be improved if it is addressed with a realistic scientific approach using a project-based learning model and PISA-based measurements (Utami & R. N., 2018). Apart from that, according to research the project-based learning (PjBL) model is suitable for increasing students' mathematical literacy because students not only learn theory but also real-world practice (Jannah, R., Budi Waluya, S., 2021). Subsequent research argues that the PjBL model can improve students' communication skills and mathematical creative thinking abilities (Chung et al., 2022; Hamidah, 2022).

There are differences between this research and previous research, namely, 1) the type of research is development research and systematic literature review, while this type of research is quasi-experimental research, 2) previous research only discusses increasing students' mathematical literacy abilities, even though in this research apart from measuring Improving mathematical literacy skills also discusses the process of completing answers for students who have high and low mathematical abilities. 3) previous research discussed mathematical communication skills and creative thinking, while this research discusses students' mathematical literacy abilities. Based on the information above, further research is needed to find out whether the increase in mathematical literacy skills of students taught using the project-based learning model is higher than students taught using the regular learning model. This research hypothesizes that the increase in mathematical literacy skills of students taught using a project-based learning model is higher than students taught using a regular learning model.

2. METHOD

This research is a quasi-experimental research designed to see whether the project-based learning model (PjBL) can improve students' mathematical literacy skills (Rogers & Revesz, 2019). The independent variable of the research is project-based learning methods, and the dependent variable is students' mathematical literacy abilities. This research was conducted at SD Negeri 064967 Jl. Sidorukun, East Medan

sub-district journalist complex. North Sumatra region. The population in this study were all students at SD Negeri 064967. The sampling technique used was purposive sampling, which is a technique used in qualitative research to select a group of individuals or certain units for analysis. The reason for using purposive sampling is because the material studied is fractional numbers and is in class IV. The sample for this research was all fourth grade students at SD Negeri 064967 Medan. This research used a pre-test – post-test control group design. The sample was divided into two classes, namely 13 people as a sample who would apply project-based learning as an experimental class and 13 people as a sample who would apply regular learning as a control class as show in Table 1.

Table 1. Research Design

Class	Pre-test	Treatment	Post-test
Experiment (E)	O1	Using the project based learning method	O2
Control (K)	O3	Using conventional learning methods	O4

In the two class groups as show in Table 1, the researcher will give a pretest question first, this is done to find out the results of students' initial abilities before holding the posttest or to know the results of learning carried out using the previous method. After the pretest is carried out, both classes will be given a final test often called a posttest intending to compare learning outcomes between the previous method and the method that will be applied, but before the posttest is carried out, the experimental class is given treatment or treatment first. Next, this research will explain how to find out the differences and changes in the use of project-based learning methods. Data collection techniques include documentation, interviews, and observation. Meanwhile, the instrument of this research is a mathematical literacy ability test which consists of five description questions, each of which consists of five indicators of mathematical literacy ability, namely: 1) identifying facts, 2) describing problems, 3) using mathematical concepts, 4) implementing calculations and 5) interesting conclusions.

The instrument of this research is a mathematical literacy ability test. The data analysis techniques used in this research consist of two, namely inferential and descriptive statistics. Inferential statistics are used to determine the differences in the use of project-based learning models and regular learning models concerning students' mathematical literacy abilities. Meanwhile, the process of completing students' answers taught using the PjBL model and regular learning related to mathematical literacy problems was examined with the help of descriptive statistics.

The data analysis technique in this research uses quantitative descriptive data analysis techniques. Namely, the data analysis technique used to describe the effectiveness of using project-based learning in improving student learning outcomes in lessons. Based on the results of this analysis, research instruments can function to obtain numerical data. This research uses techniques that will be used to obtain comparison results between the average learning outcomes in the control class and the experimental class. Descriptive Data Analysis is statistics used to analyze data that has been obtained from researchers. The method is to describe/illustrate the data that has been collected based on what is available, and does not aim to conclude with a conclusion that applies or in short, is generalized. Next, hypothesis testing is carried out on the data to clarify the research results using the Independent Sample t-Test and Paired Sample t Test if the data is normally distributed but if the data is not normally distributed then hypothesis testing in this study uses the Wilcoxon Test and Mann Whitney Test.

3. RESULT AND DISCUSSION

Result

Based on the mathematical literacy ability test given to control class and experimental class students before and after treatment, the summarized data can be seen in Table 2.

Table 2. Data Description

Class	Score			
	Pre-Test	Post-Test	N-Gain	Criteria
Experiment	57.29	88.21	0.72	High
Control	46.43	27.14	-0.38	Low

Table 2 shows that the average pre-test score for the experimental class is higher than the control class. In the experimental class, the average pre-test result was 57.29, while in the control class it was 46.43. Apart from that, the average post-test score for the experimental class was higher than the control class. In

the experimental class, the average post-test score was 88.21, an increase compared to before. Meanwhile, in the control class, the post-test average was only 27.14 and experienced a decrease compared to before. The n-Gain score is then calculated to determine the increase in mathematical literacy skills before and after learning. The average N-Gain value for the experimental class reached 0.72 for the high gain criteria. Meanwhile, the average N-Gain score for the control class reached -0.38 with low improvement criteria. Thus, it can be concluded that in general the mathematical literacy skills taught using the PjBL model are higher than those taught using normal learning.

Next, to determine the difference in ability improvement between control classes, testing continues using parametric statistics (t-test), by determining the hypothesis to be tested, presented in Table 3.

Table 3. Hypothesis Details

	Research Hypothesis	Statistical Hypothesis
H_0:	Average increase in literacy skills Student mathematics taught through the PjBL model is the same as the regular learning model.	H_0:$\mu_1=\mu_2$
H_a:	The average increase in students' mathematical literacy skills taught using the PjBL model is higher than when using the regular learning model.	H_a:$\mu_1>\mu_2$

Before testing the hypothesis, the researcher first carried out prerequisite tests, namely the normality test and homogeneity test. test for normality of the average scores of the experimental class and control class. In this test, the Shapiro-Wilk test will be used with a significance level of 0.05. After the data is processed using the SPSS program, the output results can be seen in Table 4.

Table 4. Shapiro – Wilk Test

	Statistic	df	Sig
Pre Test Experiment	0.951	13	0.125
Post Test Eksperimen	0.968	13	0.400
Pre Test Control	0.104	13	0.202
Post Test Control	0.116	14	0.284

Based on Table 4 calculations using the Shapiro-Wilk test in the table above, it can be concluded that the pretest score data are significant for the experimental class and control class. In the experimental class, it was 0.125 and in the control class, it was 0.202. Thus, it can be concluded that the data is a normally distributed sample with a significance level of more than 0.05. The same thing can also be seen in the table above at the posttest significance level for both classes, namely 0.400 for the experimental class and 0.284 for the control class. By presenting the results of the significance of the data, it can be concluded that the two classes as well as the pretest and posttest data are normally distributed samples, so data testing can be continued using parametric statistics to see the differences between the 2 samples using no test. Next, the homogeneity test is calculated as one of the conditions for using the t-test. The results of homogeneity test calculations for both the experimental class and the control class searched using SPSS are presented in Table 5.

Table 5. Summary of Homogenity Test Result

Class	Varians	F_{count}	F_{table}	Information	Conculation
Experiment Control	0.093 0.159	2.995	3.38519	$F_{count} < F_{table}$	Homogen

From Table 5, the $F_{count} < F_{table}$ value is obtained with a significance level of α=0.05 so it can be concluded that the data for the two samples are homogeneous. So the t test can be continued because it meets both conditions, namely that the data is normally distributed and homogeneous. A summary of the t-test results can be seen in Table 6.

Table 6. Summary of t-test Result

	Research Hypothesis	Statistical Hypothesis	T_{count}	T_{table}	Information
H_0:	The average increase in students' mathematical literacy skills taught through the PjBL model is the same	H_0:$\mu_1=\mu_2$	22.231	2.5326	H_a received The meaning is The average

	Research Hypothesis	Statistical Hypothesis	T_{count}	T_{table}	Information
	as the normal learning model.				increase in students' mathematical literacy skills taught using the PjBL model is higher compared to the normal learning model
H_a:	Average increase in students' Mathematics literacy skills Taught with the PjBL model higher than Using normal learning models	H_a:$\mu 1 > \mu 2$			

From Table 6 it is known that the t_{count} is 20.231 and the table is 2.5326, namely $t_{count} > t_{table}$. Thus, the hypothesis is accepted, which means that the average increase in the mathematical literacy skills of students taught using the PjBL learning model is greater than the average increase in the mathematical literacy skills of students taught using the regular learning model.

In the second indicator, namely formulating the problem, the number of students who answered the good or very good category in the experimental class was more, to be precise 13 people compared to only 4 people in the control class. In the third indicator, namely using mathematical concepts, the number of students who answered the good or very good category in the experimental class was more, namely 13 people, compared to only 4 people in the control class. In the fourth indicator, namely. Based on calculations, the number of students who answered the good or very good category in the experimental class was more, namely 13 people, compared to only 4 people in the control class. Apart from that, in the fifth indicator, namely concluding, the number of students who were able to answer the good or very good category in the experimental class was more, namely 12 people, compared to the control class which only reached 2 people. A graph depicting the number of students who were able to answer mathematical literacy skills questions based on indicators in the good or very good category between the experimental class and the control class is presented in Figure 1.

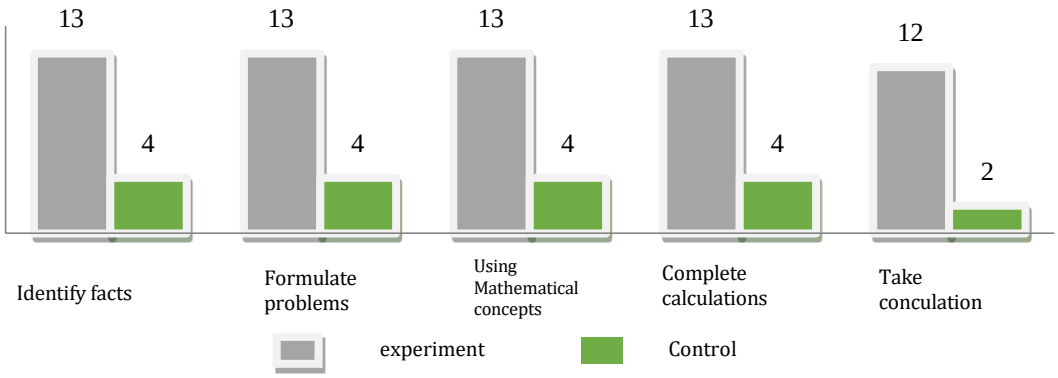

Figure 1. Graphic of Number Students in Mathematical Literacy Skills

Discussion

The use of a project-based learning model has a significant influence on students' mathematical literacy abilities. This is because students not only have to understand the concepts of the material being taught but they are also involved in projects related to that material to further develop their understanding (Afriana et al., 2016; Hamidah, 2022). Apart from testing the hypothesis that the increase in students' mathematical literacy skills using the PjBL model is higher than regular learning, it is also important to know how students complete the process of answering questions about mathematical literacy skills. Many students answered the > Good category (who got a score of 3 or 4 on each indicator). Judging from the process of completing students' answers to questions, the mathematical literacy skills taught through the PjBL model are better than the process taught through regular learning (Maulana, 2019; Nizham et al., 2017). This is seen in the first indicator, namely identifying facts mathematically. In the experimental class, more people answered the good or very good category, namely 13 people compared to the control class which only reached 4 people.

The factors that influence the results of this research are caused by the PjBL model, namely a learning model that emphasizes project assignments in practice in the field. A project is a collection of tasks that culminate in the achievement of a product to maximize student knowledge, broadening students' horizons by exploring their environment in solving everyday problems. In line with previous study that said

the first reference to project-based learning is mentioned in the work of Kilpatrick, who believes that the use of literacy in real life is meaningful as a means of building basic knowledge and achieving student goals. personal goals, growth (Suraweera et al., 2018).

Through project activities, students can provide a rich understanding of concepts and ideas. Topics that originate from students' interests and through activities carried out by students in groups will help students develop an understanding of their lives and prepare themselves for work. This is by constructivist learning theory which provides opportunities for students to explore available learning media and materials and actively seek information about existing topics (Alenezi, 2020; Xu & Shi, 2018). The advantage of using constructivist learning theory is that it trains students to be able to create creativity in learning so they can create a project related to the material being taught. This learning theory emphasizes that students build knowledge through interaction with their environment.

By conducting research, discussions, or activities, students can build new knowledge based on students' previous knowledge. This is very different from ordinary learning, namely learning that is usually applied in class. Learning generally begins with the teacher providing an explanation of the material accompanied by examples and discussion, asking questions, and students are asked to solve problems. In ordinary learning, the teacher dominates the class, students are rarely involved in group discussions which can train good communication and collaboration skills between fellow students in the class (Amna Saleem et al., 2021; Sugandi & Bernard, 2018).

Apart from that, teachers also rarely involve the surrounding environment as a source of learning information related to the mathematics material being taught. Teachers are used to asking abstract questions contained in the handbooks they use and rarely ask contextual questions. So it is very natural that students' mathematical literacy skills are less honed if they are taught using normal learning. This is by research by previous study that shows that the PjBL model is effective for teaching mathematical literacy skills to students because they learn theory and apply it in the real world (Jannah, R., Budi Waluya, S., 2021). The advantage of this research is that it shows an increase in mathematical literacy skills in students who are taught using a project-based learning model, and examines the process of completing students' answers. However, the weakness of this research is that it has not used technological tools (software) to solve problems related to mathematical literacy.

4. CONCLUSION

The results of this research found that the increase in the mathematical literacy skills of students taught with the PjBL model is higher compared to those taught with the normal learning model. Moreover the process of completing students' answers regarding mathematical literacy questions taught with the project based learning model is better than those taught without the project based learning model. Through project activities, students can provide a rich understanding of concepts and ideas.

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