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THE EFFECT OF THE PROBLEM-BASED LEARNING MODEL ON THE NUMERICAL LITERACY ABILITY OF ELEMENTARY SCHOOL STUDENTS

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Abstract
This research was motivated by elementary school students' low numeracy literacy ability, especially grade III. The low numeracy literacy of students is caused by students' thinking that mathematics is a complex subject and the selection of learning models that do not develop students' critical thinking skills. Meanwhile, students need good critical thinking and problem-solving skills to answer numeracy literacy questions. This study aims to determine the effect of problem-based learning models on numeracy literacy skills. The research method used in this study is a quantitative method with a quasi-experimental non-equivalent control group design. The samples in this study were grade III A and B students of SD Negeri Sukaraja Wetan I. The research instruments used were numeracy literacy tests, teacher performance observation sheets, and student activity observation sheets. Data analysis techniques used in SPSS version 26 are the t-test, simple linear regression, and N-Gain tests. The results of this study showed the influence of the problem-based learning model on the numeracy literacy ability of elementary school students by 52.8%. In addition, there was a difference in students' numeracy literacy ability, marked by an increase of 41% with the medium category in the experimental class. In contrast, in the control class, there was only an increase in scores of 11% with the low category.
Keywords: *Problem-Based Learning*; *numeracy literacy*

Abstrak
Penelitian ini dilatar belakangi oleh rendahnya kemampuan literasi numerasi siswa sekolah dasar khususnya kelas III. Rendahnya literasi numerasi siswa disebabkan oleh pemikiran siswa yang berasumsi bahwa matematika merupakan mata pelajaran yang sulit dan pemilihan model pembelajaran yang kurang mengembangkan kemampuan berpikir kritis siswa. Sedangkan dalam menjawab soal literasi numerasi, siswa membutuhkan kemampuan berpikir kritis dan pemecahan masalah yang baik. Tujuan dari penelitian ini adalah mengetahui pengaruh model *problem based learning* terhadap kemampuan literasi numerasi. Metode penelitian yang digunakan pada penelitian ini adalah metode kuantitatif dengan jenis kuasi eksperimen *non-equivalent control group design*. Sampel pada penelitian ini adalah siswa kelas III A dan B SD Negeri Sukaraja Wetan I. Instrumen penelitian yang digunakan adalah tes literasi numerasi, lembar observasi kinerja guru, dan lembar observasi aktivitas siswa. Teknik analisis data yang dilakukan dengan menggunakan SPSS versi 26 adalah uji t, uji regresi linear sederhana, dan uji N-Gain. Hasil pada penelitian ini menunjukkan adanya pengaruh model *problem based learning* terhadap kemampuan literasi numerasi siswa sekolah dasar sebesar 52,8%. Selain itu, terdapat perbedaan kemampuan literasi numerasi siswa yang ditandai dengan adanya peningkatan sebesar 41% dengan kategori sedang pada kelas eksperimen sedangkan pada kelas kontrol hanya ada peningkatan skor sebesar 11% dengan kategori rendah.
Kata Kunci: *Problem Based Learning*; literasi numerasi

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Introduction

To deal with the concept of life in the 21st century, 16 skills must be mastered and applied by students in their daily lives. One such skill is essential literacy ability. According to Kuder & Hasit (Apipatunnisa et al., 2022), literacy relates to individual skills in writing, reading, speaking, processing information, and the ability to solve problems that arise in everyday life. In the 21st century, Indonesia must improve six literacy levels to increase competitiveness. The six literacy areas include language, numeracy, scientific, digital, financial, cultural, and civic. Numeracy literacy is part of mathematics. Mathematical literacy is a person's ability to formulate, apply, and interpret mathematics in all situations by thinking mathematically and utilizing concepts and tools to describe, explain, use, and predict a condition that can help someone understand the benefits of mathematics in everyday life (Ashri &; Pujiastuti, 2021). There are four parts to numeracy literacy: exploring, associating, thinking logically, and using mathematical methods (Febrianti, 2022).

According to the findings of a 2019 survey conducted by PISA (Programme for International Student Assessment), the quality of education in Indonesia was ranked unfavorably, placing 74th out of 79 countries (Kurniawati, 2022). In addition to mathematics, PISA assessed reading and science skills as well. The outcomes of the PISA test in Indonesia revealed that the students achieved an average score of 371 in reading, 379 in mathematics, and 396 in science. These scores fall below the average of the 79 countries surveyed by PISA. The average proficiency scores for reading, math, and among the 79 countries were 487 and 489, respectively (OECD in Purwaningrum et al., 2023).

According to the Education Standard, Curriculum, and Assessment Agency of the Ministry of Education and Culture, the 2019 Reading Literacy Activity Index (Alibaca) study revealed that the Nation Alibaca index scored an average of 37,32 out of 100, placing it in the low category. Alibaca categorizes literacy skills into low, medium, and very low. The study found that 24 provinces fell into the low category, nine into the medium category, and one into the deficient category (Febrianti, 2022). These findings, along with the results of the PISA surveys conducted in 2015 and 2019, indicate that the literacy ability of Indonesian students needs to improve. Moreover, there has been no significant improvement in literacy rates over time.

Jannah, et al (in Fitriana, 2022) argues that in the 21st century, mathematics learning in schools focuses more on critical thinking skills, being able to relate insights to the real world, being proficient in information technology, and being able to communicate and collaborate. Based on the results of observations and interviews conducted by researchers at several elementary schools in December 2023, it was found that a similar problem in grade III was that mathematics is the subject most avoided by students. According to the explanation of one of the teachers who was a resource person, this was caused by students who assumed that mathematics subjects were complex subjects so that when mathematics lessons were to be carried out, students tended to complain and did not focus on learning. Numeracy literacy skills in mathematics subjects in grade III could be higher. This can be seen in the acquisition of students' consistently low mathematics scores, especially in the types of description questions that require good numeracy literacy skills. In addition, students need to be used to solving numeracy literacy problems that require reasoning, critical thinking, reflection, and process.

Model deployment *Problem-Based Learning* (PBL) is a solution that can help teachers increase elementary school students' numeracy literacy in teaching and learning activities. Wibowo and Harun (in Samad et al., 2023) argue that Problem-Based Learning is a learning

model that has a primary concentration on problems so that it can help in the growth of learning skills through an open, reflective, critical mindset and prioritizes active learning. In this model, students will face a problem at the beginning of learning, which will then be solved using their knowledge. According to Rusman (in Suratno et al., 2020), PBL is a learning that can optimize students' thinking skills through a systematic cooperation process so that students can improve their thinking skills continuously.

According to Samad, et al (2023), the application of problem-based learning approaches can result in significant improvements in numeracy literacy, particularly in mathematics. In the initial cycle, students obtained an average numeracy literacy score of 64.13, so students were in the medium category with a classical completion level of 20%. However, in the next cycle, students showed remarkable progress, achieving an average numeracy literacy score of 100 with a high category and with a climax completeness rate of 100%. In another study conducted by Aditya, et al (2023) It was found that the application of a problem-based learning approach proved successful in improving students' numeracy literacy skills. In line with Fitriana (2022) Those who conducted similar studies also concluded that the learning model *Problem-Based Learning* has the potential to improve mathematical numeracy literacy skills. This can be seen from the results of the experimental class regression analysis, which showed that the model used had an effect of 84.7% on improving numeracy literacy skills.

Results of research conducted by Ab'ror (2023) shows that there is a difference between the average pretest and post-test scores, namely the average pretest score of 28.4 and the average post-test score of 68.2. T-test results using *paired sample t-test* A significance value of 0.000 is less than an alpha value of 0.05. This means that there are differences before and after treatment using the model of *problem-based learning.* Research conducted by Prasetyo (2023) also states that there is a similar point that there is an influence of fashion *Problem-based Learning in* the form of increasing literacy and numeracy skills of elementary school students. This can be seen from the results of the test calculation, which is *descriptive* by average rating. *The pretest experimental class is 41.25, and the grade point average posttest is* 86.00. In the control class, the average score obtained was 63.00 for the *Pretest*, and at the time of the posttest, the score was 64.00.

Based on the studies that previous researchers have conducted, the researcher realizes that there is a difference between previous studies and research conducted by the researcher himself. The difference lies in the location and population of the study. This research was carried out at SD Negeri Sukaraja Wetan 1 with a research population of grade III elementary school students in the Majalengka Regency area. Therefore, the results of the study will be novel because the location and population of the study have never been conducted on the numeracy literacy ability of elementary school students before.

The issue of low numeracy literacy skills among elementary school students is the primary focus of this research. To address this concern, the researcher has chosen the title "The Effect of The Problem-Based Learning Model on The Literacy Ability of Elementary School Students." The objective of this study is threefold: (1) to assess the influence of the problem-based learning model on the numeracy literacy skills of elementary school students, (2) to compare the numeracy literacy skills of elementary school students before and after implementing the problem-based learning model, and (3) to analyze the implementation of the problem-based learning model and its effects on the numeracy literacy skills of elementary school students.

Research Methods

This research adopts quantitative research methods, with the type of research being quasi-experimental. Sugiyono (in Pratama, 2022) Explains that researchers can conduct experimental research to understand the causal influence between independent and dependent variables. The independent variable in this study is the problem-based Learning model, and the dependent variable is numeracy literacy. In this study, researchers used the design of a *Non-equivalent Control Group*. *Non-equivalent Control Group Design* is a research design carried out with initial and final tests of the experimental and control classes. Experimental classes using models *Problem-Based Learning* In its learning, the control class uses a conventional learning model. The population in this study was grade III elementary school students in Majalengka Regency. This research sample comprised III A students as an experimental class and III B as a control class at SD Negeri Sukaraja Wetan I. The sample is part of the number and characteristics possessed by the population (Sugiyono in Pratama, 2022). The sampling technique in this study used purposive sampling, which is carried out with specific considerations. The research instruments used were student numeracy literacy tests, teacher performance observation sheets, and student activity observation sheets.

Data analysis techniques on observation sheets of teacher performance and student activities are only done in data processing by taking the average score obtained in percentage form. At the same time, the data analysis technique carried out by data on the results of student numeracy literacy test instruments aims to see whether there is an influence before and after treatment. Therefore, the data from the numeracy literacy test instrument results carried out statistical tests in the form of normality tests, homogeneity tests, average difference tests (*independent sample t-tests*), simple linear regression tests, and N-Gain tests. The statistical test was carried out with the help of *SPSS application version 26*. Before conducting research, a trial of student numeracy literacy test questions was carried out to find out whether the test instrument was valid or not. The question trial was conducted on non-research participant respondents, namely grade III students of SD Negeri Sukaraja Wetan II. Based on the results of the validity test using *SPSS version 26*, there are nine valid numeracy literacy test questions out of 10 test questions. In addition to conducting validity tests, student numeracy literacy test questions also carried out reliability tests, differentiating power tests, and difficulty levels. Nine student numeracy literacy test questions were declared to have a high-reliability correlation coefficient with a Cronbach's Alpha score of 0.841. The results of the discriminating power test stated 1 question item with a perfect category, seven questions with a suitable category, and 1 question point with a sufficient category. Meanwhile, based on the results of the difficulty level test, it was stated that of the nine questions tested, there were five questions with a medium level of difficulty and 4 points of questions with a manageable level of difficulty. Here is the hypothesis in this study:

H_0: There is no influence of *the problem-based learning model* on the numeracy literacy ability of elementary school students

H_1: There is an influence of *the problem-based learning model* on the numeracy literacy ability of elementary school students

The testing criteria for the hypothesis are as follows:

1) If sig. < α, then H_0 is rejected, and H_1 is accepted, meaning that there is an influence of *the problem-based learning model* on the numeracy literacy ability of elementary school students

2) If sig. > α, then H_0 is accepted, and H_1 is rejected, meaning that there is no influence of *the problem-based learning model* on the numeracy literacy ability of elementary school students

Results and Discussion

The results of this study contain data on student numeracy literacy test results, teacher performance observations, and student activity observations. The pretest score results are obtained before being treated in the experimental or control classes. At the same time, the post-test score is obtained after being treated in the experimental class, namely by applying the problem-based learning model and conventional learning to the control class. The following is a statistical data description of *the pretest and posttest scores of* the experimental and control classes.

Table 1
Pretest Posttest Descriptive Statistical Data

Description	Experimental Class		Class Control	
	Pretest	Posttest	Pretest	Posttest
Number of students	27	27	26	26
Ideal maximum score	27	27	27	27
Minimum score	5,5	10,5	5	7
Maximum score	14	21,5	15	19
Average	9,904	17,426	10,907	13,192
Revision standards	1,7211	2,4007	2,3023	3,1211

Based on the table above, it can be seen that the average pretest score in the two classes does not have a significant difference. At the same time, in the post-test result data, there is a substantial difference between the post-test results of the experimental class and the control class. The average posttest score obtained by the experimental class was 17,426, while the average posttest score in the control class only received a score of 13,192. Calculations are needed in the form of t-tests, simple linear regression tests, and N-Gain tests to find out the significant difference in students' numeracy literacy ability. Before conducting the test, prerequisite tests must be carried out, namely the normality test and the homogeneity test. Because of the requirements for performing a t-test, the data obtained must be normally distributed and homogeneous. The following are the results of the normality test of pretest data and posttest numeracy literacy of elementary school students using Shapiro Wilk.

Table 2
Test Results from Normality of Pretest Posttest Data

Class	p-value
Experimental class pretest	0,067
Control class pretest	0,984
Posttest experimental class	0,323
Posttest control class	0,927

Based on the normality test results on pretest and posttest data in both classes, a p-value more significant than sig was obtained. = 0.05, which means that all the data obtained are typically distributed. After conducting a normality test, proceed with a homogeneity test, which aims to determine whether the variance of the data analyzed is homogeneous or not. In this study, the significant level used was 0.05. The following are the homogeneity test results on the pretest and posttest score data.

Table 3
Homogeneity Test Results

Data	p-value
Pretest	0,115
Posttest	0,142

Based on the results of the homogeneity test above, it can be seen that the p-value in the experimental and control class posttest pretest data obtained a value greater than $\alpha = 0.05$. This means that pretest-posttest data in experimental and control classes have homogeneous data. The results of the normality and homogeneity test show that the pretest post-test data of the experimental class and the control class are typically distributed and homogeneous, then the calculation can be continued by conducting a t-test to determine whether there is a difference in the average numeracy literacy ability of students between the experimental class and the control class. The results of the average difference test using the independent sample t-test are in the following table:

Table 4
T-test Results Pretest-Posttest Score Student Numeracy Literacy Ability

Data	p-value
Pretest	0,077
Posttest	0,000

Based on the table above, it can be seen that the pretest data obtained a p-value of 0.077 $> \alpha = 0.05$, which means that there is no significant average difference in the pretest data on students' numeracy literacy skills in the experimental class and control class. However, in the posttest data, the p-value obtained was $0.000 < \alpha = 0.05$, which means there is a significant average difference in the posttest data on the numeracy literacy skills of experimental and control class students. To find out more details about the difference in the average numeracy literacy ability of students, an N-Gain test was carried out, which serves to analyze the difference in students' numeracy literacy skills in the experimental class and the control class by looking at the extensive comparison of the increase in scores obtained. The following are the results of the descriptive statistical test of the N-Gain Score index.

Table 5
Descriptive Statistics of Index N-Gain Score

Class	N	N-Gain_{min}	N-Gain_{max}	Average	Information
Experimental	27	0,17	0,61	0,41	Medium
Control	26	0,00	0,44	0,11	Low

The table above shows that there is a considerable difference in average N-Gain scores between the experimental class and the control class. The experimental class showed an increase of 41%, with the medium category marked with an average score of 0.41. The increase in scores in the control class only showed a score of 0.11, a percentage of 11% in the low category. The learning model can influence the considerable increase in numeracy literacy skills in experimental classes applied, the model of *Problem-Based Learning,* and the use of learning media. Lemonade (in Nurcahyono, 2023) argues that problem-based learning is a learning model that involves students solving problems through the stages of the scientific method and creates students who have problem-solving skills so that students can learn

knowledge related to the problem. The opinion is supported by Tedana, Tindangen, and Rosifah (2024) Implementing the problem-based learning model can shape numeracy literacy skills by improving critical thinking and problem-solving skills. Alan and Afriansyah (in Ambarwati &; Kurniasih, 2021; Y. I. Siregar, 2024) States that the use of learning media in the problem-based learning model can help students solve problems and shorten learning time for students who lack understanding of the material to be studied. According to Khakim (2023) Learning models and media are needed to help students learn in elementary school, according to research conducted by Rifki et al. (in Rosanty, 2003) States that a positive and significant relationship exists between a mathematical disposition to model implementation of *Problem-Based Learning* and mathematical literacy skills.

To see whether or not there is an influence of *the problem-based learning* model on the numeracy literacy ability of elementary school students, calculations are needed in the form of simple linear regression tests on experimental class pretest and posttest data assisted by the *SPSS version 26 application*. The results of a simple linear regression test can be seen in the following table:

Table 6
Simple Linear Regression Test Results

Model	R	R Square (r^2)
1	0,727	0,528

Based on the table above, it is known that the R square in the experimental class posttest pretest data is 0.528, or a percentage of 52.8%. This means that the problem-based learning model has an influence of 52.8% on the numeracy literacy ability of elementary school students. Many factors can influence such a large gain or significant impact. Syntax on learning models *Problem-Based Learning* Is one of the crucial factors in this study because it can have a positive influence on students' numeracy literacy skills by improving critical thinking skills and problem-solving skills in students. According to Ratnawati (in Nurcahyono, 2023) Learning Model *Problem-Based Learning* It is a learning concept with a distinctive characteristic involving problems to train problem-solving skills and various literacy skills. In line with the opinions expressed by Andini, et al. (2023) Learning model syntax Problem-based learning can improve numeracy literacy skills, especially in the phase of individual or group investigation, where students conduct investigations by asking questions and reasoning to solve problems.

The statements of Harafe and Silalahi support the above opinion. (in Nisa, 2023) The model syntax concatenation *Problem-Based Learning* can improve students' numeracy literacy skills. Siregar, et al. (2023) States that applying the model of *Problem-Based Learning* In learning can improve students' numeracy literacy skills because students' curiosity increases as well. According to Yani, et al. (2024) Model implementation *Problem-Based Learning* In learning can facilitate students' understanding of the material learned because, in its implementation, students will be encouraged to be actively involved so that it can have a positive impact on their numeracy literacy skills. Therefore, the problem-based learning model influences the numeracy literacy ability of elementary school students because it can provide a better change in grades.

To determine the influence of the problem-based learning model on the numeracy literacy ability of elementary school students, observations were made on the implementation of PBL syntax and student activities regarding numeracy literacy skills. Observation of the implementation of PBL syntax aims to determine the level of implementation of the problem-based learning model syntax carried out by teachers by putting a checkmark on the

appropriate column. The following are the results of observations on the implementation of PBL syntax:

Table 7
Results of Observation of the Implementation of PBL Syntax

PBL Syntax	Maximum Score	Score Obtained	Percentage
Student orientation to the problem	8	8	100%
Organizing students to learn	20	20	100%
Guiding individual and group investigation	8	7	88%
Develop and present	12	11	92%
Analyze and evaluate the learning process	8	7	88%
Total	**56**	**53**	**468%**
Average percentage amount			**94%**

Based on the table above, the implementation of PBL syntax carried out by teachers in providing treatment in the form of problem-based learning obtained an average score of 94%. That is, the stages or syntax of the problem-based learning model have been implemented following the Learning Implementation Plan (RPP) prepared previously and known by observers. To determine how implementing the problem-based learning model affects students' numeracy literacy skills, observations were made on student activities during the learning process. The following are the observations obtained:

Table 8
Results of Observations of Student Activities

Indicators	Maximum Score	Score Obtained	Percentage
Use basic math numbers or symbol	432	323	75%
Analyze information in the form of graphs, tables, diagrams, and others	324	241	74%
Interpreting the results of the analysis	216	147	68%
Total	**972**	**711**	**217%**
Average percentage amount			**72%**

Based on data from observations of student activities carried out when given treatment in applying problem-based learning mode to numeracy literacy skills, an average percentage of 72% was obtained in the excellent category. The acquisition of the average rate of student activity is influenced by the implementation of the problem-based learning model, which is implemented very well following the results of teacher performance observations. Andini, et al. (2023) It argues that the phases or syntax in the problem-based learning model are references that help the process of learning activities improve numeracy literacy skills, especially in the phase of individual or group investigation. In this phase, students will investigate by asking questions and thinking to solve problems provided by the teacher. Murtono, et al. (2023) It states that good learning preparation and selection of suitable learning models will positively influence student learning outcomes, including numeracy literacy skills. The enthusiasm and high motivation of students to follow the learning is mentioned by Anugrah &; Sarnawiah (2023) As one of the factors that can have a good

impact on students' numeracy literacy skills, with high motivation, students have the drive to observe and understand the material.

Model Deployment *Problem-Based Learning* The appropriate will make students actively involved in the learning process through problem-solving activities by discussing and reasoning on problems affecting the help of learning media that the teacher has adjusted (Agustin, 2022; Ambarwati &; Kurniasih, 2021; Masliah &; Nirmala, 2023; Mawarsari et al., 2022; Rahmah et al., 2023; Widiastuti &; Kurniasih, 2021). Sumartini (in Aisah, et al., 2023) argues that the problem-based Learning model enables students to solve real problems through group discussion activities. In addition, Mulyati and Watini (in Rahayu, et al., 2023) They added that teachers who understand the learning model students have chosen can influence the process of maximizing their literacy and numeracy skills.

Conclusion

The Problem-based Learning model influences students' numeracy literacy ability based on the results of the calculations that have been carried out. The results are influenced by several factors, one of which is that the syntax or stages in the *problem-based learning* model encourage students to think critically and solve problems well, which can affect the numeracy literacy ability of elementary school students. The numeracy literacy ability of elementary school students before and after learning using *the problem-based learning model* has differences. The difference in the form of an increase in scores is influenced by the application of *the problem-based learning model* and the use of learning media in learning activities. The implementation of the problem-based learning model has a positive impact on the numeracy literacy ability of elementary school students. This is influenced by the level of implementation of PBL syntax, which is very good or very appropriate.

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