Improving the Numeracy Skills Elementary School Students by Problem Based Learning Model

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A B S T R A K

Ada empat kategori keterampilan abad 21 yang sangat diperlukan saat ini mencakup Personal Skills, Social Skills, Information and Knowledge dan Digital Literacy. Akan tetapi kemampuan literasi dan numerasi siswa sekolah dasar masih dalam kategori rendah. Penelitian ini bertujuan untuk menganalisis pengaruh yang signifikan model pembelajaran Problem Based Learning terhadap kemampuan numerasi siswa kelas V sekolah dasar. Penelitian ini merupakan penelitian quasi experiment dengan desain non-equivalent control group design. Populasi penelitian melibatkan sebanyak 118 siswa. Sampel diambil dengan teknik cluster random sampling dan diperoleh sampel kelompok eksperimen sebanyak 26 orang dan sampel kelompok kontrol sebanyak 19 orang siswa. Metode pengumpulan data menggunakan metode tes, dengan jenis tes yang digunakan yaitu tes pilihan ganda yang berjumlah 20 butir soal. Berdasarkan hasil analisis data, diperoleh hasil analisis skor post-test pada kelompok eksperimen adalah 82,31 dan berada pada kategori tinggi, sedangkan hasil analisis skor post-test pada kelompok kontrol adalah 63,68 dan berada pada kategori rendah. Hasil dari analisis uji-t menunjukkan bahwa thitung (10,038) lebih besar daripada ttabel (2,016), sehingga H0 ditolak dan H1 diterima. Diperoleh kesimpulan bahwa terdapat pengaruh yang signifikan model pembelajaran Problem Based Learning terhadap kemampuan numerasi siswa kelas V sekolah dasar..

A B S T R A C T

There are four categories of 21st century skills that are urgently needed nowadays: Personal Skills, Social Skills, Information and Knowledge and Digital Literacy. However, the literacy and numeracy skills of elementary school students are still in the low category. This research aims to analyze the significant influence of the Problem Based Learning model on the numeracy abilities of fifth grade elementary school students. This research is a quasi-experimental with a non-equivalent control group design. The research population involved 118 students. Samples were taken using a cluster random sampling technique and the experimental group sample was 26 students and the control group sample was 19 students. The data collection method uses the test method, with the type of test used being a multiple choice test consisting of 20 questions. Based on the results of data analysis, the post-test score analysis results in the experimental group were 82.31 and were in the high category, while the post-test score analysis results in the control group were 63.68 and were in the low category. The results of the t-test analysis show that tcount (10.038) is greater than t¬ (2.016), so H_0 is rejected and H_1 is accepted. It was concluded that there was a significant influence of the Problem Based Learning learning model on the numeracy abilities of fifth grade elementary school students.

1. INTRODUCTION

21st Century Learning is currently very popular by bringing changes, namely the rapid development of Science and Technology (IPTEK) resulting in changes in the learning paradigm which is characterized by changes in curriculum, media and technology. There are four categories of 21st century skills that are very necessary, namely Personal Skills, Social Skills, Information and Knowledge and Digital Literacy (Rahayu et al., 2022; Sadaf & Johnson, 2017). More concisely, the most important 21st century softskill abilities include: Critical Thinking and Problem Solving, Creativity and Innovation, Communication, and Collaboration. Knowing the importance of this, the education needed by students today is skills in understanding

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problems, analyzing problems, managing problems, finding ways to solve problems critically and creatively, and implementing solutions to these problems to be resolved (Astuti et al., 2019; Sadaf & Johnson, 2017).

The government's effort to realize 21st century education is by creating an independent learning policy. The beautifier created the concept of independent learning because of his desire to create a happy learning atmosphere without being burdened with achieving certain scores or grades (Ebele & Olofu, 2017; Mustaghfiroh, 2020). After the implementation of the independent learning policy, there will be many changes, especially in the learning system. One of the independent learning policies is the National Examination which is replaced with the *Asesmen Kompetensi Minimum* (AKM) which is expected to be able to encourage improvements in the quality of learning in Indonesia. This AKM system will assess two cognitive aspects, namely literacy and numeracy. Literacy material will emphasize comprehension skills and the ability to analyze (Klarita & Syafi'ah, 2022; Yuliandari & Hadi, 2020).

Numeracy itself is the knowledge, skills and behavior that students need to use mathematics in various situations, including the introduction and understanding of mathematics in the world, as well as having the ability to use this knowledge and skills according to their goals (Muliantara & Suarni, 2022; Ouahidi, 2020). The numeracy material here will emphasize the ability to analyze numbers. This numeracy is different from general mathematical knowledge. In simple terms, numeracy is the skill to apply mathematical knowledge such as number concepts and arithmetic operation skills as well as interpreting quantitative information in real life (Rachman et al., 2021; Yuliandari & Hadi, 2020). Literacy and numeracy are the minimum competencies or basic competencies that students need to be able to learn. The assessment will be carried out by students who are in the middle of the school level, so that it can encourage teachers and schools to improve the quality of learning.

The reality is inversely proportional, the facts in the unit show that students' literacy and numeracy skills are still categorized as low (Megawati & Sutarto, 2021; Safaringga et al., 2022). The survey conducted by PISA (Program for International Student Assessment) in 2018, stated that Indonesia's PISA ranking in 2018 had decreased compared to the PISA results in 2015. This 2018 study assessed 600,000 15 years old children from 79 countries every three years. The study compared each child's math, reading, and science performance. For the reading ability category, Indonesia is ranked 6th from the bottom, aka 74th. Indonesia's average score is 37. Meanwhile, for the mathematics category, Indonesia is ranked 7th from the bottom (73rd) with an average score of 379. Indonesia is at the top Saudi Arabia has an average score of 373. Then for the science performance category, Indonesia is ranked 9th from the bottom (71), namely with an average score of 396 (Kusumawardani, 2018). From these results, Indonesia is one of the countries that has obtained the lowest consistent results in the PISA survey results ranking. This supports the results of interviews in elementary school regarding students' low numeracy abilities. This is proven by the results of AKM's ability scores which are still below the minimum competency. Especially the results of students' numeracy abilities are below average or less than 50% of students have achieved minimum competency for numeracy.

The reason why numeracy in Indonesia is still low is because teachers are less interested in developing the learning models and media used. This statement is supported by previous research that providing appropriate learning media can provide a solution to increasing Indonesia's numeracy literacy skills. This statement is also supported by previous research that the implementation of appropriate and innovative learning models is expected to have a positive influence on students (Widiastuti & Kurniasih, 2021; Yulianti et al., 2019). This is also the same as the results of interviews in elementary schools that the majority of teachers still apply conventional learning or teacher-centered learning. This causes students to become bored and not interested in following lessons. Learning now should be learning that activates students in the classroom so that students can be directly involved in the learning process. To support improving students' ability results, teachers can use learning models in the teaching and learning process. In order to create an active, creative and innovative class when teaching and be able to improve students' literacy and numeracy skills, one of the existing learning models, namely Problem Based Learning, can be used.

Problem Based Learning is a learning model that can help students improve the abilities currently needed where students are faced from the start with a real problem which aims to train students' abilities and gain new knowledge from solving the problems faced which will ultimately influence learning outcomes (Andeswari et al., 2022; Zulva et al., 2022). The problem based learning model is a learning model that begins by providing an authentic problem for students so that learning focuses on the problem solving skills that students have. Problem Based Learning is a learning approach that uses real world problems as a context for students to learn through critical thinking and problem solving skills in order to gain essential knowledge and concepts from the subject matter that students must have in accordance with the applicable curriculum (Astutik, 2022; Pamungkas, 2022). Problem based learning is a learning approach that gives

students the freedom to plan learning activities, carry out projects collaboratively, and ultimately produce work products that can be presented to others.

The problem-based learning model is characterized by the presentation of contextual problems presented by the teacher and then students' skills are needed in analyzing and providing solutions to these problems. So by applying the problem based learning model, learning is dominated and centered on students, and students become more familiar with the questions presented in contextual problems (Ismail et al., 2018; Widiastuti & Kurniasih, 2021). Based on the explanation that has been described, researchers will conduct a study on the numeracy abilities of fifth grade elementary school students using the Problem Based Learning model on numeracy abilities. This research aims to analyze the significant influence of the Problem Based Learning model on the numeracy abilities of fifth grade elementary school students.

2. METHOD

This research is experimental research. This type of research is quantitative research with a quasi-experimental design (Quasi-Experimental Design) with a nonequivalent control group design. This design involves an experimental group and a control group that are given a pre-test and post-test (Siedlecki, 2020). One class group was the experimental group which received treatment using the Problem Besed Learning model and one group was the control class which did not receive treatment using the Problem Besed Learning model. In group equalization, the technique used is one-way analysis of variance.

The population in this study involved 118 students. The sampling technique used in the research was cluster random sampling. Until finally the experimental class group was determined as 26 students and the control class group as 19 students. The data needed in this research is the numeracy abilities of fifth grade elementary school students. Data collection was carried out using the test method, namely measuring students' numeracy abilities. The type of test used to measure mathematical knowledge competency is this research, namely an objective test in the form of multiple choices. The grid of instrument that used in this research is show in Table 1.

Table 1. Grid of Instrument

Core Competencies	Basic competencies	Indicator	Knowledge Competency Level	Number of Questions
3. Understand factual, conceptual, procedural and metacognitive knowledge at a basic level by observing, asking and trying based on curiosity about himself, God's creatures and their activities, and the objects he encounters at home, at school and elsewhere. play.	3.8 Explain the presentation of data relating to students and compare it with data from the surrounding environment in the form of lists, tables, pictograms, bar charts or line charts.	3.8.1 Analyze problems related to data presentation.	C4	4
		3.8.2 Solve daily problems related to presenting data in list form	C4	2
		3.8.3 Solve problems in everyday life related to presenting data in tabular form	C4	7
		3.8.4 Solve problems in everyday life related to presenting data in the form of picture, bar, line diagrams	C4	7

Instrument testing was carried out in 2 stages: content validity test, item validity test, reliability test, difficulty level test, and differential power test. This content validity test is carried out to adapt the test content to material that is in accordance with the curriculum and textbook material used. Meanwhile,

testing the validity of the questions uses the point biserial correlation coefficient (Y_{pbi}) formula. Then test the reliability using the Kuder Richardson 20 (KR-20) formula.

The data obtained in this research is quantitative data and is continued with data analysis. The data analysis used in this research is data processing and statistical analysis. The statistical analysis used in this research is descriptive statistical analysis and inferential statistical analysis. Descriptive statistical analysis is used to determine the quality of the learning outcomes of students who are taught using the Problem Based Learning learning model and students who are not taught using the Problem Based Learning learning model. Calculate the high and low levels of student learning outcomes through average (mean), standard deviation and variance. Inferential statistical analysis is used in hypothesis testing with the t-test formula, namely polled variance.

3. RESULT AND DISCUSSION

Result

Based on the results of calculating the work table for the normality test using the Kolmogorov-Smirnov technique as show in Table 2.

Table 2. Normality Test

No	Data	Sample	Max	Table Count	Conclusion
1	Mathematical Knowledge	Experimental	0.168	0.259	Normally Distributed
2	Competency	Control	0.195	0.301	Normally Distributed

Based on Table 2, the data on the mathematical knowledge competency of experimental group students obtained the maximum value |FT – FS| namely 0.168 and at the significant level for n = 26 the Kolmogorov-Smirnov table shows 0.259. Up to the maximum value |FT – FS| < K-S table, namely 0.168 < 0.259. So it can be concluded that the numeracy abilities of the experimental group students are normally distributed. Meanwhile, based on the results of calculating the normality test work table using the Kolmogorov-Smirnov technique, the control group students' mathematical knowledge competency data obtained the maximum value |FT – FS| namely 0.195 and at the significant level for n = 19 the Kolmogorov-Smirnov table shows 0.301. Up to the maximum value |FT – FS| < K-S table, namely 0.195 < 0.301. So it can be concluded that the numeracy abilities of the control group students are normally distributed. The variance homogeneity test is carried out to find the level of homogeneity between two parties taken from separate groups of one population, namely the experimental group and the control group as show in Table 3.

Table 3. Homogeneity Test

Data	F_{count}	F_{table}	Conclusion
Experimental & Control	1.94	2.02	Homogeneous

Base on Table 3 it is known that the Fcount of the post-test results of the experimental and control groups is 1.94, while the F_{table} in $db_{numerator}$ = n control - 1 = 19 - 1 = 18, $db_{denominator}$ = n experiment - 1 = 26 - 1 = 25, and the 5% significance level is 2.02. This means that the variance in the numeracy ability data for the experimental and control groups is homogeneous. From the results of the prerequisite tests it can be seen that the data obtained by the sample group is normally distributed and homogeneous, so the statistical test used to test the research hypothesis is the t-test with the polled variance formula with a significance level of 5% with the empirical research formula. The result of hypothesis test is show in Table 4.

Table 4. Hypothesis Test

Class	Subject (n)	Mean (X)	Varians (S^2)	Degree of Freedom (Df)	t_{count}	t_{table} (t.s. 5%)
Experiment	26	82.31	28.46	43	10.038	2.016
Control	19	63.68	55.12			

Based on Table 4 the results of the t test obtained tcount = 10.038 and for a significance level of 5% with dk = (26 + 19 - 2) = 43, t_{table} = 2.016. With the criteria t_{count} > t_{table}, namely t_{count} = 10.038 > t_{table} = 2.016,

it can be stated that H_0 is rejected and H_1 is accepted. There is a significant difference in numeracy abilities between the group of students who were taught using the problem-based learning model and the group who were not taught using the problem-based learning model in class V elementary school students.

Discussion

From the results of the scores obtained in the two groups, which initially had equal abilities, after the experimental class was given treatment, they experienced differences in numeracy ability scores. The numeracy abilities of students in the experimental class were better and superior compared to the numeracy abilities of students in the control class. The difference in numeracy ability results in the experimental class and the control class was caused by the treatment in the form of a problem-based learning model which was given only to the experimental class. There is an average difference between the numeracy abilities of the group of students who were taught using the problem based learning model and the group of students who were not taught with the problem based learning model because the problem based learning model presents mathematical concepts by providing real problems so as to stimulate students to learn, by using the problem based learning model students can carry out discussion activities in groups so that individual difficulties can be overcome (Asrizal et al., 2018; Rahman et al., 2019).

The Problem Based Learning Model develops students' abilities in groups to solve problems based on real conditions in the surrounding environment and stimulates students to think critically and creatively (Anggreni & Agustika, 2020; Hidayati et al., 2021). This can be seen from the results of research that has been carried out, using the problem based learning model, students are very enthusiastic in learning which makes students want to know the concept of the problem being given. With this, students become independent to learn to work in groups to solve the problems given and relate them to their daily lives (Ariyani & Kristin, 2021; Sadiyah et al., 2022).

This is also supported by previous research that stating the advantages of the Problem Based learning model, namely: 1) students are encouraged to have the ability to solve problems in real situations, 2) students have the ability to build their own knowledge through learning activities, 3) learning focuses on the problem so that unrelated material does not need to be studied by students. This reduces the burden on students to memorize or store information, 4) scientific activities occur in students through group work, 5) students are accustomed to using sources of knowledge from libraries, the internet, interviews and observations, 6) students have the ability to assess their own learning abilities, 7) students have the ability to carry out scientific communication in discussion activities or presentations of the results of their work, 8) individual students' learning difficulties can be overcome through group work in the form of peer teaching (Ernawati, 2023; Putri et al., 2018).

The results of this research are similar to previous research which states that there is a significant influence of the problem based learning model on the mathematics learning of grade 1 students on students' numeracy abilities (Lestari et al., 2021). The similarities between this research and the research carried out are the learning model used, namely problem-based learning and the same subject, namely mathematics. And the difference between this research and the research carried out is the research location. Apart from that, in the problem based learning model there are several shortcomings, namely this model cannot be applied to every subject matter, there are parts of the teacher who play an active role in presenting the material (Duda et al., 2019; Irhandayaningsih, 2020). Problem Based Learning is more suitable for learning that requires certain abilities related to problem solving, in a class that has a high level of student diversity there will be difficulties in distributing tasks. However, researchers have overcome this by solving problems collaboratively by involving students in group discussions, situation modelling and mathematical exploration.

This research can provide empirical evidence about the effectiveness of the problem-based learning model in improving elementary school students' numeracy skills. These implications will encourage the use of more interactive and problem-oriented learning approaches in various educational institutions. The results of this research can provide a basis for curriculum development that focuses more on active learning and the application of mathematical concepts in real life situations. This can influence curriculum development at the school, district, or even national level. Research may have certain time constraints that limit the length of intervention or observation, so the results may not reflect the long-term impact of the learning model.

4. CONCLUSION

Based on this explanation, conclusions can be drawn that the use of the Problem Based Learning model is effective for use in student teaching and learning activities in the classroom. It can be seen that the Problem Based Learning model is able to accommodate students' abilities in critical thinking, especially in

learning mathematics. Students will understand better because they participate directly in carrying out training and developing new knowledge, they will understand more and be able to apply it in life.

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