

APPLICATION OF PROBLEM BASED LEARNING (PBL) ACCOMPANIED BY QUIZZ TO IMPROVE STUDENTS' MATHEMATICAL COMMUNICATION SKILLS

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Abstract

This study examines the low mathematical communication skills of class VIII students at MTsN 3 Sijunjung, by applying the Problem Based Learning (PBL) and Quizizz models. The aim is to determine the improvement of students' mathematical communication skills using this method compared to the scientific approach. The methodology applied was a quasi-experiment with a randomized control group design, involving experimental and control classes. The results showed that the average mathematical communication score of the experimental class students was 76.85, while the control class was 70.54. Hypothesis testing shows that the mathematical communication skills of experimental class students are higher, so it is recommended that mathematics educators use the PBL and Quizizz models to improve these mathematical communication skills.

Keywords: Problem Based Learning, Quizizz, Mathematical Communication.

INTRODUCTION

Mathematics plays an important role in human survival, especially in the era of modern technology. Annur (2020) states that the teaching of mathematics is an important teaching and knowledge procedure on the preparation of Human Resources (HR) to compete around the world. Mathematics is also an important part of various fields of study and contributes to the growth of the human mind. When a person learns mathematics, they have creative, innovative thinking, and curiosity, rigor, careful decisions, assumptions, high-quality reasoning, and form a system way of thinking. Therefore, mathematics is very likely to enable to improve the ability to reason (Rahmasari et al., 2022).

According to NCTM (2000), important skills for students in mathematics learning include the ability to read, write, and interpret mathematical ideas; express and explain concepts and their relationships; formulate definitions and make generalizations; write mathematical expositions; present ideas, relationships, and models using mathematical language and notation; understanding and evaluating concepts orally, in writing, and visually; observing, hypothesizing, formulating questions, and evaluating information; and constructing logical and strong arguments. Here, according to NCTM, mathematical communication ability is one of the basic abilities that must be possessed and developed by students (Hidayat et al., 2023). Baroody (1993) states that there are two main reasons why communication should be a top priority in mathematics learning: mathematics is used as a social activity and as a thinking tool to solve problems. This is in line with what Turmudi (2008) said, which states that communication is very important for mathematics and its education (Lubis et al., 2023).

Based on the results of interviews with one of the mathematics teachers at MTsN 3 Sijunjung, it was stated that mathematics learning in the classroom was still low in improving students' mathematical

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communication skills. This is in line with research conducted (Putri et al., 2022), explained that students' mathematical communication skills are still not optimal.

Innovation in mathematics learning is needed to improve students' mathematical communication skills based on the existing problems. One alternative learning innovation is to change the learning model in the classroom. Problem Based Learning (PBL) can be an innovative learning model to generate ideas and problem solving. PBL, known as problem-based learning, uses real-life everyday problems that can be solved by learners to develop creative thinking skills, problem-solving skills, learning independence, and learner knowledge construction (Rahimma et al., 2024). The PBL problem-based learning model is one of the learning models that meets these criteria. This is because PBL can create an active learning atmosphere by allowing students to work together to solve problems.

The Problem Based Learning (PBL) model can help students understand the problems around them, as well as improve learning activities in the classroom. This model not only involves students listening, keeping records, and memorizing what is explained by the teacher, but they are also involved in actively participating in learning. They are invited to convey their mathematical ideas, and then show the results of the knowledge they gain (Siswadi et al., 2023).

In addition, to make learning more interesting for students, learning media is needed. By using interactive learning media that encourages cooperation and communication, learners can interact with each other and get motivation to learn. One of these ways is through games. Interactive learning games can be used to deliver material and measure how well learners understand the material. Quizizz is an online platform that offers quizzes, surveys, games, and discussions. Purba (2019) states, Quizizz is a game-based learning application that incorporates activities with multiple players into the classroom and is incorporated into interactive and fun exercise classes (Prasetya et al., 2023).

The use of the Quizizz application can help learners bond more with the learning material. This is evident from the fact that most learners are enthusiastic about using the Quizizz application as a medium for future assessments. Learners who have used the Quizizz application also have a good impact on their abilities. Therefore, it can be concluded that the Quizizz application can help students in learning, especially learning Mathematics (Ramadhani & Ardi, 2022).

The purpose of this study, based on the problem formulation described above, is to determine whether the mathematical communication skills of students learning with the Problem Based Learning (PBL) model accompanied by Quizizz are higher than the mathematical communication skills of students learning through the scientific approach in class VIII MTsN 3 Sijunjung. Because in previous studies, the use of the Problem Based Learning (PBL) PBL model using the Quizizz application (X) to improve students' mathematical communication skills (Y) has not been explored, I have not found any studies that combine variables X and Y. Therefore, i chose this theme for my research.

RESEARCH METHODS

The research used is the Quasi Experimental Design research method or quasi-experimental research. The research design used is randomized control group only design. The form of the research design can be seen from the following Table 1:

Table 1. Research Design

Group	Treatment	Posttest
Experiment	X	T
Control	Y	T

Description:

X: Problem Based Learning (PBL) model assisted by Quizizz

Y: Scientific learning approach

T: Posttest of mathematical communication ability

The location of this research was MTsN 3 Sijunjung. This research was conducted in the even semester of the 2024/2025 school year in October-November 2024. The population in this study were

students in grade VIII MTsN 3 Sijunjung. This research was conducted on two sample classes from the population. The sampling technique used is random sampling or random sampling. Population data that has been taken is normally distributed, has a homogeneous variance and has an average similarity, then sampling is done, then sampling is done, drawing the seven population classes to get the experimental class and control class. After the drawing, class VIII.1 was chosen as the experimental class and VIII.3 as the control class.

The variables of this study consist of independent variables and dependent variables. The independent variable in this study is the Problem Based Learning (PBL) learning model. While the dependent variable in this study is the ability of mathematical communication. As the sample class, class VIII.1 as the experimental class and class VIII.3 as the control class.

This research procedure consists of three stages of research, namely (1) Preparation stage. This stage consists of: making observations to schools, formulating problems to be studied, preparing proposals, preparing research materials, determining samples, preparing learning devices, preparing data collection instruments, namely test grids, test questions and test answer keys, validating all research tools needed in research, and completing all research administration; (2) Implementation stage. At this stage, the research implementation is divided into the implementation of research in the experimental class and the implementation of research in the control class. Research in the experimental class was conducted using the PBL model while the control class was conducted using the scientific approach; (3) The closing stage. This stage consists of: collecting and processing data obtained from the final test in the sample class, drawing conclusions from the analyzed research data, and compiling a research report.

Data collection techniques and instruments used in this study are in the form of question grids, test questions, and answer keys for mathematical communication ability test questions. The test questions are in the form of essay questions as many as 6 items. Before the research was conducted, a test of test questions was carried out, which included analyzing the validity, differentiation of items, difficulty level of questions, and reliability of the test.

Table 2. Assessment Criteria

Number	Mathematical Communication Skills Indicators	Question Number	Question Type
1	Connect real objects, pictures, tables, and diagrams to mathematical ideas.		
2	Express everyday events in mathematical language/symbols.	1,2	Description
3	Present written solutions to mathematical problems in a structured manner.		

Number	Questions	Answer Key	Indicators	Scores																																																
1.	Look at the following table! <table><tr><th colspan="3">MAKANAN RINGAN</th></tr><tr><th>NO</th><th>NAMA BARANG</th><th>HARGA</th></tr><tr><td>1</td><td>SUKRO KECIL</td><td>Rp. 2.000</td></tr><tr><td>2</td><td>TIK-TAK (SAPI PANGGANG/ MIX)</td><td>Rp. 2.000</td></tr><tr><td>3</td><td>SALTCHIESE COKELAT KECIL</td><td>Rp. 2.000</td></tr><tr><td>4</td><td>WAFELLO</td><td>Rp. 2.000</td></tr><tr><td>5</td><td>NABATI RICHOCO KECIL</td><td>Rp. 2.000</td></tr><tr><td>6</td><td>ROMA MALKIST COKELAT KECIL</td><td>Rp. 2.000</td></tr><tr><td>7</td><td>BETTER</td><td>Rp. 2.000</td></tr><tr><td>8</td><td>BENG BENG KECIL</td><td>Rp. 2.000</td></tr><tr><td>9</td><td>BENG BENG MAX</td><td>Rp. 5.000</td></tr><tr><td>10</td><td>SUPERSTAR PANJANG</td><td>Rp. 2.000</td></tr><tr><td>11</td><td>SUPERSTAR PANJANG</td><td>Rp. 2.000</td></tr><tr><td>12</td><td>TOP SEDANG</td><td>Rp. 2.000</td></tr><tr><td>13</td><td>PILLOWS COKELAT/ COKELAT KACANH</td><td>Rp. 1.000</td></tr><tr><td>14</td><td>GORIORIO</td><td>Rp. 1.000</td></tr></table> Based on the table above, how much are 2 wafellos and 3 bengbeng maxes?	MAKANAN RINGAN			NO	NAMA BARANG	HARGA	1	SUKRO KECIL	Rp. 2.000	2	TIK-TAK (SAPI PANGGANG/ MIX)	Rp. 2.000	3	SALTCHIESE COKELAT KECIL	Rp. 2.000	4	WAFELLO	Rp. 2.000	5	NABATI RICHOCO KECIL	Rp. 2.000	6	ROMA MALKIST COKELAT KECIL	Rp. 2.000	7	BETTER	Rp. 2.000	8	BENG BENG KECIL	Rp. 2.000	9	BENG BENG MAX	Rp. 5.000	10	SUPERSTAR PANJANG	Rp. 2.000	11	SUPERSTAR PANJANG	Rp. 2.000	12	TOP SEDANG	Rp. 2.000	13	PILLOWS COKELAT/ COKELAT KACANH	Rp. 1.000	14	GORIORIO	Rp. 1.000	Ex: Wafello = $x = 2.000$ Bengbeng max = $y = 5000$ Mathematical model: = $2x + 3y$ = $2(2.000) + 3(5.000)$ = $4.000 + 15.000$ = 19.000	1	4
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2	Look at the following table!	Ex: Eraser = $x = 1.000$ Pencil = $y = 500$	1	4																																																

Barang	Harga	Mathematical model:	2 and 3	8
Penghapus	Rp 1.000,00	$= 4x + 3y$		
Pensil	Rp 500,00	$= 4(1.000) + 3(500)$		
Penggaris	Rp 2.000,00	$= 4.000 + 1.500$		
Buku tulis	Rp 3.000,00	$= 5.500$		
Buku gambar	Rp 6.000,00			
Bolpoin	Rp 1.500,00			
Based on the table above, what is the price of 4 erasers and 3 pencils?				
Total Value				24

The data analysis technique used is the analysis of differences for hypothesis testing by determining the average learning outcomes of each class, standard deviation (S) and variance (S^2). For the analysis of the final test data of the experimental class and control class using the t-test, in analyzing the data the steps are carried out: normality test, homogeneity, and hypothesis testing.

Normality testing is a procedure used to determine whether data comes from a normally distributed population or is within a normal distribution (Nuryadi et al., 2017). In addition, testing can also be done using SPSS (Statistical Product and Service Solution), namely the Kolmogorov-Smirnov and Shapiro-Wilk tests. Data is normally distributed if it has a significance level or probability value greater than 0.05. The homogeneity test aims to investigate whether the two sample groups have homogeneous variance or not. To test for variance equality, the Bartlett test can be used.

The t test carried out must meet two conditions, namely that the sample comes from a normally distributed population and the two classes have homogeneous variances. In this study, the test was conducted to determine the ability of mathematical communication with the PBL model accompanied by Quizizz higher than the scientific approach. The research method contains: 1) type of research; 2) research subjects or population and samples (research targets); 3) data collection techniques; 4) and data analysis techniques.

RESEARCH RESULTS AND DISCUSSION

Data on mathematical communication skills in this study were obtained from the final tests of the two sample classes. The final test consisted of 6 description questions. This final test was attended by both sample classes consisting of 31 people for the experimental class and 32 people for the control class. From the analysis conducted, an overview is obtained as shown in Table 3.

Table 3. Final Test Description Results

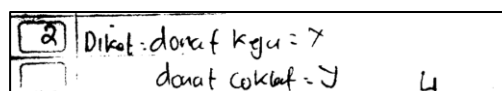
Class	N	$\bar{x}$	x_{max}	x_{min}	S_t
Experiment	31	76,85	100	54,41	10,75
Control	32	70,54	95,59	48,53	12,49

Based on the average of the two classes of mathematical communication ability tests, students in the experimental class were higher than the average in the control class. This means that the value of students in the experimental class is higher than the control class. Judging from the standard deviation, the experimental class has a smaller standard deviation than the control class, this means that the value of students in the experimental class is more uniform than the control class.

The following is presented an example of the mathematical communication ability test results of sample class students for indicators:

a. Connecting real objects, pictures, tables, and diagrams into mathematical ideas

In this indicator, students are expected to be able to connect real objects, images, tables and diagrams into mathematical ideas. The following are presented the answers of experimental and control class students.



Based on Figures 5 and 6, it can be seen that students in the experimental class demonstrated a better understanding of the indicators of presenting structured written mathematical problem solving. This can be seen by students being able to write the exact answer requested in the problem. Whereas students in the control class had difficulty present written mathematical problem solving with structured appropriately. This can be seen from the answers of students who still have errors.

Data analysis of mathematical communication skills of experimental and control classes is carried out to test the hypothesis that has been formulated, accepted or rejected. To find out this, first the normality test and variance homogeneity test were carried out on the students' mathematics learning outcomes in both samples. The results of the normality test calculation of the two sample classes were normally distributed and the results of the homogeneity test of the two sample classes had homogeneous variances. Based on the normality test results obtained from each sample class, it can be concluded that both sample classes are normally distributed.

After the normality test is carried out, then the homogeneity test is carried out, which aims to see whether the two sample classes have homogeneous variances or not. The variance homogeneity test was carried out using the Barlett test. The test criteria are: if $X^2_{count} < X^2_{table}$ with $\alpha = 0,05$ means that the sample class data has a homogeneous variance, and vice versa. So that $X^2_{count} < X^2_{table}$ ($1,1052 < 3,841$) is obtained, then H_0 accepted. Thus, it can be concluded that the two sample classes have homogeneous variance at a confidence level of 95%.

Based on the normality test and the variance homogeneity test that has been carried out, it turns out that both sample classes have homogeneous variance, thus to find out whether the hypothesis is accepted or rejected, t-test is used. The testing criteria used are: if $t_{count} > t_{table}$, then the students' mathematical communication skills through the PBL Learning Model accompanied by Quizizz are higher than the scientific approach.

From the calculation obtained $t_{count} = 2.16$ and $t_{table} = 1.67$ means $t_{count} > t_{table}$. This shows that H_1 is accepted or the mathematical communication skills of students who learn through the PBL (Problem Based Learning) learning model accompanied by Quizizz are higher than the mathematical communication skills of students who learn through the scientific approach in class VIII MTsN 3 Sijunjung 2024/2025.

These results are in line with the results of research conducted by several studies as follows: (Nisa, 2023) with the title "Improving Student Numeracy Skills Through Problem Based Learning Model Assisted by Quizizz". The results of this study indicate that numeracy skills in students increase in the use of Quizizz application media. (Susanto & Ariadi, 2017) with the title "Application of Problem Based Learning Model in Mathematics Learning in Class VIII SMPN 28 Padang". The results of this study indicate that the problem solving ability of students through the PBL Learning Model is higher than ordinary learning with the average value of the experimental class and control class respectively 73.83 and 68.93; while the mathematical connection ability of students through the PBL Learning Model is higher than ordinary learning with the average value of the experimental class and control class respectively 69.53 and 62.43.

(Ayu et al., 2023) with the title "Oral Mathematical Communication, Conceptual Understanding and Learning Motivation in Mathematics Learning Using Quizizz Media". The results showed that in learning mathematics quadratic equation material using Quizizz media in class XII students for three meetings, oral mathematical communication skills were categorized as good, conceptual understanding was categorized as very good, and learning motivation was categorized as very high. (Saputra et al., 2024) with the title Improving Mathematical Communication Skills of Junior High School Students Through the Learning Cycle 7e Model Assisted by Quizizz. The results showed that the improvement in mathematical communication skills of students who obtained the Learning Cycle 7E learning model assisted by Quizizz was higher than students who obtained the conventional learning model.

(Safitri et al., 2023) with the title "Improving Mathematics Learning Outcomes Using Problem Based Learning Models and Quizizz Applications in Class VII SMP Negeri 1 Kembang Janggut". The results

showed that there was an increase in students' mathematics learning outcomes on data presentation material in Class VII D SMP Negeri 1 Kembang Janggut. The average value of students after after implementing learning has increased in each cycle. The average base score of 47.64 increased to 64.77 or increased by 35.95%. In cycle II it increased to 75.15 or increased by 16.02%. Then in cycle III it increased to 86.01 or increased by 14.45%.

(A'la & Arnawa, 2023) with the title "Development of PBL-Based SPLDV Learning Design to Improve Students' Mathematical Communication Skills". The results showed that the learning design of SPLDV topics with a PBL approach through educators' books and students' books was valid, effective and practical. It is said to be valid because it has met the characteristics of validity both in terms of content and construct. It is said to be effective because it can improve students' mathematical communication skills. It is said to be practical because this product is easy to use and understand, the time allocation is very efficient, very interesting and contributes to SPLDV learning.

(Amina et al., 2024) with the title "The Effect of Problem Based Learning (PBL) Model Assisted by Quizizz on Cognitive Ability and Critical Thinking of UPTD SD Negeri Sabiyan Students". The results showed that 1) Independent sample T-Test test in the posttest average column of class A students' cognitive abilities with the Problem Based Learning (PBL) learning model assisted by the Quizizz application amounted to 81.60 while in the posttest average column of class B with conventional learning amounted to 76.60. 2) Independent sample T-Test test in the posttest average column of critical thinking skills of class A students with the Problem Based Learning (PBL) learning model assisted by the Quizizz application of 81.60 while in the posttest average column of class B with conventional learning of 71.60.

Based on relevant research and the results of the research found, it can be concluded that the mathematical communication skills of students who learn with the Problem Based Learning (PBL) model accompanied by Quizizz are higher than the mathematical communication skills of students who learn with a scientific approach in class VIII MTsN 3 Sijunjung in the 2024/2025 academic year.

CONCLUSIONS AND SUGGESTIONS

Conclusions

Based on the results of research conducted at MTsN 3 Sijunjung, it can be concluded that the mathematical communication skills of students who learn through the PBL (Problem Based Learning) learning model accompanied by Quizizz are higher than the mathematical communication skills of students who learn through the scientific approach in class VIII MTsN 3 Sijunjung. The results showed that the average test of students' mathematical communication skills in the experimental class was 76.85 and the control class was 70.54. In addition, the experimental class was more uniform than the control class. Data processing of mathematical communication ability test results is done through hypothesis testing using the t-test. After the calculation, it was obtained $t_{count} (2.16) > t_{table} (1.67)$ with 95% confidence level. This means, it shows that the hypothesis in this study is accepted.

Suggestions

Based on the results of the study, the researcher provides the following suggestions:

- For mathematics educators in class VIII MTsN 3 Sijunjung and other mathematics educators to apply the Problem Based Learning (PBL) learning model accompanied by Quizizz in learning as an effort to improve students' mathematical communication skills.
- For future researchers to conduct research on the Problem-Based Learning (PBL) model accompanied by Quizizz on other mathematical abilities and using different subject matters.
- For readers, it is hoped that the results of this study can be used as one of the materials to enrich their insights.

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