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The Influence of the Reciprocal Teaching Learning Model Assisted by Student Worksheets (LKPD) on Students Mathematical Communication Ability

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Abstract: This research aims to determine whether there is an influence of the reciprocal teaching learning model assisted by Student Worksheets (LKPD) on the mathematical communication skills of students at Senior High School 7 Mataram for the 2023/2024 academic year. This research is included in quantitative research with a quasi experimental design research type with a posttest-only control design. The population in this study were all class X students at Senior High School 7 Mataram for the 2023/2024 academic year with samples from classes X.K and the instruments in this research are observation sheets and tests of mathematical communication skills as well as data analysis techniques using valid tests, namely the normality test, homogeneity test and hypothesis test. The results of this research show that there is a difference in the average value of the mathematical communication skills of students who use the reciprocal teaching learning model assisted by LKPD and students who use the conventional learning model. So this shows that there is an influence of the reciprocal teaching learning model assisted by Student Worksheets (LKPD) on the mathematical communication skills of students at Senior High School 7 Mataram in the 2023/2024 academic year

Kata Kunci: *Reciprocal Teaching*, LKPD, Mathematical Communication Skills

INTRODUCTION

In Minister of Education and Culture Regulation No. 69 of 2013 states that education aims to build a better present and future life than the past, one of which is through communication skills. According to Putri, Turmuzi, Junaidi, & Hikmah (2022) said that students' mathematical communication skills are the abilities that students develop in conveying ideas orally or in writing during the learning process at school. Communication skills can also help students convey information in the form of messages, inspiration or ideas to other parties (Hidayah, Subarinah, Turmuzi, & Baidowi, 2023).

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Based on the results of the Trend in Mathematics and Science Study (TIMSS) in 2015, it was found that only 51% of students in Indonesia had mathematical communication skills compared to other countries where students had 80% mathematical abilities. In this regard, Indonesia ranks 45th out of 49 countries. The results of the PISA (Program for International Student Assessment) survey in 2015 regarding the low mathematical communication skills of students conducted by the OECD (Organization for Economic Co-operation and Development), Indonesia was in 63rd position out of 72 countries (Fitriani, Kurniati, Tyaningsih, & Baidowi, 2022). These two things show that students' lack of mathematical communication skills has an impact on mathematical communication skills which are relatively low. This is because most students consider mathematics to be a difficult subject because it is related to calculations (Putri, Azmi, Salsabila, & Hikmah, 2022).

Based on the results of an interview with one of the mathematics teachers at Senior High School 7 Mataram, it appears that students are still less active in answering teacher questions, expressing opinions and communicating during discussions. Students tend to have difficulty expressing mathematical ideas, explaining mathematical ideas, expressing events in life with mathematical symbols, and re-expressing information obtained in their own language. Supported by the distribution of questionnaires, it was found that 29% of students at Senior High School 7 Mataram had a low category of ability, 53% of students had a sufficient ability category, and 18% of students had a high category of ability. It can be seen that the mathematical communication skills of Senior High School 7 Mataram students are still considered sufficient or in the medium category. This shows that there is still a lack of mathematical communication skills among students at Senior High School 7 Mataram.

Seeing the problem of students' mathematical communication skills, teachers can increase students' activeness and role during learning by using learning models that suit their needs. Therefore, one learning model that supports students' needs is the reciprocal teaching model. Nasruddin & Jahring (2019) define that reciprocal teaching is a teaching model where students act as teachers to deliver learning material and the teacher becomes a facilitator in learning activities. The reciprocal teaching learning model encourages students to develop their abilities such as summarizing, asking questions, predicting and clarifying (Fadly, 2022).

The basic concept of reciprocal teaching was put forward by Palincsar & Brown (1984), namely that reciprocal teaching can help students to improve their understanding abilities through the strategies of predicting, clarifying, questioning and summarizing. The reciprocal teaching strategy was also put forward by Shoimin (2014) who said that the reciprocal teaching strategy uses the flow of questioning-clarifying-predicting-summarizing. In this research, researchers used the summarizing-questioning-predicting-clarifying flow because it was appropriate to the learning activities carried out.

The success of the reciprocal teaching learning model cannot be separated from the help of interactive learning media, one of which is the Student Workshee (Mahadewi, Ardana, & Mertasari, 2020). Student Worksheets (LKPD) are needed in the reciprocal teaching learning model to produce students who have high mathematical communication skills. In line with research conducted by Randa, Maimunah, & Yuanita (2020) which states that LKPD is needed to support the reciprocal teaching learning model so that it can increase student activity because in reciprocal teaching students are expected to learn by experience, not memorize.

Several previous studies that have been conducted using the reciprocal teaching model show that there is an influence of the reciprocal teaching learning model on students' mathematical communication skills. One of the previous studies conducted by Astuti & Purwanto (2021) concluded that there was an influence of the reciprocal teaching model assisted by Google meetings on the communication skills of junior high school students during the COVID-19 pandemic.

Meanwhile, in the class used as a comparison, the conventional learning model is used. The conventional learning model is a learning where the teaching and learning process is carried out in the old way, namely in delivering lessons the teacher still relies on the lecture method (Prameswara & Pius, 2023). According to Hidayat & Wiyono (in Sherley, Santoso, & Matstan, 2019) stated that the

conventional learning model is a learning process that only focuses on lectures so that students will be required to memorize the material without being connected to the surrounding conditions. So Purnomo, Kanusta, Fitriyah, Guntur, Siregar, Ritonga, Nasution, Maulidah, & Listantia (2022) stated that the learning steps in this model are: (1) conveying the objectives; (2) presenting information; (3) checking understanding and providing feedback; and (4) provide further training opportunities.

So, based on the background that has been described, researchers are interested in conducting research on the influence of the reciprocal teaching learning model assisted by Student Worksheets (LKPD) on the mathematical communication skills of students at Senior High School 7 Mataram for the 2023/2024 academic year. The aim of this research is to find out whether there is an influence of the reciprocal teaching learning model assisted by Student Worksheets (LKPD) on the mathematical communication skills of students at Senior High School 7 Mataram for the 2023/2024 academic year.

METHOD

This research uses a quantitative approach with a quasi experimental design type of research with a posttest-only control design. The population in this study was all 13 class X students of Senior High School 7 Mataram in the 2023/2024 academic year. The samples in this study were class X-K as the control class and X-L as the experimental class taken using purposive sampling techniques. Purposive sampling is a technique for taking samples with certain considerations (Sugiyono, 2019).

The data collection method in this research uses observation and mathematical communication ability tests. The observation sheet instrument filled in by observers during learning activities and tests of students' mathematical communication skills consists of 3 questions in the form of descriptions. However, before conducting research, the observation sheet and mathematical communication ability test must first be tested for validity.

The indicators of mathematical communication skills used are according to Kadir (in Turmuzi, Wahidaturrahmi, & Kurniawan, 2021), namely (1) Written Text (writing), namely students are able to create mathematical models based on situations and problems using their own language, explain and ask questions about mathematics that has been studied, constructing arguments and generalizations; (2) Drawing, namely students are able to reflect real objects, pictures, graphs or diagrams into mathematical ideas; and (3) Mathematical Expression, namely students are able to express mathematical concepts in the form of language or mathematical symbols to express everyday events.

To obtain scores in students' posttest questions, a formula is used, namely:

$$Score = \frac{Scores\ obtained\ by\ students}{Maximum\ score} \times 100 \qquad (1)$$

Next, the scores obtained by the students are categorized using assessment scores according to Table 1 as follows:

Table 1. Assessment Score Conversion

Student Scores	Category
$81 - 100$	Very High
$61 - 80$	High
$41 - 60$	Currently
$21 - 40$	Low
$0 - 20$	Very Low

Source: Damayanti, Zulkarnain, & Sari (2020)

Then, to find out the category of students' mathematical communication abilities, it can be determined based on the guidelines in Table 2 as follows:

Table 2. Mathematical Communication Ability Category

Rentang Nilai	Tingkat Kategori
$\geq 72{,}82$	High
$50{,}10 < X < 72{,}82$	Currently
$\leq 50{,}10$	Low

Source: Shofiyah & Hendriana (2021)

Data analysis techniques used in this research include: (1) Normality test to test whether the sample can represent the existing population; (2) Homogeneity test to determine if data groups have the same characteristics or features; (3) Test the hypothesis to determine the average difference between each group, namely the experimental group that applies the reciprocal teaching model assisted by LKPD and the control group that applies the conventional learning model.

RESULTS AND DISCUSSION

Results

This research instrument was validated by expert validators, namely one mathematics lecturer at FKIP Mataram University and one mathematics teacher at *Senior High School 7 Mataram*. The results of the validation by experts were calculated using the Aiken formula and the validation results of the observation sheet instrument were obtained at 0.95 and were declared very valid and the validation results for the mathematical communication ability test instrument were 0.80 and were declared valid so that both instruments were suitable for use for research. Furthermore, the data processed is quantitative data in the form of numbers from the results of a mathematical communication skills test (posttest) which is then analyzed using the help of Microsoft Office Excel 2019 and SPSS.

Mathematical Communication Ability Data

Mathematical communication abilities in the experimental class and control class were measured through tests in the form of essay questions adapted to indicators of mathematical communication ability. Questions are given once after being given treatment in each class. The results of the data obtained regarding students' mathematical communication abilities can be seen in Table 3 as follows:

Table 3. Mathematical Communication Ability Data

Class	*Mean*	Indicators of Students' Mathematical Communication Skills			Category
		Written Text	*Drawing*	*Mathematical Expression*	
Experiment	64,50	203	205	175	Currently
Control	50,13	132	152	121	Currently
Total Score		335	357	296	

Data Analysis

The results of students' posttest questions in the experimental class and control class were then analyzed using Microsoft Office Excel 2019 and SPSS. Next, the data is calculated and processed

based on predetermined tests, namely the normality test, homogeneity test, and hypothesis test as well as the observation sheet used to obtain the results which can be seen in Table 4 as follows:

Table 4. Data Calculation Results

Class	Data Analysis				Observation Sheet	
	Normality Test	Homogenity Test	Hypothesis Test			
	Sig. Value	Sig. Value.	t_{count}	t_{table}	Score	Category
Experiment	0,114	0,355	4,15	2,00	74	High
Control	0,084				77	High

Sample Data Normality Test

The normality test was carried out using the Kolmogorov-Smirnov test and the data obtained a significance value in the experimental class of 0.114 and a significance value in the control class of 0.084. Because the significance value in the two classes is greater than the significance level of 0.05, the two classes have a normal distribution.

Test the Homogenity of Sampel Data

The results of the homogeneity test in the experimental class and control class obtained a $sig\ value = 0.355 > sig\ level = 0.05$. Thus, the two classes produce homogeneous data or have the same characteristics.

Hypothesis Test (t-test)

Hypothesis testing is used to determine whether there is a difference in the average mathematical communication skills of students taught using the reciprocal teaching learning model assisted by LKPD and students taught using the lecture method. Based on the results of the hypothesis test calculations (t-test) that have been carried out, the value obtained is $t_{count} = 4.15 > t_{table} = 2.00$. Because the $t_{count} > t_{tabel}$ value shows that there is a difference in the average value of the mathematical communication skills of students in the experimental class which uses the reciprocal teaching learning model assisted by LKPD and the control class which uses the conventional learning model.

Observation Sheet Calculation Results

The observation sheet is used to see the extent to which the implementation of the learning model is implemented in the experimental class and control class. From the calculation results, it can be seen that the results of the observation sheet in the experimental class were 74 and in the control class were 77, so both were in the high category. So, it can be said that the experimental class which applies the reciprocal teaching learning model assisted by LKPD and the control class which applies the conventional learning model have carried out learning activities well.

DISCUSSION

The research results show that the average score in the class that uses the reciprocal teaching learning model assisted by LKPD is 64.50 and in the class that uses the conventional learning model is 50.13. After carrying out t-test calculations with a significance level of 5%, it was found that the value of $t_{count} = 4.154 > t_{tabel} = 2.000$, where this result is significant which means that there is a difference in the average value of students' mathematical communication skills in classes that use the assisted reciprocal teaching learning model. LKPD with classes that use conventional learning

models. Thus, when the average student score changes, the score obtained by each student will automatically change. This shows that there has been an increase in the average which shows an increase in the abilities possessed by students. This increase in ability is solely due to the learning treatment using the reciprocal teaching model assisted by LKPD. This means that the results obtained show that there is an influence of the reciprocal teaching learning model assisted by Student Worksheets (LKPD) on the mathematical communication skills of students at Senior High School 7 Mataram for the 2023/2024 academic year.

The influence of the reciprocal teaching learning model assisted by LKPD was implemented in the high category. This can be seen in the active and communicative response of students in the learning process. Based on research findings conducted by Nurfajriana, Satriani, & Alqausari (2020), 84% of students were actively involved in activities and 83% of students received positive responses. For example, when research is carried out, students work on assignments on LKPD and discuss the problems found with their group of friends so that discussions between groups are created. Apart from that, students' active role was also seen during presentations and question and answer activities carried out by group representatives. So from this discussion it can be seen that there is an increase in mathematical communication skills as a result of working on the LKPD. In line with research conducted by Magfiroh & Marhaeni (2024) which stated that LKPD was developed practically and received a good response so that it could influence the average score obtained by students.

Thus, the stages of the reciprocal teaching learning model, namely summarizing, asking questions, predicting and clarifying, are very helpful in improving the ability to write, draw and express mathematics in accordance with students' mathematical communication indicators. So that the reciprocal teaching learning model will run effectively and be more meaningful and can help students develop their cognitive abilities, one of which is mathematical communication skills (Mahadewi et al., 2020). Supported by research conducted by Fauziah & Desniarti (2021) which states that learning using the reciprocal teaching model is recommended for teachers because student scores are greater than the scores of students taught using the conventional learning model.

Meanwhile, for classes that apply conventional learning models, it appears that learning only focuses on the teacher and involves little students so that students play less of a role in learning activities. When the learning process takes place, especially in the phase of checking understanding and providing feedback, student responses do appear active, but only for a few students, this happens because learning activities are dominated by the teacher. Students only listen, receive and record the material presented by the teacher. So students are still lacking in searching for mathematical concepts themselves. Communication that occurs only in one direction and is dominated by the teacher results in students becoming passive and causes students to quickly feel bored in learning (Surahman, Hayati, Lu'luilmaknun, & Subarinah, 2022). Supported by the opinion of Mahadewi et al., (2020) who stated that applying a learning model using the lecture method can limit students' learning motivation and creativity so that it can hinder the development of their mathematical communication skills.

If we look at it in terms of mathematical communication skills starting from the written text indicator, it can be seen that the average value in the experimental class is greater than the average value in the control class. So it can be seen that students in the experimental class are more able to create mathematical models based on problems in their own language because they are helped by the existence of LKPD in reciprocal teaching learning. Meanwhile, students in the control class showed that their scores were lower because only some students were active in asking questions and other students were passive. This is in line with research conducted by Masfiyah & Shodikin (2021) which states that the reason for students' difficulties in making mathematical models is because students do not know what a mathematical model is, rarely practice working on problems, and there is a lack of supporting facilities and infrastructure to help students. in making mathematical models so media is needed to help students in making mathematical models.

Next, at the drawing stage, it can be seen that the average value in the experimental class is higher than the average value in the class. It can be seen that students in the experimental class are helped by the reciprocal teaching model assisted by LKPD to help their ability to illustrate or reflect a problem into an image. According to Sulistiowati (2022), in her research, students have difficulty illustrating pictures because they cannot visually imagine the problem. So students need freedom to predict and clarify their understanding in accordance with the strategy of reciprocal teaching which is assisted by the existence of LKPD media so that the use of media in learning has important benefits in facilitating the learning process.

Then at the mathematical expression stage it was seen that the average value in the experimental class was higher than the average value in the control class. However, the total score for these two classes received the lowest score compared to the other indicators. According to Septikayanti, Prayitno, Kurniawan, & Kurniati (2022), students are still lacking in expressing mathematics as seen in students not being able to use mathematical symbols and carry out the solution steps correctly. This situation often occurs due to a lack of students trying to work on practice questions, which causes them

According to Rohmah & Sumardi (2020), students are still lacking in providing a logical representation of the results of their work and students are also less able to explain mathematical ideas, situations and relationships through language or mathematical symbols in everyday life. In line with the research results of Nurhasanah, Waluya, & Kharisudin (2019) which states that students who have not been able to solve problems related to mathematical expressions are caused by old ways of thinking, forgetting the steps to solve them, and a lack of motivation and enthusiasm in learning mathematics. Supported by the results of research conducted by Turmuzi et al., (2021) who stated that another factor that supports students' lack of ability to express mathematics is because students do not fully understand the problem and the desired solution to the problem so that students do not understand the concept of the material and do not able to solve existing problems.

CONCLUSION

Based on the results of research and data analysis that has been carried out regarding the influence of the reciprocal teaching learning model assisted by LKPD on students' mathematical communication skills which refer to the research objectives, it can be concluded that with hypothesis testing analysis shows that $t_{count} > t_{table}$ with a significance level of 5%, it is obtained that $t_{count} = 4.15 > t_{table} = 2.00$. This shows that there is a difference in the average value of the mathematical communication skills of students who use the reciprocal teaching learning model assisted by LKPD and students who use the conventional learning model. So this shows that there is an influence of the reciprocal teaching learning model assisted by Student Worksheets (LKPD) on the mathematical communication skills of students at Senior High School 7 Mataram in the 2023/2024 academic year.

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