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The Effects of TTW Learning Model at SMP Negeri 3 Binjai on Students' Mathematical Communication Ability

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ABSTRACT

The purpose of this study is to collect information regarding mathematical communication using the TTW model, and to identify differences between mathematical communication from students who using this model or not. In this study, a quasi-experimental design incorporating pretest-posttest cohorts was used to determine the effectiveness of the TTW model. Purposive sampling was used to select the study's population from all class VIII students at SMPN 3 Binjai. The samples were collected from classes VIII-1 and VIII-3 as control and experimental classes, respectively. A t-test formula and the N-gain score were used to analyze the research data. 1) The t-test of the independent sample control class with experiments yielded a higher number than ttable at a significant level of 0.048. Accordingly, there are differences in mathematical communication between students who use the TTW paradigm and those who do not. 2) When the TTW model is combined with the results of the N-gain test with high scores, the TTW model does perform better in learning mathematical communication.

***Keywords**: Effectiveness, Mathematical Communication, Think Talk Write*

PRELIMINARY

In addition to training individuals in logic, conceptualization, rationality, and methodical thinking, Mathematics is regarded as the foundation of current science and technology progress (Hidayati Rais & Yohanes, 2018). In addition, mathematics has been claimed to be a fundamental science that plays a significant role in achieving success in every field (Nahdi, 2019). This claim is based on the claim that knowledge of mathematics can be used as a powerful guide in studying other sciences, either at an equivalent or higher level of learning.

In SMP Negeri 3 Binjai, students had difficulty learning mathematics, which adversely affected their achievement of learning objectives. The instructor stated during the interview that he used various pedagogical methods, including lectures, discussions, and homework, but the student did not actively participate in learning.

According to Hidayat (Hidayati Rais & Yohanes, 2018), similar findings were presented in regard to a study conducted on students who received learning through the Mind learning paradigm. As a result of their mapping experience, students were able to communicate better than those who received hands-on training. In addition, students who learn using the Mind methodology Mapping demonstrate better ability to speculate, review, and infer than students who learn through direct instruction. Asikin Dalam (Darkasyi et al., 2014) suggests that communication skills are related to classroom events where students communicate orally and in writing to convey messages, particularly mathematical information.

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The importance of communication in learning mathematics can not only be seen in the ability to convey ideas, but also in the ability to understand the relationship between ideas, conceptual language, and mathematical symbols (Andini et al., 2019). Having the ability to communicate mathematical concepts in writing or orally, as well as the ability to interpret and receive mathematical ideas from foreign parties analytically, comprehensively, evaluatively, and intrinsically to increase knowledge, are both considered mathematical communication skills (Lestari & Yudhanegara, 2015).

Using real-world objects, graphs, tables, and mathematical symbols, students demonstrate mathematical communication skills (Astuti & Leonard, 2015). The ability to communicate mathematical ideas and concepts in writing and orally using pictures, graphics, and symbols is the essential ability required for learning mathematics (Damayanti et al., 2020) . Application of objects constitutes mathematical communication skills as well. The ability to communicate mathematical concepts orally or in writing in class is a necessary skill when learning mathematics.

Students' mathematical communication skills are lacking when dealing with arithmetic problems and communicating in study groups (Damayanti et al., 2020). Students have difficulty speaking in groups, and they lack the courage to express their opinions or views (Hayati et al., 2016). Students appear less engaged when answering questions in learning activities. The students only accept what is conveyed by the teacher, and sometimes they do not pay attention to what is being conveyed by the teacher, resulting in a lack of understanding of the subject matter. For class VIII students, essay tests were conducted with indicators of mathematical communication skills in order to determine their mathematical abilities, as well as the indicators studied. 1) demonstrating an image as an idea, 2) stating events mathematically, 3) explaining ideas in

a concrete form both orally and in writing. Based on the following data, the test results can be obtained:

Table 1 Average Results of Students' Mathematical Communication Tests

Indicators	Mark
Presenting an image into an idea	29,49
Express events in the form of mathematical language	38,4
Explaining ideas orally and in writing into a concrete form.	38

Based on the average value in table 1, we can determine if the class VIII students at SMP Negeri 3 Binjai have less good mathematical communication skills. (Jumrawarsi & Suhaili, 2021) Students are less active learners while teachers are more active. As a result, students lack mathematical communication skills as learning is often focused on the teacher. In order to gain a better understanding of communication, we need to look at models as intermediate steps, means to achieve our objectives. It is possible to adopt the problem-based learning paradigm as it guides students in assessing their mathematical communication skills and can be obtained through mathematics (Bandi et al., 2015). (Kuslinar et al., 2019) proposes that problem-based learning can improve mathematical communication skills by utilizing the TTW paradigm. Sumirat (2014) found the TTW paradigm to be more effective than direct learning expository in improving students' communication skills and mathematical perspectives.

Students engage in thinking, discuss with themselves after reading, exchange ideas (sharing) with peers, and then write concepts (Istarani & Ridwan, 2014) in the TTW method of learning. The TTW methodology is described as a cooperative model technique that emphasizes the processes of gathering, thinking, contemplating, testing, and writing down ideas, as described in (Pratiwi & Muiz, 2016). The objective of this active learning technique is to improve students' mathematical communication exchange skills during learning activities. Students with appropriate mathematical communication skills can provide explanations of mathematical ideas orally or in writing, as well as check and take in other people's mathematical ideas. (Lestari & Yudhanegara, 2015) attentively, structured, evaluative, and essential for obtaining higher interpretations.

Students are required to express their thoughts about the challenges provided by the instructor by using the TTW model. A relationship between the TTW paradigm and mathematical communication can also be demonstrated through discussion and writing (Nurapriani, 2016). Learning activities can also influence the communication of mathematical concepts through listening, presentations, discussions, reading, and writing. Through the TTW approach, students who were previously passive participants became active participants in the learning process.

The TTW learning paradigm is a simple learning strategy based on thinking, speaking and writing processes. Following the reading phase, the TTW strategy flow begins with students conducting self-reflection and processing information. Additionally, before moving on to the final phase of writing, group members share thoughts with one another in order to practice speaking. Reading scientific literature and composing a record of what has been read constitutes an act of thinking. In order to connect concepts or information obtained through reading, students make and write notes that are then presented in their mother tongue in writing (Suparya, 2018). This argument emphasizes the importance of evaluating the TT W model when it comes to mathematical communication.

RESEARCH METHODS

We utilized a quasi-experimental design with a group pretest-posttest design in this study. The sample consisted of students of class VIII in SMPN 3 Binjai, with class VIII-1 as a control and class VIII-3 as an experiment. The test was administered twice: once as a pretest and once as a posttest. Each of the five-question tests was subjected to descriptive, validity, and reliability testing. TTW model is treated as an independent variable and mathematical communication is treated as the dependent variable. Therefore, if the validity and reliability tests of the description test are valid and reliable, the test may be used and explored.

RESEARCH RESULT

Data description

It was determined that experimental class students utilizing the Think-Talk-Write (TTW) cooperative learning paradigm and control class students receiving direct learning therapy had pretest-posttest scores. The pretest and posttest were administered to 32 students in the experimental and control groups. In order to determine the extent to which students improved as a result of their participation in class, posttest results were examined. In the table 2 below, the results of the mathematical communication skills tests in the experimental and control classes are summarized.

Table 2. The pretest and posttest values of the control and experimental groups

Descriptive Statistics

	N	Min.	Max.	Mean	Std. Deviation
Pre-test Control	32	43	77	60.31	10.648
Post-test Control	32	77	97	87.16	5.974
Pre-test Exp	32	40	77	60.00	9.326
Post-test Exp	32	80	97	89.94	5.003
Valid N (listwise)	32				

Prerequisite test analysis

a. Normality test

To determine if the pretest and posttest values of mathematical communication in the control and experimental classes have normal values, a normality test is conducted, which is based on the Komogorov-Smirnov results, which were calculated with the assistance of SPSS version 22. The results of the normality test are shown in Table 3 below.

Table 2. Normality Test Results

Class		Kolmogorov-Smirnov [a]		
		Stat.	df	Sig.
Mathematics Communication	Pretest Control	.146	32	080
	Posttest Control	.146	32	082
	Experiment Pretest	094	32	.200 *
	Posttest Experiment	.136	32	.139

It is known from the table above that the pretest and posttest values are normally distributed, this can be seen from the significant value which is greater than 0.05.

b. Homogeneity test

The variance homogeneity test was carried out to see whether the sample variances were the same. The sample requirements are said to have the same variance, especially if the fcount value is less than the ftable value and P>0.05. If the significance value obtained using SPSS software version 22 is more than 0.05 then the two groups have the same or homogeneous variance. The table below shows the results of the calculation of the variance homogeneity test.

Table 3. Homogeneity Test Results

	Levene Statistics	df1	df2	Sig.
Pretest	1,670	1	62	.201
Posttest	.563	1	62	.456

It is known from the table above shows that the homogeneity value is homogeneous, this is known from the significant value obtained for the significant pretest has a value of 0.201 while the posttest significant value has a value of 0.456.

Data analysis

a. Independent Sample t-test

1) Pretest t-test control and experimental classes

Before the treatment was administered, this test was conducted in order to determine whether the pretest values of the control and experimental groups differed. As shown in the table 5 below, the independent sample t-test calculation values for the control and experimental class pretests are as follows:

Tabel 4. The Results of The Pretest for The Control and Experimental Classes

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Pretest	Equal variances assumed	1.670	.201	.125	62	.901	.313	2.502	-4,689	5.314
	Equal variances not assumed			.125	60,941	901	.313	2,502	-4,691	5.316

It can be seen that, according to the data table above, the calculated t value of 0.125 is lower than the t table value of 1.999 with a significant yield level of 0.901. Therefore, it can be concluded that there is not a significant difference between the values of the two classes.

2) Posttest Class Control and Experiment t-test

The purpose of this t-test is to determine whether there is a change in the results of posttest scores for the experimental class and the control class, in which the experimental class received the TTW model treatment, in which the experimental class received the treatment as described above. The following table shows the results of the calculations:

Table 5. The Results of The Posttest for The Control and Experimental Classes

		Levene's Test for Equality of Variances		t-test for Equality of Means					
								95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Posttest	Equal variances assumed	.563	.456	-2.019	62	.048	-2.781	1.377	-5.535	-.028
	Equal variances not assumed			-2.019	60,147	048	-2,781	1,377	-5,536	-.026

The results of the table data above indicate that after the treatment was administered, the calculated t value of 2.019 was higher than the calculated t table value of 1.999, with a significant yield level of 0.048. Therefore, the values of the two classes showed a significant difference between the control group, which did not receive TTW treatment, and the experimental group, which received the treatment.

b. Paired Sample t-test

Using this sample test, we attempted to determine whether the sample is related to the class of sample subjects who tend to receive the same treatment. Data from the pretest and posttest assessment results for the two classes are presented below. The data were processed using SPSS version 22.

Table 7. Results of paired sample t-test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Means	std. Deviation	std. Error Means	Lower	Upper	Q	df	Sig. (2-tailed)
Pair 1	Pre-test Control - Post-test Control	-26,844	9,609	1,699	-30,308	-23,379	-15,803	31	.000
Pair 2	Experimental Pre-test - Experimental Post-test	-29,938	8,269	1,462	-32,919	-26,956	-20,479	31	.000

According to the data presented above, it is evident that the pretest-posttest data for the control class in Paired 1 has a tcount value of 15.803 higher than the ttable value of 2.040 with a significance level of 0.000, indicating a significant difference between pretest and posttest values in the control group. There was a significant difference between the pretest and posttest values of the experimental class in Paired 2 with a t count of 20.479 t table value of 2.040 and a significance value of 0.000, which indicates that both pretest and posttest values were significantly different in the experimental class.

Test the N-Gain Score

In this study, the effectiveness of the TTW model was determined in relation to mathematical communication in class VIII students from SMP Negeri 3 Binjai. In order to determine if the experimental class is significantly different from the control class, there is a criterion where the <g> value of the experimental class is higher than the value of the control class.

Table 6. Distribution of N-gain scores

N-Gain Value	Category
$g > 0{,}7$	Tall
$0{,}3 \leq g \leq 0{,}7$	Currently
$g < 0{,}3$	Low

As a result of the calculation results of the N-gain score test, which were produced using SPSS ver.22 software, the average N-gain score for the experimental class was 0.75, whereas the average N-gain score for the control class was 0.66. Thus, TTW has proven to be an effective method of mathematical communication at SMPN 3 Binjai.

Hypothesis Test

a. First hypothesis test results

In this independent sample t-test, the t table value of 1.999 was used in the analysis of the posttest value, which results in a greater value in the t count than the value obtained in the t table, which is 2.019. Ha is therefore used in this study, because TTW has been shown to produce differences in mathematical communication between classes that receive treatment with TTW and classes that do not receive treatment.

b. Results of the second hypothesis test

It is important to note that for the second hypothesis, the N-gain score is used in order to determine the degree to which TTW is effective in mathematical communication. The results of the data processing indicate that Ha is accepted and H0 is rejected, which demonstrates that mathematical communication with the

TTW model is more effective than learning without the TTW model in terms of mathematical communication.

DISCUSSION

Mathematics Communication Differences Among Students With and Without the TTW Model in Class VIII

According to the results obtained from the Independent pretest t-test, there was no significant difference between the experimental class and the control class. Based on the significance value obtained of 0.901 where the value obtained exceeds the specified value. In the experimental class, TTW model treatment will be given to the control class and the material will be given to the experimental class, so the test can be conducted by both classes after they have been given the material without any treatment. According to the results obtained from the posttest, the t-test was used for descriptive analysis. Accordingly, the calculated t value is 2.019, which is higher than the significant level obtained from t table 1.999, which was 0.048. In other words, there is a significant difference between the control and experimental groups.

A paired t-test can also be used to indicate that an increase in the average values between the experimental and control classes has been observed, as evidenced by the presence of an average value and a significant value of 0.000 for the two classes. This study found that the experimental class showed a significantly higher increase in average values after receiving the TTW treatment, whereas the control group showed a decrease in average values of 26.84, while the experimental group recorded an increase in average values of 29.94.

Mathematical Communication on The Effectiveness Of The TTW Model In Class VIII

As a result of the think, talk, write strategy, students are able to gain the ability to think critically, communicate and discuss, and stop Delisgan from using writing assignments independently, and it also allows them to develop a sense of responsibility. Students will first need to gain an understanding of the subject matter on their own. The students then work in groups to exchange information on the given topic. When faced with a difficult topic to understand, students will want to leave the discussion of procrastination in the group when faced with one that is difficult to understand. After solving problems directly from the lesson material, students are more likely to remember the content learned. The final step is for these students to complete assignments based on the material they learned during the lesson.

In the initial phase, the pretest was given to the control and experimental groups. The pretest results revealed that the control and experimental groups were able to write at similar levels. In order to improve mathematical communication, the experimental group was given the TTW method twice. After that, the control and experimental groups were administered posttests to assess how well they had performed. The independent t-test analysis result for the experimental group was 0.048, which means that there was a significant difference between the experimental group and the control group in terms of the dependent variable.

As a result of calculating the N-gain score, it was found that the average of the experimental class was higher than the average of the control class. This indicates that the mathematical communication that had been given the treatment by the TTW was much more effective than the control class that did not receive the treatment. As a consequence of this description, it can be seen that the existence of truth can be supported by previous relevant theories and research that have provided evidence of this truth.

CONCLUSION

The results of the research conducted have shown that in class VIII students of SMPN 3 Binjai, there is a difference in mathematical communication between those students receiving TTW treatment compared to those students not receiving TTW treatment. Using data analysis tests on independent t-test samples in support of this assertion, it is evident that this is the case. Additionally, this study showed that the TTW model was found to be an effective method of mathematics communication in class VIII at SMPN 3 Binjai, as evidenced by the research data showing a high ranking for this method.

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