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THE EFFECT OF NHT-TYPE COOPERATIVE LEARNING WITH PEER TUTOR METHOD ON MATHEMATICAL COMMUNICATION SKILLS

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Abstrak

Penelitian ini bertujuan untuk mengetahui pengaruh dari penerapan model pembelajaran kooperatif tipe NHT dengan metode tutor sebaya terhadap kemampuan komunikasi matematis siswa. Metode peneliltian yang dipilih adalah quasi eksperimen. Populasi penelitian terdiri dari keseluruhan siswa kelas VIII, di mana dua kelas dipilih sebagai sampel penelitian, yakni satu kelas eksperimen dan satu kelas kontrol. Pengambilan sampel dilakukan melalui metode *cluster random sampling*, di mana dua kelas dipilih secara acak karena kelas-kelas tersebut tidak dikelompokkan berdasarkan kriteria apapun. Data yang terkumpul kemudian dianalisis menggunakan uji statistik. Temuan dari penelitian menunjukkan bahwa penerapan model pembelajaran kooperatif tipe NHT dengan metode tutor sebaya berpengaruh positif terhadap kemampuan komunikasi matematis siswa SMP Negeri 2 Bintan secara signifikan setelah memperhitungkan kemampuan akhir siswa, dengan nilai rata-rata N-gain 61,5%.
Kata kunci: kooperatif tipe NHT, tutor sebaya, kemampuan komunikasi matematis

Abstract

This study aims to decide the impact of the application of a sort of agreeable learning show with a peer guide strategy on students' scientific communication aptitudes. The investigate strategy chosen was quasi-experiment. The inquire about populace comprised of all VIII review understudies, where two classes were chosen as investigate tests, to be specific one test course and one control lesson. Testing was done through the cluster arbitrary inspecting strategy, where two classes were haphazardly chosen since the classes were not assembled based on any criteria. The collected information were at that point analyzed utilizing measurable tests. The discoveries of the ponder appeared that the application of the NHT-type agreeable learning show with the peer guide strategy had a positive impact on the scientific communication aptitudes of SMP Negeri 2 Bintan understudies essentially after taking under consideration the students' last capacity, with an normal N-gain esteem of 61.5%
Keywords: *NHT type cooperative, Peer tutor, mathematical communication skills*

INTRODUCTION

One of the subjects instructed at all sums of instruction in rudimentary, junior tall, tall school, and college is mathematics. Ovan (2022) argues that mathematics is a thinking tool used to provide structured, logical, mathematical, and accountable understanding. Given this important role of mathematics, mathematics learning carried out at every level of education must be carried out by what is expected.

Mathematics learning has mathematical proficiencies that pupils must acquire. NCTM (2000) sets five standards of mathematical abilities that students must master: the ability to understand, reasoning, communication, connection, and problem-solving. The general ability of mathematics learning formulated by NCTM is in line with the learning objectives of mathematics in Permendiknas Number 22 of 2006, one of which is that mathematics learning has numerical capacities that have to be faced by understudies.

Through mathematical communication which can include formulas, tables, diagrams, illustrations, and demonstrations students can articulate and interpret mathematical ideas both orally and in writing (Isnayanti et al., 2023). The

significance of mathematical communication among students is stated by Lubis & Rahayu (2023), namely to aid in improving students' critical thinking skills, to serve as a means of evaluating their comprehension, to bolster understudies in extending their numerical information, make strides in their capacities, and make strides in their social abilities. However, in reality, based on research conducted by Saiman et al (2022) and Setyawati & Budiman (2023) related to the test results of The communication skills of students in mathematics are still comparatively low.

Beginning study information on understudies of course VIII SMP Negeri 2 Bintan, found that students' common numerical communication abilities stay within the moo extent. Low mathematical communication among students is caused by a variety of factors. Hasbi et al. (2023) state that learning without focus is one of the factors contributing to low student mathematical communication, which results in a lack of understanding of the material taught, teachers concentrating too much on procedural, mechanistic matters such as teacher-centered learning and inappropriate learning processes, and students are trained to solve many problems without deep understanding.

One way to solve this problem is by paying attention to the characteristics of learning that developed in the 21st century such as student-centered learning, as well as the provision of various useful activities to prevent learning from becoming monotonous and boring (Usman, 2019). According to Siallagan (2020) to train students' mathematical communication skills, a learning model is needed to support the lesson plan which is used as a tool in delivering material to students by creating a conducive learning atmosphere that can provide opportunities to develop student activeness. One of the learning models that meet these criteria is the cooperative learning model.

Cooperative learning is a learning model carried out in groups, where each student has both individual and group responsibility for the success of student learning developed through interactions that occur between group members during the learning process (Nurwadani et al., 2021). One of the models that can energize understudies to lock in more completely within the classroom learning preparation is the NHT-type agreeable learning show. The NHT cooperative learning model according to Astuti et al (2020) is a type of group learning that emphasizes a structure designed to influence the way a group shares and accepts each other. Each group member has a head number and is assigned to complete the tasks given to them. Some studies such as those conducted by Arnawa & Wulandari (2020) and Tambunan et al (2022) revealed that when compared to students taught conventionally, students had considerably better mathematical communication abilities when instructed using the NHT-style cooperative model had considerably better mathematical communication abilities when instructed using the NHT-style cooperative model.

The NHT-type cooperative learning model can be combined with various methods. One of them is the peer tutor method. Peer tutoring is a teaching strategy that involves giving highly engaged students leadership roles to become tutors for their friends. This is evidenced by research conducted by Rahmawati (2017) at SMP Negeri 8 Bandar Lampung who created NHT-type agreeable learning with peer guides and demonstrated viability in making strides in students' numerical communication aptitudes. This shows that the agreeable show of the NHT sort is appropriate to be combined with the peer guide strategy to be connected in junior tall school. According to the findings of the research by Ainiah et al (2022) which shows that learning with peer tutoring can also help students become more proficient communicators in mathematics at PAB II Helvetia Junior High School because applying The peer tutoring approach can help students comprehend and effectively communicate their problems to find a solution.

Based on the results of previous research searches, one of the relevant studies to this research is research conducted by Rahmawati (2017) with the title

"Development of the NHT Model through Peer Guides to Make strides Scientific Communication Abilities and Learning Activities" to decide the adequacy of the NHT sort agreeable learning show with peer guides in terms of students' logical communication capacities. The researcher's research is similar to previous research because it uses the same learning model and method, namely the NHT-type cooperative learning model with the peer tutor method. Not only that, the mathematical abilities reviewed are also the same, namely students' mathematical communication abilities. And also the same research subject is junior high school students in grade VIII. The difference in research can be seen in the type of research and research design. The sort of inquiry utilized in the past investigations was the advancement, namely Research and Development with preliminary study research design, model development, and experimentation. In the meantime, the researcher's investigation utilized a quasi-experimental sort of inquiry with a pretest-posttest nonequivalent control bunch plan. In addition, research differences can also be seen from the learning materials raised. The previous research learning material raised geometry and building materials, while the researcher's learning material was triangles and quadrilaterals.

According to the above description, the researcher is curious about how students' mathematical communication is affected by the kind of cooperative learning model that uses the peer tutor method.

METHOD

This thought about combining a quasi-experimental inquiry plan with a quantitative strategy. In this ponder, a Nonequivalent Control Design Plan was utilized with a test course treated with an NHT sort of agreeable learning show with a peer guide strategy and a control course treated with routine learning. The tests chosen for this consideration were 28 understudies of lesson VIII A and 28 understudies of course VIII C from SMP Negeri 2 Bintan. This testing utilized Cluster random sampling.

The instrument used in this research is a test instrument conducted by the students' mathematical communication indicators namely expressing real objects or images into mathematical symbols or models, explaining mathematical ideas in writing with images, using terms, notations, and symbols to present mathematical information from problems, and showing composed numerical problem-solving in an organized and organized way. The instrument is suitable for use because it has passed the validity, reliability, difficulty level, and distinguishing power tests analyzed before being used in research. By using these instruments, the information collected at that time was prepared and analyzed using statistical tests. The data analysis process was carried out using the help of Microsoft Excel and SPSS. This inquiry about hypothesizes that there's a significant effect of employing a sort of agreeable learning demonstrated with a peer tutor method on students' mathematical communication ability. The statistical hypothesis proposed is $H_0: \mu_1 = \mu_2$ means that there is no difference in the average posttest of students' mathematical communication skills using the NHT-type cooperative learning model with the peer tutor method with the conventional learning model. And $H_a: \mu_1 \neq \mu_2$ means a difference in the average posttest of students' numerical communication capacity utilizing the NHT-type agreeable learning show with peer guide strategy with routine learning demonstrated. The hypothesis analysis stage includes prerequisite testing such as normality and homogeneity tests. If the prerequisite test is met, hypothesis testing uses the Independent Sample t-test. If the prerequisite test is not met, at that time, hypothesis testing uses the Mann-Whitney U test. In addition, observation sheet instruments were also used in this study. The observation sheet was used as a tool to observe all activities within the learning handle toward the execution of the NHT-type agreeable learning demonstrated with the peer mentor strategy.

RESULTS AND DISCUSSION

Six meetings were required for each class to complete the research tasks. The pretest was used at the first meeting to gauge the

student's preliminary mathematical communication skills, then continued with the second, third, fourth, and fifth meetings for teaching sessions in both classes. The second meeting taught with the learning objective of proving the properties of isosceles triangles and equilateral triangles by using the triangle congruence condition. The third teaching meeting with the learning objective of proving the properties of a jajargenjang by using the properties of parallel lines and the properties of triangular congruence. The fourth meeting teaches the learning objective of proving the properties of geometric figures using the properties of jajargenjang. The fifth meeting teaches the learning objective of finding and proving the terms of a quadrilateral into a jajargenjang. And finally, at the sixth meeting, a posttest was carried out to assess students' final proficiency in mathematical communication.

Table 1 displays information on the starting skills of the pupils in the control and experiment. Table 1 shows that the pretest average for the experiment course is lower than the pretest normal for the control course. At that point to see the conveyance of pretest information, the calculation of Standard Deviation (SD) was carried out. The results of the pretest SD calculation in both classes are lower than the average value of the pretest of both classes, meaning that the data is tightly collected around the average value. The smaller the resulting SD value, the more homogeneous and uniform the calculated data.

Table 1. Initial Mathematical Communication Ability Data

Description	Experimental Class	Control Class
Average	16,0	20,1
Minimal	3,0	9,1
Maximum	36,4	30,3
Standard Deviation (SD)	6,8	7,1

The first hypothesis test was conducted using the Independent Sample t-test following the completion of the prerequisite exam, which revealed that the data on students' initial abilities were homogeneous and normally distributed.

Table 2. Independent Sample T-Test Test Results Pretest

Independent Samples Test			
		t-test for Equality of Means	
		Df	Sig. (2-tailed)
Hasil Pretest	Equal variances assumed	51	.064

Table 2 shows that the Asymp.Sig (2-tailed) value is 0.064. It is known that 0.064> 0.05 which means H_o is accepted or $H_a$is rejected, indicating that there is no discernible difference between the experimental and control group students' average pretest scores for mathematical communication skills. Thus, in Conclusion students in the experimental class and control class started off with the same ability.

Table 3 displays information on students' final abilities in the test and control classes. Table 3 illustrates that the exploratory class's normal post-test score is higher than the control class's normal post-test score. Then to see the distribution of posttest data, the Standard Deviation (SD) calculation was carried out. The results of the pretest SD calculation in both classes are lower than the average pretest value of the two classes, meaning that the data is tightly collected around the average value. The smaller the resulting SD value, the more homogeneous and uniform the calculated data.

Table 3. Final Mathematical Communication Ability Data

Description	Experimental Class	Control Class
Average	67,8	58,2
Minimal	30,3	33,3
Maximum	81,8	72,7
Standard Deviation (SD)	10,2	9,92

The second hypothesis test was conducted using the Mann-Whitney U test after the prerequisite test was completed and it was discovered that the student's final ability data was not normally distributed.

Table 4. Mann-Whitney U Test Results Posttest

	Posttest results
Mann – Whitney U	123.500
Wilcoxon W	399.500
Z	-3.542
Asymp. Sig. (2 – tailed)	.000

Table 4 shows that the Asymp.The Sig (2-tailed) value is 0.000 <α. It is known that 0.000 < 0.05, which means that $H_o$is rejected or H_a is acknowledged, indicating that there's a refinement within the middle posttest of students' scientific communication abilities utilizing the NHT sort agreeable learning, demonstrated with the peer mentor strategy with the routine learning show.

Realizing that the experimental and control groups' posttest results differ from one another, the next step is to conduct a normalized gain test to see the magnitude of the difference seen the increment in pretest scores to posttest scores. N-gain information on students' numerical communication aptitudes in exploratory and control classes is displayed in Table 5.

Table 5 shows that the normal N-gain of the experiment course is higher than the normal N-gain of the control course. The result of the N-gain experiment that learned utilizing the NHT-type agreeable learning demonstrated with the peer mentor strategy was 61.5% with a medium N-gain category. The lowest N-gain esteem was 25.9%, and the most noteworthy was 78.6%. In the meantime, the N-gain of the control lesson that was learned utilizing the ordinary learning demonstrated was 45.9%, counting the medium category with the lowest N-gain esteem was 15.3%, and the most noteworthy was 70%. Then to see the distribution of N-gain data, the calculation of Standard Deviation (SD) was carried out. The results of the pretest SD calculation in both classes are lower than the average value of the pretest of the two classes, meaning that the data is tightly collected around the average value. The smaller the resulting SD value, the more homogeneous and uniform the calculated data. It can be concluded that the NHT-type agreeable learning show with peer guide strategy contains a positive impact on students' numerical communication abilities.

Table 5. N-*gain* Data

Description	Experimental Class			Control Class		
	Pretest	Posttest	N-gain (%)	Pretest	Posttest	N-gain (%)
Average	36,4	81,8	78,6	30,3	72,7	70
Minimal	6,1	30,3	25,9	9,1	33,3	15,3
Maximum	17,8	68,2	61,5	20,9	57,5	45,9
Standard Deviation	6,5	10,8	11,4	7,5	10,1	13,3

The aforementioned findings demonstrate that, in comparison to traditional learning, students' mathematical communication abilities have improved more dramatically following the execution of the NHT-type agreeable learning was demonstrated with the peer mentor strategy. One of them can be seen within the taking after under study reply sheet. The following are examples of students' answers to the questions given.

Question 1: In the isosceles triangle PQR, it is known that point S lies on side PQ and point T lies on side PR. so that PQ=PR and QS=RT. prove that triangle SQR and TriangleTRQ are congruent if we suppose O is the intersection point of QT and RS!

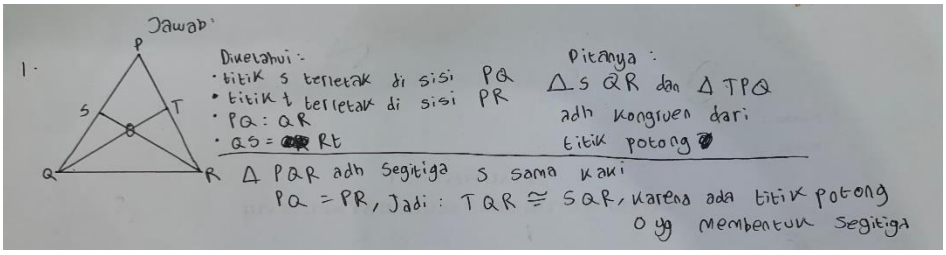
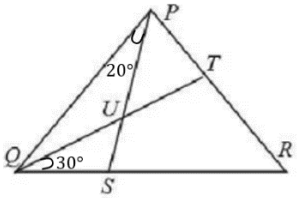


Figure 1. Students' answers to the question 1

Although the students' final answers are less precise, several indicators of students' mathematical communication have been seen, namely, , understudies can clarify numerical thoughts in composing with pictures, understudies can utilize terms, documentation, and images to display scientific data from issues, and students are also able to present structured written mathematical problem-solving.

Question 2: Take a look at the following image!



If triangle PQR is an equilateral triangle, what is the angle SUT?

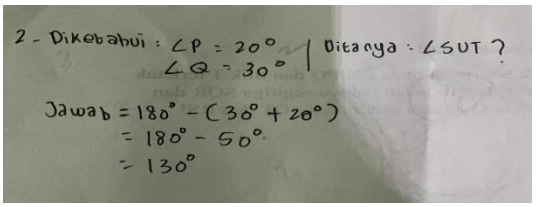
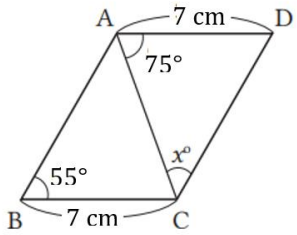


Figure 2. Students' answers to the question 2

The student's answer is correct. Students are able to express real objects or images into mathematical symbols or models, students are able to use terms, notations, and symbols to present mathematical information from problems, and students are also able to present structured written mathematical problem-solving.

Question 3: Find the value of x in the following picture of a parallelogram ABCD!



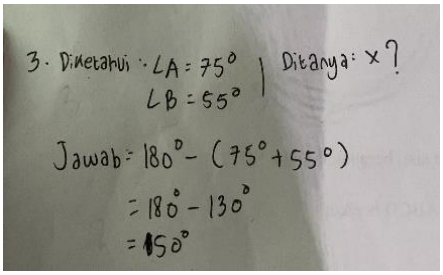


Figure 3. Students' answers to the question 3

The student's answer is correct. Students are able to express real objects or images into mathematical symbols or models, students are able to use terms, notations, and symbols to present mathematical information from problems, and students are also able to present structured written mathematical problem-solving.

Question 4: Draw a line through point O which is the intersection of the two diagonals of the KLMN jajargenjang, suppose A and B are respectively the intersection points of the KL and NM lines, and suppose C and D are respectively the intersection points of the KN and LM lines. Bolt the picture and mention which line has the same length as line AO!

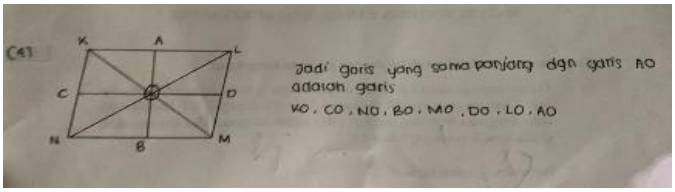


Figure 4. Students' answers to the question 4

The student's answer is not precise. Nevertheless, the student can explain mathematical ideas in writing with pictures.

The findings of this investigation corroborate those of earlier studies by Rahmawati (2017) which revealed that students using the NHT-style cooperative learning model with peer tutors had noticeably improved mathematical communication skills.

The NHT-type cooperative learning model activity allows students to collaborate directly with their group mates and each group member is responsible for their group's tasks so that there is no separation between one another in sharing knowledge. In this learning model, each student represents a different number and together discusses the LKS given by the researcher. Then the researcher calls a certain number to represent in conveying the results of his group discussion. In line with the research of Setiawati et al (2020) and Wahyuni (2019) which states that with the discussion, students certainly communicate their mathematical ideas in

groups. The results of the discussion were poured into the LKS and delivered through presentations by calling numbers as representatives. In addition, students who represent a group in presenting the results of their discussion are determined randomly by the teacher based on the head number owned by the student, so that it encourages each group member to prepare themselves as well as possible in understanding the assigned task. This can strengthen students' mathematical communication and allow students to be more involved in learning mathematics.

The results of this study also support the results of research by Azhar et al (2021) and Khomsyatun (2023) which reveal that students' mathematical communication skills improve by using the peer tutor method. In line with the research of Siregar et al (2024) which states that learning with the peer tutor method allows students to exchange ideas and discuss with each other the assigned tasks. With this method, students discuss with other students in heterogeneous groups using language that is simpler and easier to understand. So presenting the NHT-type cooperative learning model with the peer tutor method can improve mathematical communication skills on triangle and quadrilateral material.

The difference in the improvement of students' mathematical communication between the two classes is due to differences in the treatment of learning steps. The NHT-type cooperative learning model with the peer tutor method emphasizes students understand the material of triangles and quadrilaterals by actively participating in group discussions, working together, taking responsibility, helping each other solve problems, and encouraging each other to play an active role. This learning model also involves students who have high abilities to help their group members understand the material or complete tasks, as well as ensuring that all group members are involved in the discussion and understand the assigned tasks. In line with the inquiries of Sujarwati et al. (2021) and Putri (2021), which uncovered that the NHT-type agreeable learning show with peer guide procedures welcomes understudies to be straightforwardly included in group discussions which are also required to be active in working on the LKS. Where in each group there are students who act as peer tutors who help other students in learning so that they can understand the material well and complete the task correctly.

LKS is given so that students can develop understanding, skills, and knowledge of the concepts of triangles and quadrilaterals that have been learned. LKS is considered a learning media that has a considerable influence in supporting the learning process in the classroom (Haryonik & Bhakti, 2018). The use of LKS as discussion material in applying mathematical communication indicators on triangle and quadrilateral material using the NHT-type cooperative learning model with the peer tutor method has its advantages. This is supported by Heryan's research (2018) which states that students' involvement in discussion activities can provide opportunities for students to actively participate in learning and can improve students' mathematical communication.

CONCLUSION

Based on the findings of the investigation and talk, it appears that the application of the NHT-type agreeable learning demonstrated with the peer mentor strategy encompasses a positive impact in moving forward students' scientific communication aptitudes when compared to the application of routine learning. This happens since, within the NHT-type agreeable learning show with the peer mentor strategy, understudies effectively take an interest in bunch talks, work together, take obligation, and offer assistance to each other to illuminate issues. Peer tutors help their group members understand the material or complete the task and ensure that all group members are involved in the discussion and understand the given task.

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