

The Cooperative Learning Comparison of Student Teams Achievement Division Type and Teams Assisted Individualization type Toward The Students' Mathematical Communication Skill

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Abstract:

The study aimed to compare the cooperative learning model of Student Team Achievement Division (STAD) and Team Assisted individualization (TAI) types on the mathematical communication skill of class VIII students of State Junior High School 3 Sungguminasa of Gowa Regency. It was quasi-experimental research with non-equivalent control group design. The study population was all the students of class VIII of State Junior High School 3 Sungguminasa. Descriptive and inferential statistical analysis with independent sample t-test were used in analysing the data. Based on the results of the descriptive statistical analysis, the mean score of the students' mathematical communication skill using cooperative learning model of STAD type was about 65.63% at the high category and the rest score was at the very high category; while the mean score of the students' mathematical communication skill using the cooperative learning model of TAI type was about 62.5% at the high category and the rest score was at very high category. Based on the inferential analysis, it was obtained the results that there were the differences of the mean scores of the students' mathematical communication skill who possessed the STAD and TAI learning types, and TAI learning type was more effective than the STAD learning type to enhance the students' mathematical communication skill.

Keywords: *Mathematical Communication, Student Teams Achievement Division (STAD), Teams Assisted Individualization (TAI)*

Introduction

The education in Indonesia, especially in the formal education, requires all students to study mathematics started from the elementary school to the higher education level. Mathematics also has great functions and roles in the daily lives. All the human activities in various kinds of field works cannot be separated from mathematics.

The Content Standard of the Ministry of National Education's (MoNE) Regulation number 22 of the year 2006 developed by BNSP states that learning mathematics aims to prepare the students the skills to solve the problem containing the ability of communicating the ideas through symbols, tables, charts and other media in order to clarify a situation or a problem (Depdiknas, 2006: 106). Based on the learning objectives of mathematics, the mathematical communicational ability is one of the important skills that should be possessed by the students.

The students do not necessary understand the information that they receive regarding the mathematical concept because the mathematics characteristics are fully contained with terms and symbols. The students' understanding on mathematics can be more optimal by thinking, reasoning, and then communicating their ideas. In addition to communication, listening other explanation can also optimize their understanding. Communicating the ideas can be conducted in two ways, both in oral and in written forms. Through the mathematical communication, the students are able to reflect and clarify their ideas, their understanding on the mathematical correlation, and their mathematical arguments.

The mathematical communication skill needs to be considered in learning mathematics because through communication, the students are able to understand the symbols and information containing in

the lesson. Ironically, in the implementation of learning mathematics in the school, the students are difficult to communicate their mathematical ideas.

Based on the observation conducted in SMPN 3 Sungguminasa of Gowa Regency, most of students only payed attention and followed their teacher's instruction without giving feedback. The students were difficult in communicating the main problems of the tests given by the teacher both in oral and in written forms, and they were also difficult in writing it into the appropriate mathematical modeling form.

The students' low mathematical skill cannot be separated from the learning process. Learning mathematics uses standard formulas a lot, so that it causes the learning processes still tend to passive and the students are less creative because they are less involved in the learning processes.

The mathematical communication skill is the ability to convey the mathematical ideas both in oral and in written forms, and the ability to understand and receive other mathematical ideas carefully, analytically, and critically to sharpen the understanding (Lestari & Yudhanegara, 2015: 83). The evaluation standards to measure this skill are: (1) expressing the mathematical ideas by speaking, writing, demonstrating, and describing it in visual forms, (2) understanding, interpreting, and assessing the mathematical ideas presented in writing, oral, or visual forms, and (3) using vocabulary / language, notation, and mathematical structures to express ideas and describe the relationship and model making (Ansari, 2016: 16).

To improve the students' mathematical communication skill, NCTM recommends that the communication should be focused on the meaningful mathematics tasks. The teacher should identify and use the tasks that are importantly related to the mathematical ideas, able to be completed by using various kinds of methods, to fulfill many examples, and to give the opportunities to the students to interpret, investigate, and estimate it.

One of the learning models that is expected to improve the students' mathematical communication skill is cooperative learning model. The cooperative learning model is a series of learning activities carried out by the students in certain groups in order to achieve the formulated learning objectives (Asnita, 2015). The cooperative learning models has some characteristics such as: 1) team learning, 2) based on cooperative management, 3) willingness to work together, and 4) skill to work together (Rusman, 2010: 207).

There are some cooperative learning models that can be adapted into some large classes and levels, such us, Student Team Achievement Division (STAD) and Teams Assisted Individualization (TAI). Cooperative Learning type type STAD is a Cooperative Learning approach that emphasizes activities and interactions among students to motivate each other and help each other in mastering subject matter in order to achieve maximum achievement (Esminto, 2016: 22). STAD's learning is considered as one of cooperative learning types that can motivate the students to increase their mathematical reasoning and communication skills. The syntax of cooperative learning model of STAD type are: 1) giving objective or motivation, 2) group division, 3) teacher presentation, 4) group work, and 5) evaluation and giving award (Rusman, 2010: 215).

TAI is a cooperative learning model developed by Robert E. Slavin. This model is a learning model that combines the advantages of cooperative learning with individual learning (Mustofa dan Istiqomah, 2018: 528). The TAI type of cooperative learning model is better than conventional learning. Therefore, this learning can be used as an alternative learning model in mathematics learning (Hasbi and Putri, 2018: 133). Based on the above description, both cooperative learning models of STAD type and TAI type can help the students to improve their mathematical communication skill. The syntax the cooperative learning model of TAI type are: 1) Placement Test, 2) Teams, 3) Student Creative, 4) Teams Study, 5) Teams Scorer and Team Recognition, 6) Teaching Group, 7) Fact Test, and 8) Whole-Class Unit (Lestari & Yudhanegara, 2015: 49).

Research Method

This study used a quantitative research approach of quasi experimental with nonequivalent control group design. In this design, there were two experimental groups that were given the same treatment. The experimental group₁ was taught by using cooperative learning model of STAD type, and the experimental group₂ was taught by using cooperative learning model of TAI type.

The population of this study was all the students of class VIII of SMPN 3 Sungguminasa of Gowa Regency for academic year 2017-2018. Simple random sampling was used as the sampling technique of this study. Therefore, the students of class VIII E with the total number of 32 students were selected as the experimental group₁, and the students of class VIII F with the total number of 32 students were selected as the experimental group₂ as the samples of this study.

The researchers used data collection technique by using written test technique in the form of essay test, and the data were analyzed by using descriptive and inferential statistics. The descriptive statistic was used to find out the general description of the students' mathematical communication skill, while the inferential statistic was used to test the research hypothesis by using independent simple t-test then continued by the effectivity test by using relative efficiency formula. The normality test and the homogeneity test were used in advance as the prerequisite test.

Findings and Discussion

The following table is the descriptive analysis result of students' mathematical communication skill data using STAD cooperative learning model in class VIII E (experimental class₁).

Table 1. The Statistic of Descriptive Mathematical Communication Skill in Experimental Class₁
Statistic Score

Statistic	Statistic Score	
	<i>Experimental Class Pretest₁</i>	<i>Experimental Class Posttest₁</i>
The lowest score	14	63
The highest score	41	91
Mean Score (\bar{x})	24,28	75,31
Standard Deviation (SD)	8,09	8,97

If the students' mathematical communication skill is categorized in the lowest, low, middle, high, and the highest scores, then the frequency and the percentage will be obtained after doing the *pretest* and the *posttest* as follows:

Table 2. The Category of Mathematical Communication Skill in Experimental Class₁

Mastery Level	Category	<i>Pretest</i>		<i>Posttest</i>	
		<i>Experimental Class Pretest₁</i>		<i>Experimental Class Pretest₁</i>	
		Frequency	Percentage	Frequency	Percentage (%)
0-20	Lowest	15	46,875	0	0
21-40	Low	15	46,875	0	0
41-60	Middle	2	6,25	0	0
61-80	High	0	0	21	65,625
81-100	Highest	0	0	11	34,375
Total		32	100	32	100

Referring to the table above, the highest percentage of the students' mathematical communication skill in the experimental class₁ in *pretest* was in the low category and the highest percentage of students' mathematical communication skill in experimental class₁ when taking the *posttest* was in the highest category.

In addition these are the descriptive table of the students' mathematical communication skill result of TAI cooperative learning model in class VIII F (experimental class₂).

Table 3. The Statistic of Descriptive Mathematical Communication Skill in Experimental Class₂

Statistic	Statistic Score	
	<i>Experimental Class Pretest₂</i>	<i>Experimental Class Posttest₂</i>
The lowest score	16	67
The highest score	45	94
Mean Score (\bar{x})	24,09	79,94
Standard Deviation (SD)	7,59	7,34

If the students' mathematical communication skill is categorized in the lowest, low, middle, high, and the highest scores, then the frequency and the percentage will be obtained after doing the *pretest* and the *posttest* as follows:

Table 4. The Category of Mathematical Communication Skill in Experimental Class₂

Mastery Level	Category	<i>Pretest</i>		<i>Posttest</i>	
		Experimental Class ₂		Experimental Class ₂	
		Frequency	Percentage (%)	Frequency	Percentage (%)
0-20	Lowest	14	43,75	0	0
21-40	Low	16	50	0	0
41-60	Middle	2	6,25	0	0
61-80	High	0	0	20	62,5
81-100	Highest	0	0	12	37,5
Total		32	100	32	100

Based on the table above, the highest percentage of the students' mathematical communication skill in experimental class₂ of the *pretest* was in the lowest category. While the highest percentage of the students' mathematical communication skill in experimental class₂ of the *posttest* was in the highest category.

The result of normality test of the *pretest* and the *posttest* of control class with the experimental class showed that the whole data were distributed normally. Moreover homogeneity of the test result showed that the data was homogeneous.

It was revealed from the hypothesis test that the $t_{score} = -2,26$ and the score of t_{Table} with $\alpha = 0,05$ and $dk = 32 + 32 - 2 = 62$ was 1,99, because the $t_{score} \geq t_{Table}$ or $-t_{score} \leq -t_{Table}$ ($-2,26 < -1,99$). Thus it can be concluded that H_0 was rejected, which means that there was distinction in the mean score of the students' mathematical communication skill in class VIII of SMPN 3 Sungguminasa, Gowa Regency using STAD cooperative learning model and TAI cooperative learning model.

Concerning about the the effectiveness test by applying relative efficiency pattern, it was found that the $R\ score > 1$ ($1,49 > 1$) which means that TAI cooperative learning model was relatively more efficient than the STAD cooperative model towards the students' mathematical communication skill in class VIII of SMP Negeri 3 Sungguminasa, Gowa Regency.

Before implementing the STAD and TAI cooperative learning models, the students' mathematical communication skill category was in lowest category, low, and middle. It occurred due to most of students who encountered difficulty in finding the main problems which were discovered in the tasks given. Consequently, the difficulty in finding the main problems which made the students could not overcome the shown tasks including writing mathematical models to assist in expressing daily events in mathematical language.

The difference of the students' mathematical communication skill was more noticeable after the STAD cooperative learning model conducted, with 65,675% students who had high category of mathematical communication skill, 34,375% students who had high category mathematical communication skill. Hence it could occur owing to the use of STAD cooperative learning model students would cooperate in discussing the mathematical ideas, solving the problems, looking for the patterns and the correlation in data series, and engaging the students actively expressed their ideas with the other students. Likewise, they helped one another to understand the taught materials, so they were able to write the information and the problema in a task and through discussing they were able to implement the terms and the mathematical notation by modelling a mathematical problem. Besides, by providing much time for them to discuss, it would would make them know the meaning of the task, not only counting the numbers but also knowing the meaning of every steps in finishing the task untill concluding process. Thus the way of assisting the students to develop their mathematical communication skill especially for those who encountered fear or shame to ask to their teachers when there were difficult materials through the STAD model, the students could express their ideas easily when sharing with the other groups without any reluctances. It was in line with the previous research that the students' mathematical communication skill which was implemented in the STAD cooperative learning model was much better than the conventional way (Muharom, 2014: 12).

In addition the same way occurred in the class which applied TAI cooperative learning model, with 62,5% students who had high mathematical communication skills, 37,5% students who had high mathematical communication skills category. It occured due to the implementation of TAI cooperative learning model students would cooperate to discuss the mathematical ideas, solving the problems, looking for the patterns and the correlation in data series, and engaging the students actively expressed their ideas with the other students. Moreover, they assisted one another to understand the taught materials, so they were able to write the information and the problem in a task and through discussing they were able to implement the terms and the mathematical notation by modelling the mathematical problems. Besides, by providing much time for them to discuss, it would would make them know the meaning of the task, not only counting the numbers but also knowing the meaning of every step in finishing the task untill concluding process

It was believed that those ways help the students to improve mathematical communication skill especially for those who encountered fear or shame to ask to their teachers when there were difficult materials through the TAI model the students could express their ideas easily when sharing with the other groups without any reluctances. Moreover, there was a person in every group who acted as the assistant who had higher quality compared to the other groups so for those who encoutered difficulty in understanding the materials, they would ask for help to those who were better in the skill. It became the responsibility of the higher quality student to guarantee that all of groups could understand the taught materials. It was the same with the previous study stated that the mathematical teaching and learning applying *problem solving* in *setting* TAI cooperative learning model was more effective than the conventional approach noticed from their mathematical communication skills (Kusnaeni & Ratnawati, 2013: 11).

Based on the observation and the findings analysis that learning through model STAD and TAI cooperative learning models can be applied as learning model especially in learning mathematics dealing with daily life. It was caused by: 1) learning mathematics by implementing STAD and TAI cooperative learning models could enhance the interaction and communication among the students so the students who felt shy to ask the teachers would be brave because they just face their friends, 2) learning mathematics by implementing STAD and TAI cooperative learning models made the students easily got bored because they could not discuss with their own groups, 3) learning mathematics through STAD and TAI cooperative learning models could also train the responsibility role of the students in the group to understand the material and finish the given task, 4) learning mathematics with STAD and TAI cooperative learning models trained the students braveness to deliver the result of group discussion conducted in front of all of students in the classroom, 5) learning mathematics using STAD and TAI cooperative learning models was believed that it make them more active provided them more chance to communicate in their mathematical ideas by sharing various information followed with the argumentation internal group discussion and the other groups in this lesson. The teacher's role was as a facilitator, while the students thought, communicated the reason and trained them to respect the other people's opinions.

Referring to the relative efficiency test, it can be concluded that the TAI cooperative learning model was more effective than the STAD cooperative learning model in improving the students' mathematical communication skill. It was due to implementation of TAI and STAD cooperative learning model which obligated each student in the group to master the material assigned and the existence of the student who was appointed to be the assistant who help his/her group to grasp the difficult material. In addition, the success of TAI cooperative learning model was supported with the role of the assigned assistant and the responsibility in succeeding the member of the group in grasping the lesson and finishing the task. It was different from the STAD cooperative method in which the student in the group understood the taught material regardless the role of the responsible one who should play an important role in succeeding the group.

Conclusion

1. The students' mathematical communication skill in class VIII of SMPN 3 Sungguminasa who applied STAD cooperative learning model were about 65,63% in high category while the rest was in the highest category.
2. The students' mathematical communication skill in class VIII of SMPN 3 Sungguminasa who applied TAI cooperative learning model were 62,5% in high category while the rest was in the highest category.
3. Based on the finding analysis, it was obtained that there were distinction in the average of the mathematical communication skill among the students in class VIII of SMPN Sungguminasa who applied the STAD and TAI cooperative learning models.
4. It was found from the result that the implementation of TAI cooperative learning model was more effective in enhancing the students' mathematical communication skill in class VIII of SMPN 3 Sungguminasa compared to the STAD cooperative learning model.

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