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Mathematical communication ability viewed from mathematical anxiety in Team Assisted Individualization using Edmodo

Dhea Amalia*, Nur Karomah Dwidayati

Mathematics Department, FMIPA, Semarang State University,Semarang, Indonesia

** E-mail address: dheaamalia8@gmailcom*

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Abstract

This study aims to find out that mathematics learning using Edmodo-assisted TAI learning effectively affects students 'mathematical communication skills and describes students' mathematical communication skills through Edmodo-assisted TAI learning in terms of mathematical anxiety. The method used in this study is a mixed-method with a sequential explanatory design. Data collection methods used were tests, observations, questionnaires, and interviews. This study's population were students in grade 8 from one of the State Junior High School in Semarang for the 2019/2020 school year, using a random sampling technique that selected two classes, namely 8A class students as the experimental class and 8B class students as the control class. The results showed that: (1) students' mathematical communication skills using the Edmodo-assisted TAI model exceeded minimum completeness criteria and classical completeness; (2) the mathematical communication skills of students who use the Edmodo assisted TAI model is better than the mathematical communication skills of students who use Edmodo assisted direct instruction learning; (3) students with a low level of mathematical anxiety can meet all indicators; (4) students with medium mathematical anxiety can meet five of the six indicators; (5) students with high mathematical anxiety are only able to meet four of the six indicators of mathematical communication skills.

1. Introduction

Learning is an activity that humans experience every day, almost every time, from those who don't know to know, and also those who already know become more informed. Learning is a process that can be characterized by changes in a person. Learning is at the core of the educational process. According to the National Education System Law (2003), learning is a process of interaction between students and educators and learning resources in a learning environment. One of the lessons taught in school is mathematics.

Mathematics is a branch of science that has a very important role in life and in improving human resources. According to the Ministry of National Education (2006), learning mathematics has one objective, so that students can have good mathematical communication skills. The purpose of learning mathematics is in line with the general objectives of mathematics formulated by NCTM (2000) which states that there are five basic abilities in learning mathematics that students must master, namely problem-solving abilities, reasoning and proof abilities, mathematical communication ability, mathematical connections ability, and representation ability. So it can be said that mathematics communication is one of the important components of the basic abilities that students must have in learning mathematics.

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Based on the results of the 2018 Program for International Student Assessment (PISA) survey, Indonesia was ranked 74 out of 79 by getting an average math score of 379. The score obtained by Indonesia was still below the international average score of 458. This shows that students in Indonesia on average are still unable to develop the ability to solve math problems well. Based on Agustyaningrum's (2011) research, most students apply the method of memorizing formulas to learn mathematics, even though the essence of learning mathematics is not memorizing but can communicate ideas with symbols, tables, diagrams, or other media to clarify the situation or problem. The importance of mathematical communication skills is explained by NCTM (2000) as cited in Clark (2005), mathematical communication is a way of sharing ideas and clarifying understanding. Through communication, ideas can be reflected, refined, discussed, and developed. The communication process also helps to build meaning and make ideas permanent, and the communication process can also explain ideas.

Based on a preliminary study conducted on January 3, 2020, shows that students' mathematical communication skills are still low. It can be seen from the results of the preliminary study test on the number pattern material that has been carried out has an average of 65.69 which is still far below the minimum completeness criteria, namely: 74. From the test results, it was found that the students' ability to translate the problems on the questions into language Mathematically is not good. Data from interviews conducted with one of the mathematics subject teachers at State Junior High School 9 in Semarang, namely Mrs. Kristin Usadani, who has taught at the school for 27 years, one of which is one of the problems faced by students in mathematics is how to communicate ideas, and his opinions, both oral and written, are still not good enough. Students tend not to be able to play an active role in learning as shown by the rarity of students who ask questions or express opinions. This happens due to various factors, one of which is the use of various learning models suggested in the 2013 curriculum but the results are not optimal. Most students who do not understand the lesson make them not dare to communicate ideas about a subject matter that they are facing. Students prefer to be quiet and pretend to understand what the teacher has explained. When a daily test or sudden test was carried out, then it was proven that his communication skills in dealing with questions were still lacking.

How to foster mathematical communication skills in students, it is necessary to design appropriate learning and support and direct students to their ability to communicate ideas or mathematical ideas. One other element is the selection and use of appropriate learning model and according to learning needs (Achdiyat & Andriyani, 2016). The cooperative learning model that can be applied and following the 2013 curriculum is Team Assisted Individualization (TAI). TAI combines cooperative learning and individual teaching. Slavin developed this method for several reasons. First, this model combines cooperative advantage and individualized teaching programs. Both of these models emphasize the social effects of cooperative learning. Third, TAI is structured to solve individual learning difficulties (Slavin, 2005, p. 15) as quoted by Argianti (2017). From the results of the research, Mubarika (2017) also states that the application of the TAI type cooperative learning model can improve students' mathematical communication skills.

One of the affective aspects related to mathematics learning is mathematical anxiety. Mathematical anxiety is a feeling of anxiety that interferes with the number manipulation process and the process of solving math problems that arise from unpleasant experiences in learning mathematics as a reaction to the inability to solve a problem-solving problem in mathematics (Alimatunnisa, 2017). The research of Dharma et al. (2019) showed that students' mathematical anxiety affects their mathematical communication skills. Mahmood & Khatoon (2011) mentions indicators of math anxiety experienced by a person, namely: (a) Difficulty being ordered to do the math, (b) avoiding math classes, (c) feeling physical pain, dizziness, fear, and panic, (d) can't do math test questions.

At the beginning of 2020, the world was shocked by the covid-19 virus that emerged in China. The virus began to be detected and spread in Indonesia in the second week of March which was finally designated as a National Disaster which caused regional heads in Indonesia, especially Central Java to close school for 2 weeks which resulted in teaching and learning activities being carried out online until the time possible for teaching and learning activities carried out again at school. Therefore, the learning process and research taking will also be carried out online through the WhatsApp and Edmodo applications. Edmodo application is use in research as an assisted in learning. The use of WhatsApp and Edmodo to conduct this research can be done because all 8th-grade students in State Junior High School 9 Semarang have used the application.

Based on the description above, the objectives of this study are (1) to test students 'mathematical communication skills using Edmodo-assisted TAI learning beyond the minimum and classical completeness criteria, (2) to test students' mathematical communication skills using Edmodo-assisted TAI learning better. from the mathematical communication skills of students who use direct instruction assisted by Edmodo, (3) to analyze mathematical communication skills through learning TAI assisted by Edmodo in terms of mathematical anxiety.

2. Methods

This research uses a mixed-method type of sequential explanatory. The population in this study were 8th-grade students in State Junior High School 9 Semarang in the 2019/2020 school year. From the population, the sampling was carried out by random sampling, where students who were selected as samples were grouped into 2 groups, namely students of class 8A as the experimental group who were given the TAI learning model assisted by Edmodo and class 8B students as the control group who were given model learning. Edmodo assisted Direct Instruction. Meanwhile, students of class 8C were used as a test class for the test instrument for mathematical communication skills and the mathematical anxiety scale.

To determine mathematical communication skills in terms of mathematical anxiety, the research subject was taken by purposive sampling. The consideration made in taking research subjects is to pay attention to the criteria for categorizing mathematical anxiety and the results of tests of mathematical communication skills. The classification of mathematical anxiety consists of high mathematical anxiety, medium mathematical anxiety, and low mathematical anxiety. From the three groups, two students were each taken based on the results of their mathematical communication skills test. The results of the selected subject's work are then used as the basis for conducting interviews.

The research design used in this study was the posttest-only control-group design. There are two groups, where one group gets treatment called the experimental group, and one group that does not get treatment is called the control group as stated by Sugiyono (2012). The quantitative research design used in this study is presented in Table 1 below.

Table 1. The research design was a posttest-only control group design

Group	Treatment	*Posttest*
A	X_1	O
B	X_2	O

The research Information:
A = experimental group
B = control group
X_1 = edmodo assisted TAI model
X_2 = edmodo assisted direct instruction model
O = posttest mathematical communication skills

Learning was carried out four times in the experimental class using the Edmodo assisted TAI model and the control class using the Edmodo assisted direct instruction model. The material used is a flat side space, namely the surface area and volume of the cube and block. The variables used in this study were students' mathematical communication skills and mathematical anxiety.

The data collection techniques used were (1) observation, (2) written test in the form of posttest, (3) mathematical anxiety scale in mathematics learning, (4) interviews conducted to obtain student answer data on tests of mathematical communication skills, (5) documentation which is used to obtain research supporting data,

The quantitative data analysis used were (1) prerequisite test data analysis in the form of normality, homogeneity, and two-mean similarity test, (2) final data analysis which included the normality test to determine the parametric or non-parametric statistics used, the homogeneity test for know what statistical test is used, hypothesis test 1 uses the t-test to test the average achievement limit of classical completeness, hypothesis test 2 uses the z test to test the proportion of classical attainment limits, and

hypothesis 3 uses the advanced test and z test to test the difference in assisted Edmodo TAI model with direct instruction assisted by Edmodo.

Qualitative data analysis used was data from interviews and questionnaires. Questionnaires are used to classify the level of mathematical anxiety in students. Interview analysis in this study was conducted by reducing data, presenting data, and drawing conclusions. Data reduction is the stage of the process of selecting, focusing, simplifying, and selecting the main things according to the focus of the study, namely knowing the description of mathematical communication skills in terms of students' mathematical anxiety in Edmodo assisted TAI learning. The data reduction stage carried out was to correct students' mathematical anxiety questionnaires and then group them into three categories. Presentation of data is the stage of bringing up an organized data set so that it is possible to conclude. The validity of the data was done by using triangulation techniques, namely comparing the test results of mathematical communication skills with the data from interviews.

3. Results and Discussion

This section describes the results of both quantitative and qualitative research. Before and after learning mathematics using the TAI model assisted by Edmodo, students are given a mathematical anxiety scale. Based on the results of the mathematical anxiety scale analysis, the experimental group students' mathematical anxiety data obtained before being given the treatment is presented in Table 2.

Table 2. Mathematical Anxiety of Experiment Class Students.

Value Interval	Interpretation of Mathematical Anxiety	Many Students
$70 \leq X \leq 95$	High	3
$45 \leq X \leq 69$	Medium	24
$19 \leq X \leq 44$	Low	5

Table 2 shows that 3 students with high mathematical anxiety levels, 24 students with medium mathematical anxiety levels, and 5 students with low mathematical anxiety levels. From each category, two students were taken as research subjects.

Learning activities using the Edmodo-assisted TAI model were held four times. Learning mathematics using the Edmodo-assisted TAI model that has been carried out can also be seen on the teacher activity observation sheet that has been filled in by the observer during learning. In general, the implementation of student activities in learning mathematics using the TAI model assisted by Edmodo at each meeting is presented in Figure 1.

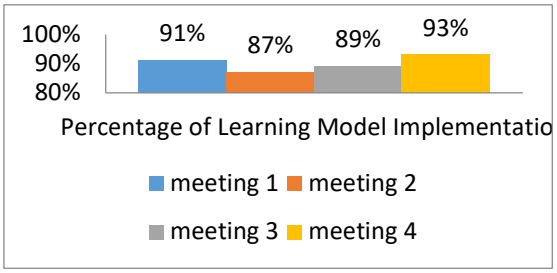

Figure 1. Percentage of Teacher Activity Sheets

Figure 1 is the result of the observation sheet of teacher activities in classroom learning using the Edmodo-assisted TAI model, carried out for four meetings. The percentage of learning model implementation at the first meeting was 91% with perfect criteria; at the second meeting, it reached 87% with ideal criteria, at the third meeting, it reached 89% with outstanding criteria, and at the fourth meeting, it reached 93% with exceptional criteria. The post-test results of mathematical communication skills can be seen in Table 3.

Table 3. Students' Mathematical Communication Ability test results

Class	Data	Result
Experiment	Mean	87,2656
	Variance	69,419
	Highest score	100
	Lowest score	65
	Many students complated	30
Control	Mean	81,5312
	Variance	76,822
	Highest score	97
	Lowest score	60
	Many students complated	25

Based on table 3 data, testing was carried out. Hypothesis 1 is used to determine whether the students' mathematical communication skills in Edmodo-assisted TAI learning can exceed the average minimum completeness of more than 74. The minimum completeness criteria in this study is in accordance with that used in school, namely 74. From the results of the study, 30 out of 32 students reached the minimum completeness criteria. . This means that as many as 93.75% of students reach minimum completeness criteria. This is confirmed by the one-sided average test. Test the one-sided average test using SPSS 16.0, namely the One Sample T-Test, obtained $sig\ 2 - tailed = 0.000$. Because of $sig. = 0.000 < 0.05, H_0$ is rejected. This means that students' mathematical communication skills in the experimental class exceed the minimum completeness criteria.

Hypothesis 2 is used to determine whether students' mathematical communication skills in Edmodo-assisted TAI learning can exceed classical completeness. The classical completeness test uses the right side proportion test. From the calculation results obtained $z_{count} = 2.45$ with a significant level $\alpha = 5\%$, obtained $z_{table} = 1.64$. Because $z_{count} = 2.45 > 1.64 = z_{table}$, so H_0 is rejected. This means that students' mathematical communication skills in the experimental class achieve classical completeness.

Hypothesis 3 was conducted to determine whether the increase in students' mathematical problem-solving abilities in Edmodo assisted TAI learning was higher than Edmodo assisted direct instruction learning. This test uses the difference test of two mean ones and the different test of two proportions of one right side. This test was conducted to determine the difference between individual and classical means of the mathematical communication ability test with Edmodo-assisted TAI learning and Edmodo-assisted direct instruction. Test the difference between the two means using SPSS 16.0, namely the Independent Samples T-Test, obtained $sig\ (2 - tailed) = 0.009$. Because of $2 \times sig. = 0.018 < 0.05, H_0$ is rejected. This means that the average mathematical communication skills of students with Edmodo assisted TAI learning is better than the average mathematical communication skills with Edmodo assisted Direct Instruction learning. The test for the difference between the two proportions of one right party obtained the value of $z_{count} = 1.798$ and $z_{table} = z_{0.45} = 1.645$ because $z_{count} = 1.798 > 1.64 = z_{table}$ then H_0 was rejected, meaning that students who completed the class using Edmodo-assisted TAI learning were more than the proportion of students who complete in a class that uses direct instruction learning assisted by Edmodo. From the calculations in hypothesis 3 test, it was found that the mathematical communication skills of students using Edmodo assisted TAI learning was better than those using Edmodo assisted direct instruction learning.

Furthermore, to determine the description of mathematical communication skills of each category of students' mathematical anxiety, it was carried out by analyzing the results of tests of mathematical communication skills and interviews with research subjects. This study's subjects were six students who were selected by purposive sampling, which consisted of 2 students in each category of mathematical anxiety. The research chosen subjects were E-06 and E-14 for low mathematical anxiety, E-15 and E-27 for medium mathematical anxiety, and E-02 and E-31 for high mathematical anxiety.

The test results were analyzed for indicators of mathematical communication skills, which include; (1) the ability to write down what is known and asked according to the problem, (2) the ability to write

mathematical symbols correctly, (3) the ability to make pictures that are relevant to the problem, (4) the ability to write answers according to the purpose of the problem, (5) ability to write down reasons in answering questions, and (6) ability to make written conclusions using their language. The results of the interviews were also analyzed based on these indicators. In the interview process, it will be seen, namely how the subject explains each question given. After analyzing the data from the results of tests of mathematical communication skills and interviews, the following descriptions were obtained.

The results of the analysis of students 'mathematical communication skills with low mathematical anxiety are in accordance with Tobias' opinion as quoted by Kurniawati (2014), which states that mathematical concern is a feeling of tension and stress that interferes with the number manipulation process and the process of solving math problems in ordinary and academic life and can eliminate trust oneself. This is indicated by the tendency of the E-06 and E-14 subject's ability to do tests of mathematical communication skills and achieve all available indicators well. The work of the E-06 issue that is less than optimal is in the drawing part of the cube in the first item of the mathematical communication ability test, which is that there is no information added to the picture that there is a thickness of the glass which makes it clear in finding a solution to the question. However, at the time of being interviewed, subject E-14 explained the meaning of the problem well and in a firm voice.

Apart from these shortcomings, the E-06 subject in the first item of the mathematical communication ability test has not added any information to the image that there is a thickness of the glass that makes it clear in finding a solution and in the calculation section, there are still errors by not reducing the length of the ribs with the thickness of the glass. However, when being interviewed, the E-06 subject could quickly realize that there was an error in writing down the calculations so that, according to him, there was no thoroughness in answering. This happens because the E-06 subject feels afraid if his work is not completed on time. According to the research analysis, the fear of taking a test if it is not completed on time can affect accuracy. Apart from that, both subjects explained the meaning of the questions and answers and their reasons correctly. This is sufficient to prove that the issue can communicate the purpose and response of the problem, even though pictures have not been given a complete explanation. There is a lack of care in answering these questions, which is influenced by a little anxiety. Of the two subjects, researchers generally describe the achievement of mathematical communication skills with the low mathematical anxiety category, which tends to achieve all available indicators. A complete description of the results is presented in Table 4.

Table 4. Achievement of Indicators of Mathematical Communication Ability from the Low Mathematical Anxiety Category

Categori	Achievement
Low Mathematical Anxiety	Tend to be able to write down what is known and asked according to the problem, write mathematical symbols correctly, make pictures that are relevant to the questions, write answers according to the purpose of the questions, write down the reasons for answering questions, and make conclusions in writing using their own language

The results of the analysis of students' mathematical communication skills with moderate mathematical anxiety show that the E-15 and E-27 subjects' learning outcomes tend to be able to achieve indicators of writing down what is known and asked according to the problem. In the second indicator, which is writing down mathematical symbols correctly, both subjects can also achieve it. In the third indicator, there is a slight difference, namely that the E-15 issue has not been able to reach the indicator to make an image relevant to the question. Subject E-15 experienced an error in drawing a charity box (made of glass) in the shape of a cube with the thickness of the glass because of the fear of not being able to complete the test from the given time. In this case, according to the analytical researcher, that the subject can think until completion with complete stages even though there are mistakes, but when interviewed, can explain well, likewise with the issue of the E-27. Subject E-27 experienced the same error as subject E-15. Still, when interviewed, subject E-27 said panic when drawing the charity box because there was confusion in understanding the meaning of the question. Apart from that from 4 other work results show that this indicator can be achieved. So that in general, the two subjects are considered capable of making images relevant to the problem. On the fourth indicator, the two issues can write answers according to the purpose of the question. In the fifth indicator, the two subjects on the test results

of mathematical communication skills could not achieve the hands of writing down reasons in answering the questions. When interviewed, subjects E-15 and E-27 gave almost the same answer, namely that this could happen because of doubts and worry if later they were wrong in writing down the reasons. In the last indicator, the two subjects can make conclusions in writing using their language. Of the two issues, researchers generally describe the tendency of achieving mathematical communication skills with the moderate mathematical anxiety category, namely five indicators of mathematical communication skills. A full description of the results is presented in Table 5.

Table 5. Achievement of Mathematical Communication Ability Indicators from the Medium Mathematical Anxiety Category

Categori	Achievement
Medium Mathematical Anxiety	Tend to be able to write down what is known and asked according to the problem, write mathematical symbols correctly, make pictures that are relevant to the questions, write answers according to the purpose of the questions, and make conclusions in writing using their own language

The results of the analysis of students 'mathematical communication skills with low mathematical anxiety are in line with Tobias' opinion as cited by Kurniawati (2014), which states that mathematical pressure is a feeling of tension and anxiety that interferes with the number manipulation process and the process of solving math problems in ordinary and academic life and can eliminate trust oneself. This is indicated by the relatively good learning outcomes of the subject of high mathematical anxiety. Regarding the mathematical communication skills measured in this study, both E-02 and E-31 subjects who were classified as students with high mathematical anxiety showed quite good mathematical communication skills. This is because of the achievement of mathematical communication skills indicators from the subject of high mathematical pressure that tends to be achieved in four of the six indicators.

The analysis results show that in the first and second indicators, the two subjects can write down what is known and asked according to the problem and write mathematical symbols correctly. In the third indicator, Subject E-31 initially made a picture that depicts the problem's general form. Only from the images that are formed many are not relevant to the question. When interviewed, subject E-31 stated that they felt tense and anxious every time they faced a math test. The E-31 subject also said that there was a lack of confidence in solving math problems. The E-02 subject also experienced this. E-02 residents often feel insecure in solving math problems because of tensions and anxiety if the work done is wrong. In the fourth indicator, the two subjects were less able to write answers according to the purpose of the questions because, from the written responses, there were several mistakes on each item. On the five indicators, the subjects E-02 and E-31 are less able to write down their reasons in answering this question. In the sixth indicator, the two issues are less able to make conclusions when using their language.

Of the two subjects, researchers generally describe the tendency of achieving mathematical communication skills with the high mathematical anxiety category, namely the first, second, third, and sixth indicators. A complete description of the results is presented in Table 6.

Table 6. Achievement of Mathematical Communication Ability Indicators from the High Mathematical Anxiety Category

Categori	Achievement
High Mathematical Anxiety	Tend to be able to write down what is known and asked according to the problem, write mathematical symbols correctly, make pictures that are relevant to the questions, and make conclusions in writing using their own language

4. Conclusion

Based on the results of the research and discussion, it can be concluded that: (1) the mathematical communication skills of class 8-th students on the flat-side building material in Edmodo-assisted TAI learning can exceed the average learning completeness criteria, (2) the mathematical communication skills of class 8-th students in The material of flat-sided building in Edmodo assisted TAI learning can exceed the requirements for learning completeness in proportion, (3) the mathematical communication skills of class 8-th students on the flat side room building material in Edmodo assisted TAI learning is better than the mathematical communication skills of Grade 8 students on building materials The flat side space indirect instruction learning assisted by Edmodo, (4) based on the analysis of students' mathematical communication skills, seen from each category of mathematical anxiety, the following results were obtained. (a) The tendency to achieve students' mathematical communication skills with the low mathematical anxiety category is that they can complete it in all available mathematical communication skills indicators. Students tend to be able to write what is known and asked according to the problem, write mathematical symbols correctly, make pictures that are relevant to the problem, write answers according to the purpose of the questions, write down the reasons for answering questions, and make conclusions in writing using the language itself, (b) the tendency to achieve students' mathematical communication skills with the moderate mathematical anxiety category, namely the five indicators of mathematical communication skills. Students tend to write down what is known and asked according to the problem, write mathematical symbols correctly, make pictures that are relevant to the questions, write answers according to the purpose of the questions, and make conclusions in writing using their own language. However, they tend not to be able to write down the reasons in answering the questions, and (c) the tendency to achieve students' mathematical communication skills with the high mathematical anxiety category, namely only on four indicators of mathematical communication ability Students tend to be able to write what is known and asked according to the problem, write mathematical symbols correctly, make pictures that are relevant to the question, make conclusions in writing using their language and tend to be unable to write answers according to the purpose of the problem, and write down reasons -reason in answering questions.

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