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Differences in Students' Mathematical Communication Ability and Self-Efficacy Between Open Ended and Contextual Learning Approach

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Abstract
This study aims to: (1) differences in students' mathematical mathematical communication skills and self-efficacy between students who were given an Open Ended Learning Approach with a Contextual Teaching and Learning Approach; (2) the interaction between KAM and the Open Ended Learning Approach and Contextual Teaching and Learning Approach on Mathematical Communication skills; (3) the difference in Self Efficacy between students who were given an Open Ended Learning Approach and a Contextual Teaching and Learning Approach; and (4) the interaction between KAM and the Open Ended Learning Approach and Contextual Teaching and Learning Approach on Self Efficacy. This research is a quasi-experimental research. The research population was all students of class VIII SMP Negeri 1 Stabat, Academic Year 2021/2022 with a sample of class VIII A who was given an Open-Ended Learning Approach and class VIII B who was given a Contextual Teaching and Learning approach. Each class consists of 32 students. The research instrument used was a student's Mathematical Communication ability test and a Self-Efficacy questionnaire. Data analysis was performed by two-way analysis of variance (ANAVA). The results of the study indicate that: (1) There are differences in students' Mathematical Communication abilities who are given learning with the Open Ended Learning Approach and Contextual Teaching and Learning Approach; (2) There is no interaction between the learning model and early mathematics skills on students' Mathematical Communication abilities; (3) There is a difference in Self Efficacy between students who are given an Open Ended Learning Approach and a Contextual Teaching and Learning Approach; (4) There is no interaction between the learning model and the initial ability of mathematics on Self Efficacy.
Keywords: Mathematical Communication, Self Efficacy, Open-Ended Approach, Contextual Approach
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INTRODUCTION

Nurhadi (2004) says that mathematics functions to develop the ability to calculate, measure, derive and use mathematical formulas needed in everyday life through geometry, algebra and trigonometry measurement materials. In line with that Soedjadi (2000) also stated that "mathematics as a vehicle for education can not only be used to achieve goals, for example educating students, but can also shape students' personalities and develop certain skills". In order to achieve the objectives of learning mathematics, currently schools in Indonesia have partially implemented the 2013 Curriculum. The implementation of the 2013 curriculum uses a scientific approach. According to the 2013 Ministry of Education and Culture, the scientific approach has the characteristics of (1) being student-centered, (2) involving science process skills and constructing concepts, laws or principles and (3) involving potential cognitive processes in stimulating intellectual development, especially students' higher-order thinking skills.

However, the efforts made by the government in improving the quality of mathematics education have not shown maximum results. This can be seen from mathematics having an important role in life, in practice some students still consider mathematics as a difficult subject. From the results of the 2018 TIMSS evaluation, TIMSS was ranked 44th out of 49 participating countries. Seeing this reality, of course, it is very concerning when compared to our neighboring countries such as Japan which is ranked 5th after Singapore and Korea, Singapore which is ranked 1st.

Based on these conditions, in order to face various problems and challenges in the development of information technology that demands reliable and globally competent human resources, one of the things that students must possess and develop in mathematics learning is mathematical communication skills.' NCTM (2000) (Effendi, 2012) sets five standards of mathematical ability that must be possessed by students, namely communication skills (problem solving), communication skills (communication), connection skills (connection), reasoning abilities (reasoning), and representation skills (representation). From the explanation above, it can be concluded that students' mathematical representation and communication skills are some of the abilities that must be possessed by students in learning mathematics in order to achieve the objectives of learning

mathematics so as to improve students' achievement in learning mathematics.

From the statement above, it is clear that mathematical communication skills are very important for students to develop, because every day-to-day problem requires good communication to find a solution. However, in reality, this mathematical communication ability has received less attention from teachers to be developed in students. This is because the teacher is trying more so that students are able to answer questions correctly without asking for reasons for students' answers, or asking students to communicate their thoughts, ideas and ideas as well as construct their own knowledge. This results in students having low communication skills. This can be seen from the results of research conducted by Ansari (2010) explaining that "high school students in Aceh Darussalam Province on average are less skilled in communicating to convey information such as ideas and asking questions and responding to questions/opinions of others".

In addition to mathematical communication skills, abilities in other aspects that are affective and no less important to be developed in students are self-efficacy abilities. Bandura (1997) says that "self-efficacy is very important because individuals who have high self-efficacy are very easy to face challenges, do not feel doubt because they have full confidence in their abilities".

This is in line with the results of research conducted by Betz and Hacket in 1983 (Arcat, 2013) that "a student who has high self-efficacy will more easily and successfully exceed the math exercises given to him, so that the final result of the learning reflected in their academic achievement also tends to be higher. So from some of the statements above, it is clear that self-efficacy must be developed in students in order to motivate them to enlarge their efforts in achieving more optimal academic achievements.

But in fact there are still many students who have low self-efficacy. This can be seen from the results of research conducted by Pajares (2002) that "low self-efficacy, in general, makes a student appear less confident, and doubts his academic ability in doing math problems given to him, so that his academic achievement also tends to be lower because".

The low mathematical communication skills and self-efficacy of students are caused by many factors, one of which is related to the learning process. In the teaching and learning process the teacher still uses conventional or traditional learning. In this kind of learning the teacher is only a messenger of knowledge, while students tend to be mere recipients of knowledge by taking notes, imitating and listening and memorizing what the teacher does not convey. Other evidence was obtained from the results of interviews conducted by researchers on November 12, 2014 with one of the mathematics teachers at SMP Negeri 1 Stabat regarding the learning methods and media used. Mrs. Lubis said that the material was explained first, then gave examples of questions, then students did the exercises. The media is usually just drawn on the blackboard what needs to be drawn, graphs, tables, triangles or building spaces. If the students we ask to find the formulas themselves, it will take a long time, it's better for us to use the time to do the exercises. After all, our students are not like that, the more confused they are. Therefore we need a learning model that can improve students' mathematical communication skills and mathematical self-efficacy, so that it will have a positive impact on student learning outcomes.

One approach that has the opportunity to improve students' mathematical communication skills and mathematical self-efficacy is Contextual Teaching and Learning (CTL), because CTL learning provides opportunities for students to construct their knowledge and fully involve students in the learning process. This is in line with Sanjaya (2006) who said that CTL is a learning strategy that emphasizes the process of full student involvement to be able to find the material being studied and relate it to real life situations so as to encourage students to apply it in their lives.

Luvy (2013) states that in CTL learning, students are given the opportunity to construct mathematical concepts being studied through an inquiry model so as to make students more active in learning. During the iknuiri process, students study together in groups, it is hoped that knowledge sharing will occur. Where students can ask the teacher, group friends and even to other groups. In addition, students can see the available models either given by the teacher or models available in the natural environment.

From this opinion, CTL learning emphasizes student-centered learning, the teacher activates students to build their own knowledge. CTL learning, allows a learning process in which students explore their understanding and academic abilities actively in a variety of contexts inside and outside the classroom. So that CTL learning is expected to be a solution to create a student learning paradigm instead of a teacher teaching paradigm as happens in conventional learning, which in turn can improve students' mathematical communication skills and self-efficacy.

To achieve maximum results in learning, a good learning method is needed. One way of learning that is good and can lead students to mathematical communication skills is to apply learning using an open-ended approach (open problems). Learning with open problems or open-ended, meaning learning that presents problems with solutions in various ways (flexibility) and the solutions can also vary (multi-responsibility, fluency).

With this basis, students' mathematical communication skills can be developed by applying an open-ended approach in learning mathematics. On this occasion the researchers were interested in seeing whether students'

mathematical communication skills and students' self-efficacy who were given an Open-Ended learning approach and a contextual approach (Contextual Teaching and Learning) were influenced by groups of students' initial mathematical abilities (high, medium, and low).

METHOD

Research Pattern

The type of research used is a quasi-experimental research (quasi-experimental) because this research wants to know whether there are differences in mathematical communication skills and student learning self-efficacy due to a treatment.

Subject

Based on random sampling from 11 class VIII at SMP Negeri 1 Stabat, 2 classes were selected, namely class VIII - A as experimental class 1 which was given learning with an Open-ended learning approach and class VIII - B as experimental class 2 which was given learning given a contextual learning approach model (Contextual Teaching and Learning). Each of the students in the two classes is 32 students.

Data Analysis

In relation to the formulation of the research problem, data analysis improves the model of the Open-ended Learning Approach and Contextual Teaching and Learning approach to mathematical community abilities and self-efficacy as well as early mathematical abilities (high, medium, low). The data obtained were analyzed by descriptive and inferential statistics, while the observation of learning activities.

Analysis Prerequisite Test Phase

The analysis prerequisite test stage is a follow-up in processing the data that has been obtained in the field research. The analysis prerequisite test stage in this study is described as follows:

Data Normality Test

Before the data was analyzed, the normality of the data was tested as a requirement for qualitative analysis. Tests were carried out to see whether the data from the mathematical communication skills were normally distributed in the Open-ended Learning Approach and Contextual Teaching and Learning model groups. To test the normality of the students' initial and final test scores in each group, the Kolmogorov-Smirnov test was used with the help of the SPSS 17.00 program and the Liliefors normality test.

Homogeneity Test

The results of the homogeneity test, the results of the mathematical communication ability test of students in both classes were analyzed using the Levene test with the help of the SPSS 17.00 program. Homogeneity test of variance between experimental group 1 and experimental group 2, was intended to determine the state of the variance of the two groups, the same or different.

Research Hypothesis Testing Stage

The hypothesis test used is a two-way analysis of variance. Analysis of variance is an inferential technique used to test differences in mean values. The analysis of variance aims to compare the mean of several populations or if it is associated with an experimental design, the analysis of variance aims to test the significance of the different effects of treatments on the dependent variable (Syahputra, 2016). Analysis of variance is also a univariate that can be used to determine the effect and interaction of two factors with one dependent variable of type or ratio and several independent variables of nominal or ordinal type. ANOVA is also used to determine the existence of an interaction, which is a two-way ANOVA (Kadir, 2015).

Data Collection Instruments and Techniques

In this study, several techniques were used to collect data obtained after the research was conducted. The data collection technique is related to the instruments used to support the implementation of the research properly and smoothly.

The instrument used in this study consisted of two types of instruments, namely the type of test and non-test. The test type instrument is used as an instrument to measure students' mathematical communication skills while the non-test type instrument is in the form of a questionnaire to measure Self-Efficacy.

Mathematical Communication Ability Test

The mathematical communication ability test that will be given is in the form of contextual questions that are directly related to the material being experimented with, this serves to reveal students' mathematical communication skills. The test that has been given is in the form of a description and consists of 5 questions, the description test was chosen because it was to see how the process of completing student answers in solving math problems.

Mathematical Self-Efficacy Scale

The self-efficacy instrument was developed from the self-efficacy theory from Bandura. This instrument consists of three dimensions, namely the dimensions of level, generality, and strength. This dimension is reduced to indicators/factors which consist of eight indicators/factors with details of three factors on the level dimension, two factors on the strength dimension and three factors on the generality dimension.

RESULT

Differences in the Open-Ended learning approach using a Contextual Teaching and Learning on mathematical communication skills

The formulated hypothesis testing was analyzed using two-way analysis of variance using F statistics with a predetermined formula. The results of the calculation of the analysis of hypothesis testing with the help of SPSS can be seen in Table 1. below.

Table 1. The results of the Two Paths Anava Test of Mathematical Communication Ability

Tests of Between-Subjects Effects

Dependent Variable:Komunikasi

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	2382.582[a]	5	476.516	88.059	.000
Intercept	202452.782	1	202452.782	3.741E4	.000
Model * KAM	25.775	2	12.887	2.382	.101
Model	200.160	1	200.160	36.989	.000
KAM	1928.342	2	964.171	178.177	.000
Error	313.856	58	5.411		
Total	322204.000	64			
Corrected Total	2696.438	63			

a. R Squared = .884 (Adjusted R Squared = .874)

Based on Table 1, it can be seen that the learning model is significant = 0.000 <0.05 or H0 is rejected. This means that there are differences in students' mathematical abilities who are taught by using an Open-Ended learning approach using a contextual teaching and learning approach. For KAM with a significance of 0.000 <0.05, then H0 is rejected. This means that there are differences in students' mathematical communication skills between those with high, medium and low initial abilities.

Differences in the Open-Ended learning model using Contextual Teaching and Learning on mathematics self-efficacy

The formulated hypothesis testing was analyzed using two-way analysis of variance using F statistics with a predetermined formula. The results of the calculation of the analysis of hypothesis testing with the help of SPSS can be seen in Table 2. below.

Table 2. Results of the Two-way ANOVA Self-Efficacy Questionnaire

Tests of Between-Subjects Effects

Dependent Variable: Self-Efficacy

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	3497.088[a]	5	699.418	50.921	.000
Intercept	291274.048	1	291274.048	21206.273	.000
KAM	3432.455	2	1716.227	124.950	.000
Model	20.589	1	20.589	1.499	.036
KAM * Model	.663	2	.332	.024	.976
Error	796.646	58	13.735		
Total	385137.000	64			
Corrected Total	4293.734	63			

a. R Squared = .814 (Adjusted R Squared = .798)

Based on Table 4.16, it can be seen that the significance of the learning model = 0.036 <0.05 or H0 is rejected. This means that there are differences in the mathematics self-efficacy of students who are taught with the Open-Ended learning model using a contextual teaching and learning approach to mathematics self-efficacy. For KAM with a significance of 0.000 < 0.05, then H0 is rejected. This means that there are differences in students' mathematical self-efficacy between those with high, medium and low initial abilities.

DISCUSSION

Differences in the Open-Ended Learning Model using a contextual learning approach (Contextual Teaching and Learning) on mathematics self-efficacy on students' mathematical communication skills

Based on the results of data analysis, the average posttest score for the OE class was 68.0, while in the CTL class the average posttest score was 73.0. This shows that students' mathematical communication skills in the CTL class are better than the OE class. This is because in CTL learning, teachers provide more opportunities for students to think, seek information from both books and the internet and find themselves a Mathematical Communication. Then this might happen because CTL learning has several advantages over OE learning.

Based on the results of statistical analysis using two-way ANOVA, it can be concluded that there are differences in mathematical communication skills between students who are taught with open-ended learning using a contextual teaching and learning approach. This shows that CTL learning has a greater influence in developing communication skills. This effect, according to the researcher, is due to differences in the Open-Ended learning process using a contextual teaching and learning approach. In Open-Ended learning, students are seen to be more active in solving problems given by the teacher. The problems given are contextual problems related to everyday life, where students solve problems and find mathematical concepts related to the material being studied.

The formation of student discussion groups based on heterogeneous initial mathematical abilities allows students to share information and solve problems well. The teacher's role as a mediator in learning and the questions in the LAS as a stimulus help students to find out the relationship between the stages in solving problems.

At the beginning of learning the first meeting in the Open Ended class, students took a long time to follow the mathematical stages contained in the LAS. This is because students are not used to solving problems with the mathematical stages contained in the LAS, but students continue to experience better progress in their thinking processes individually and in groups. Through the stages in the LAS students understand mathematical problems by only looking for conceptual linkages which from the problems presented at first are still difficult for students because students are not accustomed to linking mathematical concepts.

The cooperative learning model is in line with the underlying learning theories such as constructivism theory. Basically the constructivism theory approach requires students to find and transform information by themselves, checking new information with old rules. So that students can build their own knowledge in their minds. According to Trianto (2009) cooperative learning takes shelter in constructivism. This learning arises from the concept that students are easier to understand and find if between students discuss with each other.

Based on the results of the research described previously, it can be seen that the cooperative learning model has a positive influence on students' mathematical communication skills. Cooperative learning also has a positive influence on students' self-efficacy attitudes. This strengthens the results of previous studies which also used cooperative learning models to improve mathematical abilities. Among them, the results of Fajri's research (2013) in his research revealed that the mathematical connection abilities of students who received contextual teaching and learning were better than students who received conventional learning.

Luvy (2013) in his research stated that students' mathematical communication skills using virtual manipulative-assisted CTL learning were better than students who received CTL learning without using virtual manipulatives. Ratnasari (2018) concludes that the Contextual Teaching and Learning (CTL) approach is effective in terms of students' mathematical communication skills.

This study shows that the communication skills of students who are taught with a contextual learning approach (Contextual Teaching and Learning) are better than students who are taught using the Open-Ended model.

Interaction between Learning Models and Early Mathematical Ability (KAM) on students' communication skills

Interaction is the cooperation of two independent variables or also more in giving effect to the dependent variable. In this case, what is being researched is the collaboration between the learning model with early mathematical ability (KAM) on the ability of mathematical Mathematical Communication.

Based on the results of statistical analysis with two-way ANOVA, the significant value of the interaction of early mathematical abilities and the model is 0.101, where the significant value is greater than 0.05 so that H0 is accepted. This means that there is no significant interaction between the learning model and the initial mathematical ability of students' mathematical communication skills. In accordance with the opinion of Kerlinger (1986) that "interaction occurs when an independent variable has different effects on a dependent variable at various levels from another independent variable".

Differences in the Open-Ended Learning Model using a contextual learning approach (Contextual Teaching and Learning) on Students' Mathematics Self-Efficacy

Self-efficacy is students' self-confidence in the ability to represent and solve mathematical problems, how to learn/work understanding concepts and complete assignments, and the ability to communicate mathematics with

peers and students during learning Is it done with confidence, curiosity to find alternatives, diligent, and challenged and the tendency of students to reflect on their way of thinking. Self-efficacy that is formed will affect the mindset and emotional reactions and provide a function on individual activities.

Learning the CTL model is something new for students, where learning groups students into several groups so that it becomes very fun for students, students are given the opportunity to express ideas and ideas independently, and students are given the opportunity and are encouraged to present their work to all students. . Learning with the CTL model makes the classroom situation more active for all students. This small group learning will make students build their curiosity about mathematics, so that students' self-efficacy will be better.

Interaction Between Learning Model and Early Mathematics Ability on Students' Mathematics Self-Efficacy

Based on the results of the descriptive analysis of student self-efficacy, it was found that students with high initial mathematical abilities in experimental class 2 obtained an average score of 91 and students with moderate KAM obtained an average score of 77, and students with low initial mathematical abilities obtained an average score of 91. an average of 68. This shows that the self-efficacy of students with high initial mathematical abilities is higher than students who have moderate and low initial mathematical abilities for the experimental class. Furthermore, students with high initial mathematical ability in experimental class 1 obtained an average score of 89, students and students with moderate initial mathematical ability obtained an average score of 75, and students with low initial mathematical ability obtained an average score of 67. This shows that the self-efficacy of students with high initial mathematical abilities is higher than students who have moderate and low initial mathematical abilities for the experimental class l.

Based on the results of inferential statistical analysis using the two-way ANOVA test on the KAM * Model line, the sig. 0.976 > 0.05, it can be concluded that there is no interaction between the learning model (Open-Ended learning using a contextual teaching and learning approach) and the initial mathematical ability of students' self-efficacy. That is, there is no effect given by the learning model and initial mathematical ability simultaneously on students' self-efficacy.

CONCLUSION

There is a difference in mathematical communication ability between students who are given Open Ended learning and students who are given Contextual Teaching and Learning.

There is no interaction between the learning model and the initial ability of mathematics on students' mathematical communication skills. Based on the results of the analysis of the two-way ANOVA test, the value of sig> 0.05 (0.101>0.05) was obtained so that H0 was accepted. This means that there is no joint influence contributed by the learning model and students' KAM on students' mathematical communication skills.

There is a difference in Self Efficacy between students who are given Open Ended learning and students who are given Contextual Teaching and Learning.

There is no interaction between the learning model and early math skills on Self Efficacy. Based on the results of the analysis of the two-way ANOVA test, the value of sig> 0.05 (0.976> 0.05) was obtained so that H0 was accepted. This means that there is no joint influence contributed by the learning model and students' KAM on Self Efficacy.

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