The Differences in Communication Ability and Mathematical Disposition of Students who are given a Geogebra- Assisted Contextual Learning Model and the Cooperatif Learning Model

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Abstract

This study aims to: (1) analyze the differences in mathematical dispositions between students who are given a contextual learning model assisted by Geogebra and students who are given a model of cooperatif learning assisted by Geogebra at SMK Harapan Mekar 1 Medan, (2) analyze the interaction between learning and early mathematics ability (high, moderate, low) students towards improving students' mathematical communication skills at SMK Harapan Mekar 1 Medan, (3) analyzing the interaction between learning and the initial mathematics ability (high, medium, low) of students towards improving the mathematical disposition of students at SMK Harapan Mekar 1 Medan. The population of this study were all students of SMK Harapan Mekar 1 Medan in class X majoring in Automotive Mechanics and Computer Engineering. Samples were taken randomly from 6 classes, Students were selected as a sample of 2 classes, namely class X-2 as the experimental class I which was given the contextual learning model assisted by Geogebra and class X-3 as the experimental class 2 which was given the cooperative learning model assisted by Geogebra, with a total of 64 students. Data were analyzed using descriptive statistical analysis through two-way analysis. The results of this study indicate that: (1) There are differences in mathematical communication skills between students who are given a contextual learning model assisted by Geogebra and students who are given a cooperative learning model, (2) there are differences in mathematical disposition between students who are given a contextual learning model assisted by Geogebra and students who given a cooperative learning by Geogebra.

I. Introduction

In the world of education, mathematics plays an important role, because by learning mathematics students are expected to be able to think logically, analytically, systematically, critically and creatively. And also in learning mathematics, mathematical communication skills and students' positive attitudes towards mathematics are needed. Mathematical communication skills need to be the focus of attention in mathematics learning, because through communication, students can organize and consolidate their mathematical thinking and students can explore mathematical ideas.

Baroody (Ansari 2016) stated that there are at least two important reasons why communication in mathematics needs to be developed among students. First, mathematics as language, meaning that mathematics is not only a tool to aid thinking, a tool for finding patterns, solving problems or drawing conclusions, but mathematics is also a valuable tool

for communicating various ideas in a clear, precise and careful. Second, mathematics learning as social activity, which means as a social activity in learning mathematics, mathematics is also a vehicle for interaction between students, as well as communication between teachers and students. This can accelerate and improve students' mathematical understanding,

In fact, students' mathematical communication skills are still not satisfactory. This can be seen from the low mathematical communication skills shown in the research of Tiffany, Surya E, Panjaitan A, Syahputra E. (2017) that "the mathematical communication skills of class IX-1 students of SMP Negeri 3 Bilah Hulu Labuhan Batu are still low, because 13.33% Class IX-1 students who are able to explain mathematical ideas in writing with pictures, diagrams, tables or algebra and for the category of students able to express daily language events or mathematical symbols as much as 26.76% ".

Irhamna (2020) argues that mathematics is a universal science. Mathematical communication can be grown in various ways, including through group discussions. Brenner (Hasratuddin, 2015) states that the formation of small groups makes it easier to develop mathematical communication skills. This is also in line with NCTM (Bonsu, 2016) which says that mathematical communication skills can occur when students learn in groups, when students explain an algorithm to solve an equation, when students present unique ways to solve problems, when students construct and explain an graphical representations of real-world phenomena, or when students give conjectures about geometric drawings. In addition to abilities related to mathematical communication skills, it is also necessary to develop students' mathematical disposition abilities, namely an attitude of appreciating the usefulness of mathematics in life, namely having curiosity, attention, and interest in studying mathematics, as well as being resilient and confident in solving problems. The importance of developing mathematical dispositions was also expressed by Mahmudi (Safridla, 2012) who said that "students need a mathematical disposition to survive problems, take responsibility for learning, and develop good work habits in mathematics".

Mathematical disposition is part of the soft-skills of mathematics and basic competences of social mathematics attitudes that need the attention of the teacher in carrying out the learning. "Students' mathematical disposition develops when they learn aspects of mathematical competence" (Karlimah, 2010: 4). Mathematical disposition in mathematics learning. But in reality, several studies have shown that students' mathematical dispositions are still low. The results of Yuanari's (2011) study revealed that "100% of the total number of students got a mathematical disposition questionnaire score under the good category". In line with that, the results of research by Kesumawati (2010) show that "the average score of 297 students' mathematical disposition at four junior high schools in Palembang city has only reached 58 percent, which is classified in the low category". In addition, seen from the learning process used by the teacher, the teacher still dominantly uses ordinary learning. In this learning, the teacher is seen as a source of knowledge and students only need to receive this knowledge without having to be maximally involved in the learning process in the classroom. The learning used by teachers in schools is generally teacher-centered learning. To overcome these problems, it is necessary to apply cooperative learning models and contextual learning models, which are concepts that help teachers connect the material they teach with social situations, the real world and encourage students to make connections between their knowledge and its application in their lives as members.

Cooperative learning is a student learning activity carried out in groups. Abdulhak (in Rusman: 2012: 203) that "cooperative learning is carried out through sharing the process between the learning participants themselves". In this learning, a broader interaction is created, namely the interaction and communication between teachers and students, students and students and students and teachers (multi way traffic communication).

Furthermore, the contextual learning model (Contextual) is a learning process that builds existing knowledge based on the context that students have, not something that is absolutely accepted by students from the teacher by memorizing, but students construct their own knowledge so that learning is more meaningful.

The contextual learning model is also a learning concept that helps teachers link the material being taught to students' real situations and encourages students to make connections between their knowledge and application in their own lives. According to Nurhadi (Muchlish, 2007) states that: The characteristics of contextual learning are: cooperation, mutual support is fun, not boring, learning with passion, integrated learning, using various sources, active students, sharing with friends, critical and creative students. Furthermore, through this contextual learning it is hoped that it can foster interest, self-confidence and student motivation, so that it is hoped that an increase in student learning outcomes will be higher, and students will continue to feel the benefits.

To support mathematics learning, a learning medium is needed. A computer program aided media that can be used in so many and varied ways one of the computer programs or software is Geogebra. GeoGebra is used as a tool in making learning media that presents mathematical material that is abstract into concrete because it provides features that support and are very suitable for conveying mathematical concepts. In addition, with the help of GeoGebra, it can provide opportunities for students to make discoveries by manipulating these props so that they can build student knowledge and encourage students to understand mathematical concepts.

II. Review of Literatures

2.1 Communication Skills

Communication in general can be defined as an event to convey messages to each other that take place in a community and cultural context. According to Abdulhak (Ansari, 2016) states that "communication is interpreted as the process of delivering messages from message senders to message recipients through certain channels for certain purposes". A similar opinion was expressed by Theodore (El Khuloqo, 2015) saying that "communication is a process in which it shows the meaning of knowledge being transferred from one person to another, usually with the intention of achieving a specific goal". Communication is said to be effective if the communication that occurs creates a two-way flow of information, namely by the emergence of feedback from the recipient of the message. Indicators that show mathematical communication skills in this study are:

Expressing, demonstrating and describing mathematical ideas in the form of pictures, tables, graphs or other mathematical models; Convey a situation, picture, diagram, or real object into language, symbols, ideas, or mathematical models; Analyze, evaluate and ask questions about the information provided.

2.2 Mathematical Disposition

Students 'mathematical abilities cannot be separated from students' attitudes towards mathematics. Students with weak abilities tend to be negative towards mathematics, on the other hand students who have good mathematical abilities tend to be positive towards mathematics. In line with this, Karlimah (2010) also states that learning mathematics does not only develop the cognitive realm. When students try to solve mathematical problems, they need to be curious, resilient, and confident, to reflect on how they think. Mathematical disposition is one of the factors considered to determine student learning success. Students need dispositions to make them persistent in facing more challenging problems. To take responsibility for their own study and to develop good math habits. The indicators that show the mathematical disposition in this study are:

Self-confidence, with indicators of confidence in abilities / beliefs; Curiosity which includes: frequently asking questions, enthusiasm / enthusiasm for learning and reading a lot / looking for other sources; Persistence, with indicators of persistence / persistence / attention / seriousness; Flexibility which includes: cooperation / sharing of knowledge, respecting different opinions and trying to find other strategies. Reflective, namely the tendency to monitor work results; Application, namely assessing the usefulness of mathematics in everyday life; Appreciation, namely the appreciation of the role of mathematics in culture and its value, both mathematics as a tool and mathematics as a language.

2.3 Contextual Learning

Jonshon (2002) states that contextual learning is a learning process that aims to help students understand the subject matter given, by making connections between academic material and contexts in real life. Where the context in question is related to their own personal, social and environmental lives. Contextual learning objectives emphasize the creation of understanding, which requires creative and productive activities in the context so that it is not only a theory behind it.

2.4 Cooperative Learning Model

According to Reinhartz and Beach (in Rasyidin, 2011: 153), cooperative learning is a strategy in which students work in groups or teams to learn concepts or material. Hansen and Eller (in Rasyidin, 2011: 153) define cooperative learning as cooperation carried out by students to achieve common goals. This common goal is manifested in the form of giving awards to groups. The existence of awards for these groups, encourages each group member to help each other to master the material and achieve common goals (Clarizo, Craig, Mehrens, in Rasyidin 2011: 153).

2.5 Geogebra Software

The use of software in mathematics learning can help electronic manipulation of numbers, as geometric tools for constructing shapes and shapes, as dynamic geometry tools, as a tool for data propability and analysis and function graphing. Setiawati (2014: 348) states "with the help of software, some mathematical concepts such as the volume of rotating objects, the concept of limits, and geometry can easily be explained and mathematical proofs are presented more attractively". Geogebra software can be used to construct using points, vectors, segments, lines, conic sections and dynamically changeable functions. According to Hohenwarter and Fuchs (2004) "Geogebra is a multipurpose software for learning mathematics in secondary schools"

III. Research Methods

This research is a quasi-experimental research which aims to see the differences in communication skills and mathematical dispositions of students who are given a contextual learning model assisted by Geogebra and students who are given a cooperative learning model. The population of this study was all students of SMK Harapan Mekar 1 Medan in class X majoring in Automotive Mechanics and Computer Engineering. Samples were taken randomly from 6 classes, students were selected as a sample of 2 classes, namely class X-2 as the experimental class I which was given the contextual learning model assisted by Geogebra and class X-3 as the experimental class 2 which was given the cooperative learning model assisted by Geogebra, with the number of students as many as 64 students. Data were analyzed using descriptive statistical analysis through two-way analysis.

IV. Results and Discussion

4.1 Results

The students' initial mathematical ability was measured through the data that had been collected based on the diagnostic tests that had been given to the two experimental classes. The summary results of the mean and standard deviation of KAM are as shown in the following table:

Table 1. Description of Student KAM Score

Kelas	Ideal score	N	x_{min}	x_{maks}	$\overline{X}$	SD
Experiment class I	100	32	20	100	62,50	21,997
Experiment class II		32	20	90	60,938	19,569
Average	100	64	20	95	61,719	21,001

Table 2. The Results of the Sample Distribution Summary

KAM category	statistic	Kelas	
		Experiment I	Experiment II
High	N	7	3
	average	91,429	90
	Standard deviation	5,774	0
Middle	N	21	23
	average	59,524	65,217
	Standard deviation	13,956	11,229
Low	N	4	6
	average	27,500	30
	Standard deviation	5	8,994

To find out the similarity of the mean of the two experimental classes was carried out by performing a similarity test with the t-test. However, beforehand the analysis test was carried out which included the normality test and the homogeneity test. After testing,

it was found that the data for the experimental group I and experiment II had data that were normally distributed and the two data groups for the experimental class I and the experimental class II had homogeneous data variance.

After the learning model was applied to each experimental class, a communication ability post test was given to determine the extent to which students' ability to solve mathematical problems after being given learning. The results of the post test for the two classes are described in Table:

Table 3. The Description of Communication Ability Post Test

Kelas	Nilai Ideal	N	Xmin	Xmaks	$\overline{x}$	SD
Eksperimen I	100	32	60	92	75,59	9,21
Eksperimen II		32	50	80	65,06	8,37

Based on the table, it can be seen that the minimum post-test score of students' communication skills in the experimental class I is 60, and it is higher than the students in the experimental class II whose minimum score is 50. For the maximum value of communication skills in the experimental class I is 92 and higher than the experimental class II. the maximum value is 80. Likewise, the post-test mean of communication skills for the experimental class I was 75.59 higher than the students in the experimental class II with the mean of 65.06. The post-test standard deviation of students' communication skills for the experimental class I was 9.21 higher than the students in the experimental class II whose standard deviation was 8.37.

To find out how much the students 'mathematical disposition after being treated with the application of the learning model can be seen in the table as follows: Table 4

Table 4. The Description of Mathematical Disposition After being Treated

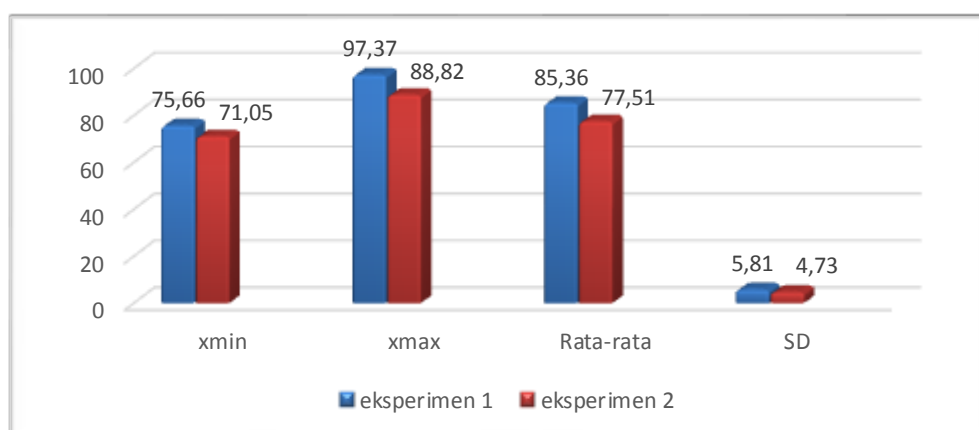| Class	Ideal Score	N	x_{min}	x_{max}	$\overline{X}$	SD
Experiment I	100	32	75,66	97,37	85,36	5,81
Experiment II			71,05	88,82	77,51	4,73

Figure 1. *The Description of Mathematical Disposition After being* Treated

Based on the table above, it can be seen that the minimum score for the mathematical disposition of the experimental class I students is 69, higher than the experimental class II

which has a minimum score of 46.The maximum score of the students' mathematical disposition in the experimental class I is 93, higher than the experimental class II with the maximum score of 85. The average score of students' mathematical disposition in experimental class I was 81.16; higher than the experimental class II with a maximum score of 68.25. And the standard deviation for the experimental class I was 8.16; lower than the experimental class II of 9.73.

Hypothesis testing was statistically carried out using two-way ANOVA. Hypothesis testing with two-way ANOVA is carried out after the fulfillment of the data requirements that are normally distributed and the variance of the homogeneous data group.

The results of the first and third hypothesis testing with the two-way ANOVA test using the SPSS program are described in the following:

Tabel 5. Hipotesis Test 1 and 3 with the Two-way ANOVA

Tests of Between-Subjects Effects					
Dependent Variable: HASIL_BELAJAR					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3380.126[a]	5	676.025	12.253	.000
Intercept	278475.705	1	278475.705	5047.399	.000
MODEL	2004.479	1	2004.479	36.331	.000
KAM	506.366	2	253.183	4.589	.014
MODEL * KAM	1099.245	2	549.622	9.962	.000
Error	3199.983	58	55.172		
Total	323127.000	64			
Corrected Total	6580.109	63			
a. R Squared = .514 (Adjusted R Squared = .472)					

Based on the table above, it can be seen that the significance value for the model is 0.000 (sig. <0.05), which means that there is a significant difference between the average communication skills in the class. Geogebra-assisted contextual learning model with Geogebra-assisted cooperative learning model, and thus Ho rejects and accepts Ha. This shows that there are differences in the communication skills learned through the Geogebra-assisted contextual learning model and the Geogebra-assisted cooperative learning model.

Based on the results of descriptive data analysis after being given treatment, the mathematical disposition of students with the Geographic assisted contextual learning model was higher than students who studied with the cooperative learning model. This is indicated by the average post test score in the experimental class I is 85.36 while in the experimental class II it is 77.51.

Based on the explanation above, the mathematical disposition of students who learn through the Geogebra-assisted contextual learning model is higher than students who learn through the Geogebra-assisted cooperative learning model. These results were analyzed using Two-Way ANOVA and it can be concluded that there are differences in the mathematical disposition of students through the Geogebra-assisted contextual learning model with the Geogebra-assisted cooperative learning model.

The learning model is one of the factors that affect students' communication skills and mathematical dispositions. Each stage of the learning model has a contribution to the communication skills and mathematical disposition of students. Thus, each stage in the contextual learning model assisted by Geogebra is applied in learning in experimental class I, and each stage in the cooperative learning model is applied in learning in experimental class II in the hope of obtaining optimal results.

Geogebra assisted contextual learning activities emphasize direct learning experiences through investigative activities, discover concepts and then apply the concepts that have been obtained in everyday life. Whereas learning activities oriented to process skills emphasize direct learning experiences, active student involvement in learning activities, and the application of concepts in everyday life. Students are encouraged to think critically, analyze themselves, so that they can find general concepts or principles based on materials or data that the teacher has provided.

Based on the results of descriptive data analysis after being given treatment, it was found that the communication skills of students who studied with the Geogebra-assisted contextual learning model were higher than those who studied with the Geogebra-assisted cooperative learning model. This is indicated by the average post test score for the experimental class I, namely 75.59; while in the experimental class II it was 65.06.

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The research, which was conducted at SMK Harapan Mekar I Medan, involved two classes, namely the experimental class I in class XI-2 and the experimental class II in class XI-3. It is known that before the research was carried out in the two classes, the first step the researcher took was to try out the students' mathematical disposition ability test instruments. After the test trial was carried out, the next stage was given different treatment in the experimental class I and the experimental class II, then the two classes were given a posttest to determine the mathematical disposition ability of the students after being treated. The posttest consists of 38 items containing aspects and indicators of mathematical disposition, starting with self-confidence, curiosity, persistence, reflective flexibility, application, and appreciation.

Based on the results of descriptive data analysis after being given treatment, the mathematical disposition of students with the Geographic assisted contextual learning model was higher than students who studied with the cooperative learning model. This is indicated by the average post test score in the experimental class I is 85.36 while in the experimental class II it is 77.51.

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4.2 Discussion

The learning model is one of the factors that affect students' communication skills and mathematical dispositions. Each stage of the learning model has a contribution to the communication skills and mathematical disposition of students. Thus, each stage in the contextual learning model assisted by Geogebra is applied in learning in experimental class I, and each stage in the cooperative learning model is applied in learning in experimental class II in the hope of obtaining optimal results. Geogebra assisted contextual learning activities emphasize direct learning experiences through investigative activities, discover concepts and then apply the concepts that have been obtained in everyday life. Whereas learning activities oriented to process skills emphasize direct learning experiences, active student involvement in learning activities, and the application of concepts in everyday life. Students are encouraged to think critically, analyze themselves, so that they can find general concepts or principles based on materials or data that the teacher has provided.

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