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Mathematical Communication of 7th Grade Students Viewed from the Attitude of Curiosity in Guided Discovery Learning Assisted by Educational Props

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Abstract

The purpose of this study are (1) to find out the mastery learning achievement of students mathematical communication ability in *Guided Discovery* learning assisted by educational props, (2) know the improvement of mathematical communication ability in *Guided Discovery* learning assisted by educational props (3) describe students mathematical communication ability for each category curiousity in *Guided Discovery* learning assisted by educational props. This research method is *mixed methods* with *sequential explanatory design*. The population in this study were all students of class VII SMP N 33 Semarang in 2019/2020, sampling was done by *random sampling* selected to be a sample is class VII-F. The research subjects were taken by using *purposive sampling* technique. The research subjects consisted of 9 students. Subjects were interviewed based on mathematical communication ability test results. The results showed that (1) students mathematical communication ability in *Guided Discovery* learning assisted by educational props reached mastery learning, with an average grade reaching 80 and classical completeness exceeding 75%, (2) there was an increase in students' mathematical communication ability in *Guided Discovery* learning assisted by educational props. Improved mathematical communication ability are medium. (3) Subjects with high curiosity have 4 indicators of mathematical communication ability, subjects with curiosity have 3 indicators of mathematical communication ability, subjects with low curiosity are only have 2 indicators of mathematical communication ability.

1. Introduction

Mathematical communication ability are important abilities in learning mathematics. This is based on the results of research Kostos and Shin (2010) which explains that students who have more mathematical communication ability will have greater understanding of mathematics. Permata et al (2015) also state that mathematical communication ability are very important for Indonesian students. Meanwhile, according to Baroody in Asikin & Junaedi (2013: 204) namely (i) mathematics is a means of communicating various ideas clearly, precisely and concisely, and (ii) learning mathematics as a social activity in which interaction occurs between students and teacher communication of students. According to Putri et al (2017) mathematical communication ability are the ability of someone in communicating mathematical ideas or ideas with symbols, tables, diagrams, or other media to clarify a situation or problem and discuss it with others.

According to Permendikbud No. 20 of 2018 concerning Strengthening Character Education, stated that curiosity is one of the attitudes in strengthening character education. The attitude of curiosity is expected to be owned by students in learning mathematics. With the attitude of curiosity, students will be more motivated and prefer to learn mathematics, so that in the end it is expected that the mathematics

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learning achievement achieved is also more optimal. Curiosity needs to be developed because with curiosity students become enthusiastic thinking in learning mathematics.

Mathematical communication ability and students' attitude of curiosity are two things that must be possessed by students in learning mathematics. It is expected that mathematical communication ability and high student curiosity are directly proportional to student achievement in learning mathematics too. Based on the results of teaching experience in SMP N 33 Semarang and analysis of student work in solving mathematical problems in number material, information is obtained that the mathematical communication ability of 7th Grade students of SMP Negeri 33 Semarang are not optimal.

Anintya et al. (2017) communication ability in terms of learning styles show that students with visual and auditory learning styles reach level 4 while students with kinesthetic learning styles achieve 3. Achievement of these different mathematical communication ability needs to be further studied to find out the mathematical communication ability of each student in terms of the attitude of curiosity. One learning model that emphasizes active involvement of students is discovery lerning. In studies related to discovery-based instruction studies, the effect of discovery learning without guidance is very small (few), while discovery learning with guidance can increase student activity in knowledge construction to be optimal according to Alfieri in Isnarto (2014). *Guided Discovery* is a learning model that involves students learning actively and independently in finding concepts or theories, understanding, and problem solving (Supliyadi, 2017). *Guided Discovery* is one of the learning models that can encourage and improve students' mathematical communication ability. Learning needs to be done that gives students the opportunity to develop their mathematical communication ability.

In addition to the learning model used to achieve maximum results in learning according to Sugiarto in Fujiati & Mastur (2014) the process of learning mathematics should students be given the opportunity to manipulate concrete objects or educational props that are specifically designed and specific and can be manipulated by students in understanding a concept mathematics. Abstract things in mathematics can be presented easily and more easily understood and understood by students with the help of these educational props. In addition, according to Rochmad in Priambodo (2014) also states that in learning mathematics, especially in instilling mathematical concepts, using educational props causes children's experience to be broader based on something tangible.

The purpose of this study are (1) to determine the achievement of learning completeness of mathematical communication abilty of 7th Grade students on *Guided Discovery* learning assisted by educational props. (2) find out the improvement in the mathematical communication abilty of 7th Grade students on *Guided Discovery* learning assisted by educational props. (3) describe the mathematical communication abilty of students in class 7 for each category of curiosity in *Guided Discovery* learning assisted by educational props.

2. Method

This research used a combination of research (mixed methods). According to Sugiyono (2016: 404) the combination research method is a research method that combines or combines quantitative methods and qualitative methods to be used together in a research activity, so that more comprehensive, valid, reliable and objective data are obtained.

The research method used is sequential explanatory design. According to Creswell (2016: 299) the mixed sequential explanatory method approach is a combination research method that combines quantitative and qualitative research methods sequentially, where in the first stage the research is carried out by quantitative methods and in the second stage is carried out by qualitative methods. Quantitative results confirm the types of participants to be deliberately chosen for the qualitative phase and the types of questions that will be asked of participants.

The quantitative research design used the One-Group Pretest-Postest Design. In this design there is one group that is given treatment. Before being given treatment, the group was given a pre-test first. Thus the results of the treatment can be known more accurately because it can be compared with the situation before being given treatment (Sugiyono, 2016: 112).

The population in this study were all students of 7th grade students SMP N 33 Semarang 2019/2020 academic year as many as 288 which were divided into nine classes. The sampling technique used was

simple random sampling technique, namely how to take sample members from the population randomly without calculating strata existing in the population and obtained research samples namely class 7F.

Quantitative research is used to find out whether the completeness of learning achievement of mathematical communication ability of 7th grade students of SMP N 33 Semarang on learning assisted learning assisted with educational props and knowing the improvement of mathematical communication ability of students of 7th grade on learning assisted learning assisted with educational props. This quantitative data was obtained through tests of mathematical communication ability, namely pretest and posttest. The indicator of mastery learning in this study is that a class is said to achieve mastery learning if the mathematical communication ability of individual students reach KKM which is 75 and classically a minimum of 75% of the number of students in the class reach the KKM value. Quantitative data analysis in this study used three tests, namely the average achievement test, classical completeness test and normalized gain test. Average achievement test with hypothesis testing $H_0 : \mu \leq 74{,}5$ (average test results of students' mathematical communication ability on learning assisted Guided Learning not yet reached mastery learning) and $H_1 : \mu > 74{,}5$ (average results students' mathematical communication ability test on learning assisted Guided Discovery educational props have reached mastery learning). While the test criteria are H_0 rejected if $t_{count} \geq t_{1-\alpha}$ with $t_{1-\alpha}$ obtained from the Student distribution table t using opportunities $(1-\alpha)$ and $dk = (n-1)$ (Sudjana, 2005: 231). Classical completeness test with testing hypothesis $H_0 : \pi \leq 0{,}745$ (percentage of students' mathematical communication ability in teaching aided assisted learning have not yet achieved classical learning completeness) and $H_1 : \pi > 0{,}745$ (percentage of students' mathematical communication ability in learning assisted learning assisted with educational props not yet achieving classical learning completeness) and $H_1 : \pi > 0{,}745$ (percentage of students' mathematical communication ability in learning assisted learning assisted with educational props achieving has reached classical completeness). While the test criteria used are accept $H_0 \; if \; z > -z_{0.5-\alpha}$ where $z_{0.5-\alpha}$ is obtained from the standard normal list with a chance $(0.5-\alpha)$. If H_0 is accepted, the research class that obtains learning material with the Guided Discovery model assisted by educational props achieves classical learning completeness.

Qualitative research is used to obtain answers to the formulation of the problem in this study, namely how the description of mathematical communication ability of students of 7th grade SMP Negeri 33 Semarang on integer material using Guided Discovery learning props assisted in terms of curiosity. Qualitative data were obtained from interviews with research subjects regarding the results of mathematical communication ability test work.

The research subjects were selected using purposive sampling technique. Purposive sampling is a data source sampling technique with certain considerations (Sugiyono, 2016: 300). The subjects chosen for qualitative research were 9 people from the research class who had previously been given a questionnaire of curiosity. Students are grouped by curiosity categories so that students will get low, medium, and high curiosity categories. Then 3 students were chosen for each category of curiosity. Subject taking criteria are based on the results of the scores of each curiosity group of students who score low, medium and high. After selecting research subjects, interviews were conducted with research subjects aimed at obtaining data directly about students' mathematical communication ability in solving problems on mathematical communication ability test questions.

3. Results & Discussions

3.1. Filling out Curiosity Questionnaire and Determination of Research Subjects

Based on the curiosity questionnaire, students are grouped according to the grouping criteria according to Arikunto (2012: 264) obtained by the student grouping curiosity data presented in Table 1.

Table 1. Grouping Students Judging from Curiosity

Category	The number of students	Percentage (%)
High	4	12,50
Medium	23	71,88
Low	5	15,62

Based on Table 1 it was found that the grouping data of students in terms of curiosity with a total of 32 students against 4 students with a category of high curiosity with the percentage of 12.50% of the total number of students, 23 students with medium curiosity category with a percentage of 71.88% from the number of students, and 5 students in the category of low curiosity with a percentage of 15.62% of the total number of students. Then from the grouping categories of curiosity were taken each of the 3 students as research subjects. So there are 9 students as research subjects namely 3 students with high curiosity, 3 students with medium curiosity, and 3 students with low curiosity. The subjects of the study will be interviewed after doing the student's mathematical communication skills posttest. Based on the category of curiosity selected 9 research subjects which can be seen in Table 2.

Table 2. Research Subjects

Category	Score Curiosity	Code
High	32	E-25
High	32	E-23
High	30	E-09
Medium	29	E-01
Medium	27	E-17
Medium	25	E-10
Low	24	E-13
Low	23	E-22
Low	22	E-02

3.2. Quantitative Data Analysis

After carrying out learning for four meetings and have carried out tests of mathematical communication ability. The test result data is then tested as follows.

(1) Normality Test

Normality test in this study was conducted in a research class based on the acquisition of students' mathematical communication ability test scores to determine whether the distribution of values from the research class came from populations that were normally distributed or not. Following are the results of normality tests of the *pretest* and *posttest* mathematical communication ability.

a. *Pretest* Normality Test

Based on calculations using Microsoft Excel obtained Chi-Square calculation = 6.212 <11.0704, because Chi-Square calculation is smaller than Chi-Square table, H_0 is accepted, meaning that the mathematical communication ability *pretest* comes from a normally distributed population.

b. *Posttest* Normality Test

Based on calculations using Microsoft Excel obtained Chi-Square test = 4,256 <11,0704, because Chi-Square calculation is smaller than Chi-Square table, H_0 is accepted, meaning that the *posttest* of mathematical communication ability comes from a normally distributed population.

(2) Avarage Test

The average posttest value of mathematical communication skills using a predetermined KKM is 75. To find out the average performance of the right-hand t test with $\mu_0 = 74{,}5$. From the calculation using Microsoft Excel, the value of $t_{count} = 2.997291894$ and $t_{1-\alpha} = 1.695$ is obtained. Then $t_{count} \geq t_{1-\alpha}$ so that H_0 is rejected and H_1 is accepted. This means that the average test results of students' mathematical communication ability in *Guided Discovery* learning assisted by educational props have achieved mastery learning.

(3) Classical Completeness Test

Classical completeness test conducted to measure students' mathematical communication skills using Guided Discovery learning models assisted by teaching aids can achieve classical learning completeness in accordance with the specified Minimum Mastery Criteria (KKM). The minimum classical completeness criteria (KKM) is set at 75%. This completeness test uses a proportion test of one party

(right) with $\pi_0 = 0{,}745$. From the results of calculations using Microsoft Excel obtained $z_{count} = 2{,}09$. With a significant level of 5% in the state $z_{tabel} = z_{0.5-\alpha} = z_{0.45} = 1{,}64$. Because $z_{count} = 2.09$ and $z_{table} = 1{,}64$. Obviously $z_{count} > z_{table}$, then H_0 is rejected and accept H_1. This means that the percentage of students' mathematical communication skills in *Guided Discovery* learning assisted by educational props has reached classical completeness.

(4) Normalized Gain Test

Before the normalized gain test, the data was tested using paired observation t test. From the results of calculations using Microsoft Excel, the value of $t_{count} = 9{,}328960462$ and $t_{1-\alpha} = 1{,}695$ was obtained. Then $t_{count} \geq t_{table}$ so that H_0 is rejected and H_1 is accepted. This means that the average *posttest* results of students' mathematical communication ability are more than the average results of the *pretest* mathematical communication ability of Grade 7th students or there is an increase in the mathematical communication ability of 7th grade students.

Having known the average difference, in this study the researchers conducted a normalized gain test according to Hake (1998: 65). From the calculation results obtained $\langle g \rangle = 0{,}59875$. Based on the normalized gain criteria $0{,}59875$ is at an interval of $0{,}3 \leq \langle g \rangle \leq 0{,}7$, which means an increase in students 'mathematical communication ability in *Guided Discovery* learning with educational props that are classified as medium.

3.3. Qualitative Data Analysis

Qualitative data in this study were obtained from the results of the posttest mathematical communication skills and the results of interviews with research subjects. Indicators of mathematical communication ability in this study are (1) the ability to write what information is obtained from a problem, (2) the ability to explain the idea of answers in accordance with the purpose of the problem in writing, (3) the ability to interpret mathematical ideas in writing using symbols, notations, and mathematical equations that are complete, correct, and systematic in solving problems, and (4) the ability to draw conclusions in writing using their own language. Istiani (2015) in his research showed that there was a positive influence of 46.3% curiosity attitude towards students' creative thinking abilities in the 8th grade geometry material.

The results of the *posttest* analysis of mathematical communication ability and interviews obtained a recap of the achievement indicators of all subjects presented in table 3.

Table 3. The Recapitulation Result of Analysis The Mathematical Communication Ability

Subject	Indicator of Mathematical Communication Ability				Category
	1	2	3	4	
T-1	√	√	√	√	High
T-2	√	√	√	√	High
T-3	√	√	√	√	High
S-1	√	-	√	√	Medium
S-2	√	√	√	√	High
S-3	√	-	-	√	Low
R-1	√	-	√	√	Medium
R-2	√	-	-	√	Low
R-3	-	-	√	√	Low

3.4. Mathematical Communication Ability Viewed from the Curiosity Attitude of the High Category

Based on the analysis of mathematical communication ability of students at SMP N 33 Semarang integer material, it was found that students who have a high curiosity attitude tend to be careful in understanding the problem and careful in solving the problem, so that the average of the three subjects curious about the answer tends to correct. At the stage of understanding the question categories of students have a high curiosity to have four indicators of mathematical communication ability studied are (Indicator 1) the ability to write what information is obtained from a problem, (Indicator 2) the ability to explain the idea

of answers in accordance with the purpose of the problem in writing, (Indicator 3) the ability to interpret mathematical ideas in writing using symbols, notations, and mathematical equations completely, correctly, and systematically in solving problems, and (Indicator 4) the ability to draw conclusions in writing using their own language.

Based on the description above it can be said that students in the high curiosity category have a high level of mathematical communication ability. This is evident, when learning students who have high curiosity actively ask the teacher and actively play a role in group discussion activities.

3.5. Mathematical Communication Ability Viewed from the Curiosity Attitude of the Medium Category

Unlike the group of students with high curiosity categories, for groups of students with the category of curiosity they have varied mathematical communication ability. S-1 subjects have medium mathematical communication ability. That is because S-1 tends to rush in understanding the problem, where S-1 is still confused in explaining the idea of the answer. Another case with S-2, S-2 mathematical communication ability included in the high category, S-2 tends to be calm in understanding problems and solving problems, so that the four indicators of mathematical communication ability under study are clearly visible. For S-3 subjects, they have low mathematical communication ability, it is because S-3 tends to be in a hurry and not careful in understanding the problem. S-3 subjects are still confused in explaining the idea of answers so S-3 tends to directly do the calculation and in fact the calculation is still wrong. It can be concluded from the three categories of curiosity students who have indicators of mathematical communication ability that are studied, namely (Indicator 1) the ability to write what information is obtained from a problem, (Indicator 3) the ability to interpret mathematical ideas in writing using symbols, notations, and equations mathematics completely, correctly, and systematically in solving problems, and (Indicator 4) the ability to draw conclusions in writing using their own language. But the category of students' curiosity does not yet have (Indicator 2) the ability to explain the idea of answers according to the purpose of the problem in writing.

Based on the description above it can be said that the student category of curiosity is having a medium level of mathematical communication ability. Students with curiosity tend to be rushed in understanding the problem so that the problem is less optimal in solving problems.

3.6. Mathematical Communication Ability Viewed from the Curiosity Attitude of the Low Category

Based on the results of the analysis of mathematical communication ability in groups of students with a category of low curiosity that students still do not have (Indicator 2) the ability to explain the idea of answers in accordance with the purpose of the problem in writing. The results of the analysis of subject R-1 have medium mathematical communication ability. It can be seen that the subject of R-1 tends to be hasty in understanding the problem, so in explaining the idea of answers often missed. Subjects R-2 have low mathematical communication ability, besides R-2 does not explain the idea of an answer, in doing calculations often R-2 experiences errors. For subjects R-3 has low mathematical communication ability, besides R-3, they are still confused in explaining the idea of answers, as seen in the results of their work, R-3 often does not write complete problem information (indicator 1). It can be concluded from the category of students' low curiosity has an indicator of mathematical communication ability studied, namely (Indicator 1) the ability to write what information is obtained from a problem, and (Indicator 4) the ability to draw conclusions in writing using their own language. But the low curiosity student category does not yet have (Indicator 2) the ability to explain answer ideas according to the purpose of the problem in writing and (Indicator 3) the ability to interpret mathematical ideas in writing using symbols, notations, and mathematical equations completely, correctly, and systematic in solving problems.

Based on the description above it can be said that students in the category of low curiosity have a low level of mathematical communication ability. This is evident, when learning students who have a low passive curiosity attitude in learning and less active in group discussion activities, so that in doing tests students are still confused and in a hurry in solving problems.

Based on the discussion above, it can be said that the attitude of curiosity in mathematics learning can affect the results of students' mathematical communication ability. This is in line with research conducted by Sasmita (2017) stating that the attitude of curiosity towards mathematics learning can affect the results of students' mathematical connection abilities. Students who have a high curiosity attitude can solve

problems well because they actively ask the teacher and actively play a role in group discussions, so that students have better mathematical abilities than other students.

4. Conclusion

Based on the results of research and discussion of mathematical communication ability in terms of the attitude of curiosity in learning Guided Discovery assisted with educational props obtained the following conclusions: (1) Mathematical communication ability of 7th grade students of SMP N 33 Semarang on *Guided Discovery* learning assisted by educational props achieve mastery learning, (2) there is an increase in mathematical communication ability of 7th grade students of SMP N 33 Semarang on *Guided Discovery* learning assisted by educational props, (3) description of mathematical communication ability 7th grade students in terms of curiosity in *Guided Discovery* learning assisted by educational props with (Indicator 1) the ability to write what information is obtained from a problem, (Indicator 2) the ability to explain the idea of answers in accordance with the purpose of the problem in writing, (Indicator 3) the ability to interpret mathematical ideas in writing using symbols, notations, and mathematical equations completely, correctly, and systematically in solving problems, and (Indicator 4) the ability to draw conclusions in writing using their own language.

(a) Students in the category of high curiosity tend to be more thorough and in understanding questions and careful in solving problems, and solving problems in a coherent and correct manner. Therefore, it can be said that students in the high curiosity category have a high level of mathematical communication ability.

(b) Students in the category of medium curiosity tend to be rushed in solving problems, so the answers tend to be correct but not yet complete according to the assessment guidelines. Students in this category have indicators of mathematical communication ability, namely (indicator 1), (indicator 3) and (indicator 4). Curiosity category students do not yet have (Indicator 2), namely the ability to explain the idea of an answer in accordance with the purpose of the problem in writing. Therefore, it can be said that the student category of curiosity is having a medium level of mathematical communication ability.

(c) Students in the category of low curiosity tend to be hasty and inaccurate in solving problems, so the answers tend to be wrong. Students in this category have indicators of mathematical communication ability, namely (Indicator 1), and (Indicator 4). Curiosity category students do not yet have (Indicator 2) and (Indicator 3), namely the ability to explain the idea of answers in accordance with the purpose of the problem in writing and interpret mathematical ideas. Therefore, it can be said that students in the category of low curiosity have low level of mathematical communication ability.

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