IMPROVEMENT OF STUDENTS’ REASONING ABILITY SKILLS BY APPLYING GROUP INVESTIGATION MODEL

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by:
ERNA ERAWATI
A 410 112 005

DEPARTMENT OF MATHEMATICS EDUCATION
FACULTY OF TEACHER TRAINING AND EDUCATION
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PENINGKATAN KEMAMPUAN PENALARAN MATEMATIKA SISWA MELALUI MODEL PEMBELAJARAN GROUP INVESTIGATION (GI)
(PTK Pembelajaran Matematika Kelas XI Tata Busana (TB) di SMK Muhammadiyah Kartasura Tahun Ajaran 2014/2015)

Diajukan Oleh:
ERNA ERAWATI
A 410 112 005

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Pembimbing I,
Rita P. Khotimah, S.Si, M.Sc
NIK 926

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Sri Rejeki, M.Pd, M.Sc
NIK 1351
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NIK 926

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Sri Rejeki, M.Pd,M.Sc
NIK 1351
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Program Studi : Pendidikan Matematika

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A 410 112 005
IMPROVEMENT OF STUDENTS’ REASONING ABILITY SKILLS BY APPLYING GROUP INVESTIGATION MODEL

By
Erna Erawati¹, Rita P. Khotimah², Sri Rejeki³

¹Student of Mathematics Department of UMS, luckytaeeerna@yahoo.co.id
²Lecturer Staff of Mathematics Department of UMS, rpramujivanti@ums.ac.id
³Lecturer Staff of Mathematics Department of UMS, sri.rejeki@ums.ac.id

Department of Mathematics Education

ABSTRACT

The purpose of this research is to describe the improvement of students’ reasoning ability skills by applying Group Investigation Model. This research is a Classroom Action Research (CAR). The subject that receive the action is grade XI TB of Muhammadiyah Vocational High School of Kartasura. The number of students of grade XI TB are 10 students. The data collection techniques are observation, field notes, test and documentation. The technique of data analysis is qualitative descriptive. Based on the research analysis it can be concluded that the application of Group Investigation Model can improve student’s reasoning ability skills of student grade XI TB. It can be seen from the increase in the percentage of indicators reasoning ability skills, namely (1) showing conjectures from 10% increase to 70%, (2) manipulating mathematics as much as 20% increase to 80%, (3) providing grounds for their answer as much as 0% increase to 60%, (4) drawing conclusion of mathematical problem increased as much as 20% to 60%.

Keywords: Group Investigation (GI), reasoning ability of mathematics

INTRODUCTION

Education is one of the aspects of life that plays an important role. A country can achieve an advancement of education in the country if it is good quality. High and low quality of education in a country is influenced by many factors, for example from students, teachers, infrastructure, and also because of environmental factors.

One of the subjects in schools can encourage students to hone his ability is mathematics. Skills or math proficiency expected in mathematics include: a) understanding the concept, b) procedure, c) reasoning and communication, d)
troubleshooting and e) appreciate the usefulness of mathematics (Jihad & Harris, 2008: 148).

Reasoning ability is one thing that must be owned by the students in learning mathematics and contains an activity that allows one to draw logical conclusions. In addition because mathematics is a science that is obtained by reasoning, as well as one of the goals of mathematics is that the students are able to use the pattern and nature of the reasoning, mathematical manipulation in making generalizations, compile evidence, or explain mathematical ideas and statements. It is necessary for a variety of new breakthroughs in the study of mathematics through various approaches, in order to improve students' reasoning ability.

In the document the Director General of Basic and Secondary Education Regulation Regulation No. 506 / C / PP / 2004 (in Sadiq 2009: 14), reasoning and communication are shown students' competence in performing mathematical reasoning and communicating ideas. According to a document on the indicators that show the reasoning, among others: 1) presents a mathematical statement, either orally, in writing, drawings and diagrams, 2) submitted conjectures, 3) conducting mathematical manipulations, 4) drew the conclusion, compile evidence, give reasons or evidence against several solutions, 5) draw conclusions from statements, 6) examine the validity of an argument, 7) determine a pattern or mathematical nature of the symptoms to make generalizations

The learning process in schools in general is still dominated by actively informing teachers and students passively accept that students are forced to learn what is being taught by teachers with applying various formulas given without being given the opportunity issuing idea / notion result-oriented learning or teacher focuses not on students.

This fact are not a lot of support on improving the quality of human resources, so it is not surprising that students' reasoning ability is still low. The success achieved in the learning of mathematics is not only influenced by teachers, students or the curriculum in force, but also dipengarungi by the accuracy of the learning model used by a teacher who is very influential in the success of the learning process.
Based on the observation that researchers do in Muhammadiyah secondary vocational school of Kartasura, it is known that the reasoning abilities of the students in vocational school is still low. This can be seen from the percentage of students who were able to ask the conjectured 10%, the percentage of students who are able to conducting mathematical manipulations 20%, the percentage of students who are able to provide a reason for the answer 0%, and the percentage of students who can draw conclusions from a given mathematical problem 20%. It is necessary for the proper model of learning in order to improve students' reasoning ability.

Several ways to enable students to think and reason is to provide answers to questions that lead to a convergent, divergent, and the investigation (investigation) (Sadiq 2013: 1). In the model of learning Group Investigation (GI) students are required to be more active in developing the attitudes and knowledge of mathematics according to their respective capabilities so consequently provide more meaningful learning outcomes in students.

According to interviews conducted by the author with some teachers, it is known that the model of learning Group Investigation (GI) has never been applied in the study of mathematics at the vocational school. So far, teachers still apply the conventional learning pattern is to lecture, so researchers interested for studying students' mathematical reasoning ability Muhammadiyah secondary vocational school of Kartasura applying the model of learning Group Investigation (GI).

**RESEARCH METHODS**

This research is a Classroom Action Research (CAR) conducted collaboratively between subject teachers and researchers in an effort to improve students' understanding of concepts through learning models Group Investigations (GI). Math teacher acts as the subject of the action, while giving researchers act as observer.

The research was conducted from planning since December 2014 to March 2015. Subject recipient of this research is the action of a grade XI T.B student of Muhammadiyah secondary vocational school of Kartasura.
The method used for data collection, observation, field notes, documentation and test. Observation is used to obtain a real situation during the learning process takes place on the level of students' mathematical reasoning abilities. Notes field is used to record events that occur during the learning process. Documentation includes lesson plan (RPP), a list of student names and photographs of implementation of the action. The test is used to obtain data about the increase of mathematical reasoning abilities of individual students in accordance indicators that have been determined.

Data were analyzed using flow method. The flow method includes data reduction, exposure data, and conclusions (Kunandar 2011: 102).

**RESULT AND DISCUSSION**

Based on the survey results revealed that the study of mathematics applying Group Investigations (GI) models can improve math reasoning skills grade XI T.B student of Muhammadiyah secondary vocational school of Kartasura academic year 2014/2015. This is evident based on data obtained through observation and the value of the test cycle I and cycle II. The data obtained by researchers on mathematical reasoning ability grade XI T.B student of Muhammadiyah secondary vocational school of Kartasura applying a model of Group Investigation (GI) of a prior action until the second cycle is presented as in Table 1 below.

<table>
<thead>
<tr>
<th>No</th>
<th>Indicator of Mathematics Reasoning Ability</th>
<th>Before Action</th>
<th>Class Action</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cycle I</td>
<td>Cycle II</td>
</tr>
<tr>
<td>1</td>
<td>Submitted conjectured</td>
<td>1 student (10%)</td>
<td>3 student (30%)</td>
</tr>
<tr>
<td>2</td>
<td>Conducting manipulation</td>
<td>2 student (20%)</td>
<td>6 student (60%)</td>
</tr>
<tr>
<td>3</td>
<td>Give reasons for your answer</td>
<td>0 student (0%)</td>
<td>4 student (40%)</td>
</tr>
<tr>
<td>4</td>
<td>Draw conclusions from a given mathematical problem</td>
<td>2 student (20%)</td>
<td>4 student (40%)</td>
</tr>
</tbody>
</table>
The graph increase students' mathematical reasoning abilities applying learning model of Group Investigation (GI) in grade XI T.B student of Muhammadiyah secondary vocational school of Kartasura before action until the second cycle can be shown in Figure 2 below.

![Graph of Improvement Reasoning Ability Student](image)

**Figure 2 Graph of improvement reasoning ability**

The data obtained to determine whether there is an increase in students' mathematical reasoning abilities in this study detailed in the four indicators used in the following research focus.

a. Students are able to submit conjectured.

Based on the results of the study data showed that the percentage of students filed allegations indicator increased from prior to action until the second cycle in accordance with the expectations of researchers so that it can be concluded that the students are able to submit allegations of mathematical problems through a process or activity of thinking. Processes and activities to think that the connection between the cases of mathematics is very useful for
the subsequent discovery (Sadiq, 2004: 7). The new discoveries will shape the pattern that led to allegations of a mathematical problem. Of stages that exist in the model of learning Group Investigation students learn filed conjectured and demanded to think about and indicate whether or not the conjectured. In line with these theories that the results of this study gained applying learning model of Group Investigation is able to improve the ability of students to apply for the conjectured reasoning. The results of students' conversations with teachers in allegations filed indicators can be written as follows:

Problems example:

Consider the following set of numbers

a. 1, 2, 3, 4, ...

b. 1, 5, 3, 4, ...

Which can be converted into a form of progression?

Student: "Mom, the answer to the above question is a"

Teacher: "Why did you choose a, what is the reason?"

Student: "Because in a certain rule that have incremented by 1 from the previous rate".

Based on the above conversation, the indicators put forward conjectured can be achieved and an increase in compare before action because students are able to describe the reason for the answer of the given problem.

b. Students are able to perform mathematical manipulations.

This indicator is obtained through tests given each end of the cycle.

Based on research data can be concluded that an increase in every action
taken. Percentage indicators of students were able to perform mathematical manipulations researchers increased in line with expectations so it can be concluded that the students are able to perform mathematical manipulations as a mathematical proof of the allegations that have been found. NCTM (Sadiq, 2009: 10) states that students must learn to develop and evaluate mathematical arguments and evidence so that in this way students will better recognize reasoning and proof as fundamental aspects of mathematics. To get the skills students need a lot of information from various existing sources. According to Jihad (2010: 93) one indicator is the ability to manipulate mathematical reasoning. In mathematical manipulation activities through learning model Group Investigation can be done in groups so that each student can exchange arguments to strengthen the mathematical proof of the conjectured that have been found. In line with these theories that the results of this study gained through learning model Group Investigation is able to improve the reasoning ability of students in mathematical manipulation, able to transform into the form of a mathematical story problems. Here are the questions and the results of student work on manipulating mathematics in terms of mathematical calculations that can be seen in Figure 3.
Problem: Calculate the rate ke- 40, if known to the tribe-5 = 27, and tribes all 8 = 42.

Based on the above picture, the indicator manipulating mathematics in figure 3 has been increased because students are able to transform matter into the form of mathematics and solve a math problem that.

c. Students are able to give reasoning about your answer

Based on the data in table and graph above it can be concluded that an increase in every action taken. Percentage indicators of students were able to give a reason for the answer to rise to the expectations of researchers so that it can be concluded that the students are able to give reasons in accordance with the mathematical evidence either in writing or orally. Students can give reasons at the time of presenting the results of focus group discussions in class so that communication can take place in the discussion. In the scientific approach teachers are expected to provide an opportunity for learners to communicate what they have learned (Kurniasih, 2014: 53). When the students presented the results of a discussion group next class, students will learn how to reason and correct mathematical proof. In the model of learning
Group Investigation teachers help students to reflect or evaluation of their investigations and the processes they use (Jauhar, 2011: 90). The evaluation of students will learn how to reason and mathematical proofs are studied in small groups right or wrong. Here are the results of student work that are presented in front of the class can be seen in Figure 4.

![Figure 4. The result of discussion](image)

From Figure 4 students can give a reason for the answer and delivered in front of the class when the discussion took place and students are able to give the reasons for the responses given to other groups.

d. Students are able to draw conclusions from a given mathematical problem

This indicator is obtained through observation during the lesson. Based on these data it can be concluded that an increase in every action taken. Percentage indicators of students were able to draw conclusions from the mathematical problem given rise to the expectations of researchers so that it can be concluded that the students were able to change from one representation to another representation. According to Sadiq (2004: 3) states that "The material of mathematics and mathematical reasoning are two things that can not be separated, ie the material is understood through reasoning and mathematical reasoning to understand and drilled through the learning of
...mathematics". In the process of reasoning will be found allegations that ended with the conclusion either inductive or deductive. As an example of drawing conclusions from the sub topics discussed within the group can be seen in Figure 5

![Figure 5. Results of student work](image)

Conclusion is also done at the end of a meeting held by teachers and students together. This is done so that students have the same level of kefahaman.

Overall after investigation applied learning model group (GI) can improve math reasoning abilities of students from the first cycle to the second cycle. Improved mathematical reasoning skills students are clearly visible in the results of the second cycle. In the second cycle of the class action has been able to control the class teacher so well that the students become more serious in participating in learning activities. Also in this second cycle teachers were not so dominate the learning activities because students are more active. This can be seen from the number of students who dared to add advanced to the front of the class to present the results of the discussion group.

The research result is consistent with the results of research conducted by Sa'adah (2010) concluded that the application of reasoning abilities using Group Investigation model can improve student learning outcomes. In addition, Fahradina et al (2014) reported an increase in mathematical reasoning ability and independence of junior high school students learn by using a model investigation group. In line with the results of these studies Sari (2011) concluded that by implementing the strategy of cooperative learning type Group Investigation can improve mathematics learning activities in class XI MAN Karanganyar second semester.
Another opinion is in line with the study proposed by HW, S and Rokhani, A (2013) states that there is an increase in the results of mathematical reasoning and problem-solving strategies of teaching and learning. In line with the results of these studies Yenilmez (2005) states that there is a significant relationship between the level of class and gender on students' reasoning ability. Besides that, Hutajulu (2011) in his study suggests an increase in the ability of comprehension and mathematical reasoning high school students through guided inquiry learning model. Widyaningtyas (2013) in his research suggests the increase of mathematical reasoning and communication skills using material Treffinger learning model equations and linear inequality one variable.

This research was also supported by Sadiq (2013: 1), which says that some of the ways to enable students to think and reason is to provide answers to questions that lead to a convergent, divergent, and the investigation (investigation). In the model of learning Group Investigation (GI) students are required to be more active in developing the attitudes and knowledge of mathematics according to their respective capabilities so consequently provide more meaningful learning outcomes in students.

Based on the above, by applying mathematics learning through group learning model investigation (GI) mathematical reasoning skills students can be increased.

CONCLUSION

Based on the results of research and discussion, we can conclude that after using the learning model Investigation Group (GI) with mathematical reasoning skills grade XI T.B student of Muhammadiyah secondary vocational school of Kartasura increases. This can be explained as follows.

1. Submitted Conjectured.

   The data observed prior to the action research as one students (10%) and after the action on the first cycle there are 3 students (30%) and then in the second cycle there are as many as seven students (70%).

2. Perform mathematical manipulations.

   The data observed prior to action much research as two students (20%) and after the action on the first cycle there are 6 students (60%) and then in the second cycle to 8 students (80%).
3. Give reasoning about your answer.

The data observed prior to the action research as 0 student (0%) and after the action on the first cycle there are four students (40%) and then in the second cycle there are 6 students (60%).

4. Draw conclusions from a given mathematical problem.

The data observed prior to action much research as two students (20%) and after the action on the first cycle there are four students (40%) and then in the second cycle to as much as 6 students (60%).

BIBLIOGRAPHY

Farahdina et all. 2014. *Peningkatan Kemampuan Komunikasi Matematis dan Kemampuan Belajar Siswa SMP dengan Menggunakan Model Investigasi Kelompok*. Jurnal Didaktik Matematika, pp. 54-64


Yenilmez ,. 2005. *Investigating Students’ Logical Thinking Abilities: The Effects Of Gender And Grade Level*, p. 219-225