

Students' Mathematical Critical Thinking Ability in Group Algebra Structure Course during the Covid-19 Pandemic

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Abstract. Critical thinking skills are very important things that students must have during online learning. Critical thinking skills are useful for solving specific problems and being able to develop in a better direction. The purpose of this study is to analyze students' mathematical critical thinking skills in solving problems in the Group Algebraic Structure course during the Covid-19 Pandemic. The research method used in this research is descriptive qualitative research using written tests and interviews. From the results of the study, it was found that students with very high critical thinking levels were 20%, high critical thinking levels were 50%, moderate critical thinking levels were 23.33%, low critical thinking levels were 3.33% and very low critical thinking levels were 3.33%. Furthermore, from the results of the written test, 5 subjects were taken based on each indicator of mathematical critical thinking skills to be confirmed through interviews. From each student who has very high, high, medium, low and very low mathematical critical thinking skills, students have different achievements from each indicator.

Keywords: Mathematical Critical Thinking Ability, Group Algebraic Structure, Online Learning

INTRODUCTION

Education is a conscious and planned effort to create an effective and efficient learning atmosphere with the aim of facing a better life. The world of education has an important role in preparing quality human resources in the future. One of the factors that determine the success or failure of education is seen from the learning outcomes, especially in mathematics.

Mathematics is a science that is taught to all levels of education in Indonesia. Susanto (2013: 185) argues that Mathematics is one of the fields of study that can improve thinking and argumentation skills to contribute to solving problems that exist in everyday life and can develop science and technology. Mathematics is the queen of science, mathematics is arranged logically, and tiered from the easiest to the most complex level. Mathematics lessons often find difficult questions for students to solve and solve, but not all problems in mathematics are difficult and are seen as problems. However, not everyone feels the same way, difficult for one person is not necessarily difficult for another. In fact, by learning mathematics, everyone is able to hone their thinking skills at a high level. So with these things every person should have higher thinking.

According to Krulik and Rudnick (Fachrurazi, 2011) suggest that thinking skills are categorized into three levels, namely: 1) *basic thinking*, critical thinking, and creative thinking. This shows that one of the higher order thinking skills is to have the ability to think critically. Critical thinking ability can be

interpreted as the ability to analyze ideas and ideas towards a more specific direction, distinguish sharply, select, identify, study, and develop them in a better direction (Taqwa et al., 2019).

Duron et al., (2006) stated that someone who has critical thinking is able to analyze and evaluate information, has very important questions, can formulate problems clearly, and is able to assess relevant information using abstract ideas, able to think openly and can communicate effectively. The industrial revolution 4.0 can make it easier for everyone to get information from various kinds of social media and can get information quickly. The development of information in technology is growing rapidly at this time, one way to take advantage of information technology in higher education is the online lecture method.

Online lectures are where lecturers and students carry out the learning process by not meeting face to face, but lecturers and students study separately using various learning media. Online lectures are one part of online learning methods or learning systems that use the internet network (Mustofa et al., 2019). One of the courses whose learning is through an online system and requires critical thinking skills is the Group Algebraic Structure course.

Group Algebra Structure is one of the compulsory subjects that students of Mathematics Education must take at the University of Muhammadiyah Surakarta in odd semesters. Aisyah (2019) stated that the Algebraic Structure course must be proven and must be understood by students, because usually students are only fixated on formulas, so most students have difficulty solving problems. This course has many theorems that must be proven true, so students need the ability to think logically, creatively, and critically.

The purpose of this study is to analyze students' mathematical critical thinking skills in solving problems in the Group Algebra Structure course during the Covid-19 Pandemic. Mathematics Education Study Program, University of Muhammadiyah Surakarta.

RESEARCH METHOD

This type of research is qualitative research. Qualitative research is a type of research whose findings are obtained through statistical procedures or other forms of calculation that aim to reveal environmental symptoms by collecting data from the natural environment with researchers as the main means (Sugiyono, 2015). The research design used is descriptive research.

The subjects of this study were students of Mathematics Education at Muhammadiyah University of Surakarta who were taking the Group Algebra Structure course for the 2020/2021 academic year online during the Covid-19 pandemic, which consisted of 30 students. This research is in the form of tests and interviews. The test was tested to determine the students' mathematical critical thinking skills, which amounted to 4 questions in the Group Algebra Structure course based on the indicators of the questions that had been validated. After the test results were analyzed, the next stage was conducted with interviews to confirm understanding in solving questions. Subjects totaled 5 students who were taken from indicators of mathematical critical thinking skills in the process of working on written test questions that had been analyzed. In this study the validity of the data used is the credibility test with triangulation techniques which include tests, interviews, and documentation. Triangulation technique is used to test the credibility of the data by using different techniques to examine the data to the same source.

RESEARCH RESULTS AND DISCUSSION

Based on research data that has been carried out, from the results of the written test of 30 students there are 1 student in the very low category, 1 student in the low category, 7 students in the medium category, 15 students in the high category, and 6 students in the very high category. From each student who has very high, high, medium, low and very low mathematical critical thinking skills, there are differences in the achievements of each indicator. (Karim & Normaya, 2015).

TABLE 1. MATHEMATICAL CRITICAL THINKING LEVELS

Interval	Critical Thinking Level
20 – 25	Very high
15 – 20	High
10 – 15	Moderate
5 – 10	Low
0 – 5	Very low

TABLE 2. STUDENT RECAPITULATION LEVEL OF CRITICAL THINKING MATHEMATICS

Thinking Level	Number of Students	Percentage
Very High	6	20%
High	15	50%
Medium	7	23,33 %
Low	1	3,33 %
Very low	1	3,33%
Total	30	100%

The following are the results of the discussion related to research on mathematical critical thinking skills.

1. The indicator understands what is known and knows what is asked in each problem.

The mathematical critical thinking ability possessed by S-19 and S-26 with a very high level of critical thinking, this is related to the indicator of understanding what is known and knowing what is asked in each question. problems, S-19 and S-26 were able to write down what was known and what was asked in the question. According to Ennis (Sumarmo, 2012) the first indicator of critical thinking ability is to focus on questions.

Furthermore, the critical thinking skills of S-4 and S-30 in the indicators of understanding what is known and knowing what is asked in each problem, are less able to write down what is known and what is asked in the question. Because based on the results of the written test, S-4 and S-30 did not write down what was known and what was asked in the question, but in the results of the interview S-4 and S-30 were able to explain what was known and what was asked in the question.

S-10 has not been able to fulfill the indicators of understanding what is known and knowing what is asked in each problem, this can be seen from the results of the written test that S-10 does not write down what is known and what is asked in the question. According to Fernanda's research (2019), the ability to focus questions is the ability to find or formulate problems from a given case or phenomenon. From the results of the explanation above, it can be concluded that the subject is able to explain what is known and what is being asked in the question.

2. The indicator of writing the concepts used in solving each problem

S-19 and S-26 have a very high level of critical thinking in writing the concepts used in solving each problem properly and correctly. Furthermore, S-4 and S-30 on indicators write down the concepts used in solving each problem, and have a moderate level of critical thinking. S-4 does not write down the concept when proving whether the integer B is a group against the multiplication operation. While S-30 did not write down the concept when asked to show that $(G, +)$ is a group for addition operations, but S-30 was able to solve problem number 4 correctly, it's just that S-30 did not write down the concept used in solving the problem. According Paradesa (2015) says that students with critical thinking skills capable of identify concept and determine what concepts used to solve the problems. In the indicator of writing down the concepts used in solving each problem, S-10 is less critical in writing the concept of solving each problem in working on the problem. S-10 only writes concepts in problem number 1, but does not write concepts in questions number 2, 3, and 4.

3. Indicators of formulating problems into mathematical models

On indicators of formulating problems into mathematical models S-19 and S-26 have very critical thinking skills high, because S-19 and S-26 are able to solve problems by formulating problems into mathematical models properly and correctly. According to research by Paradesa (2015) critical thinking skills are able to determine mathematical equations in applying concepts to answer and are able to give meaning to each symbol of a predetermined mathematical model.

While S-4 has a low level of thinking ability, it can be seen from the results of the work that S-4 when working on problem number 3 does not formulate the problem into mathematics in showing that $(G, +)$ is a group with respect to the addition operation. Furthermore, S-30 has a moderate level of critical thinking, because S-30 is only able to formulate problems into mathematical models in questions number 2 and 3, whereas S-30 does not formulate problems into mathematical models in questions number 3 and 4.

4. Indicators of solving problems by principles and mathematical models, as well as being able to draw conclusions from each problem.

Based on indicators of solving problems with mathematical principles and models, and being able to draw conclusions from each problem, S-19 has a very high level of critical thinking, because S-19 is able to solve problems with principles and principles. mathematical model properly and correctly. S-26 and S-4 have a moderate level of critical thinking, this can be seen in questions number 1 and 2 S-26 is less precise in solving problems and less precise in drawing conclusions, as well as S-26.

Furthermore, S-10 and S-30 have low levels of critical thinking in solving problems with mathematical principles and models, and have not been able to draw conclusions from each problem. It can be seen that S-10 when working on problem number 2 is not appropriate in solving problems and drawing conclusions, and for numbers 3 and 4 S-10 has not been able to solve problems and draw conclusions, based on the results of interviews S-10 does not understand related with questions number 3 and 4. While S-30 is not precise in solving and drawing conclusions on questions number 1 and 4, while for number 3 S-30 does not understand about these questions, so S-30 has not been able to solve problems and draw conclusions in question number 3. This is in accordance with Paradesa research (2015) students do not write down the results of the completion and conclude the answers obtained, and students assume that drawing conclusions is not necessary.

5. Indicators provide further explanation in solving each problem.

In the indicator providing further explanations in solving each problem, S-19 has a very high level of critical thinking, because S-19 is able to provide further explanations regarding the conclusions drawn in each question. During the interview, S-19 was also able to provide further explanations regarding the conclusions with very good and correct answers. According to Crismasanti's research (2017) the subject is able to provide further explanations regarding the results of the settlement he has obtained.

Furthermore, S-26 and S-4 are less able to provide further explanations in solving each problem. When working on questions 1,2, and 4, S-26 is still not appropriate in providing further explanations regarding the conclusions drawn. While S-4 is still not right in providing further explanations related to the conclusions drawn in questions number 1 and 4, S-4 still does not understand related to question number 4. Based on the indicators that provide further explanations in solving each problem, S- 10 and S-30 can be seen from the results of tests and interviews S-10 and S-30 in working on questions from number 1 to number 5 are still unable to provide further explanations in solving each problem.

CONCLUSION

Based on research on students' mathematical critical thinking skills in the group algebra structure course during the covid-19 pandemic, it can be concluded that students with very high critical thinking levels are 20%, high critical thinking levels are 50%, moderate critical thinking levels are 23.33%, high

critical thinking levels are 23.33%. low critical thinking 3.33% and very low critical thinking level 3.33%. Based on each indicator of mathematical critical thinking skills that have very high, high, medium, low and very low mathematical critical thinking skills, students have different achievements from each indicator.

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