

ANALYSIS OF STUDENTS' MATHEMATICAL CRITICAL THINKING ABILITY REVIEWED IN SOLVING MATHEMATICS PROBLEMS FROM GENDER DIFFERENCES

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Abstract

This study aims to determine students' mathematical critical thinking skills in terms of gender differences. This research was conducted in March 2023 in class VII junior high school. The subjects of this study consisted of 6 people, including 3 male students and 3 female students. Based on the gender of each student, they are then grouped into 2 people with high ability categories, 2 people with medium ability categories, and 2 people with low ability categories. This type of research is a descriptive research. Data collection techniques were carried out using a written test consisting of 2 questions, by interview and documentation. Data analysis techniques consist of three stages, namely data is data reduction, data presentation, and drawing conclusions. Test the validity of the data using method triangulation techniques and data source triangulation. The results showed that students with high abilities could work on critical thinking test questions and covered all the indicators. In contrast, students with moderate abilities still needed to be able to work on mathematical critical thinking test questions well according to the criteria for critical mathematical thinking. Students with low abilities have yet to be able to do well on the mathematical critical thinking test according to the criteria of critical mathematical thinking. No significant difference exists between how to solve the test questions for male and female students in each ability category.

Keywords: mathematical critical thinking skills, math problems, gender differences



1. Introduction

In the educational curriculum that applies in Indonesia, mathematics is one of the subjects taught at school. In an increasingly advanced era of development, mathematical thinking is a skill that must be mastered by students (Murtiyasa, 2019). Meanwhile, other opinions state that mathematics can develop computational skills (calculation operations) and soft skills, such as finding concepts, processing information, and communicating ideas in the form of symbols, charts, pictures or sentences orally and in writing (Yurniwati, 2019). Most students consider mathematics difficult and difficult due to its abstract nature, full of number, and formulas and requires a lot of practice (Yuberta et al., 2019). Therefore, in studying mathematics, perseverance and patience are needed in order to understand mathematics well. The implementation of learning mathematics is not enough to provide information in the form of memorized theories or concepts and needs to be oriented towards developing the skills needed problems. Students must be equipped with certain skills to solve mathematical problems because learning about mathematics is not only memorizing but mathematics is also used as a process in solving problems. In mathematics learning, students are certainly faced with a problem that must be solved, for example in mathematics problem-solving.

In the process of acquiring knowledge, critical thinking skills are needed (Nur et al., 2018). In the application of learning mathematics requires interaction between teachers and students which can involve the development of mindsets and the use of logic in a teacher-directed learning environment and providing learning experiences to students through a series of planned activities so that students can know and gain competency in the mathematics material being studied. Indicators of critical thinking ability are developed in the following four ways: (1) interpretation, namely understanding the issues contained in the question by describing the known information and providing related questions; (2) analysis, which requires deriving a precise mathematical model and providing adequate explanations for the statements, questions, and ideas included in the questions; (3) assessment, namely: the ability to be able to choose an appropriate approach in solve problems and perform calculations accurately and completely; (4) interference, namely drawing valid conclusions (Hutabarat et al., 2019). Critical thinking skills very closely related to mathematics is because critical thinking skills provide encouragement to students when thinking and

solving mathematical problems. Apart from the critical thinking skills component, other variables can influence how students answer arithmetic questions, namely internal variables and external variables (Mursari, 2020). The intended external variables are family, school environment, and community. The internal variables health, intelligence, ability to learn independently, interests, skills, knowledge, motivation, and learning styles. The development of mathematical problem-solving abilities can be done after several exercises, so mathematics is no longer a problem. The ability students to think critically is a skill that students need to have because it allows students to answer mathematical problems (Rizza, 2020). Students' critical thinking skills in problem solving mathematics by using critical thinking skills depend on gender differences (Hidayanti et al., 2020). Male and female students must have different critical thinking abilities. This is because they also have different learning experiences. Students are divided into two genders, boys and girls. As a result of these gender differences, boys and girls have different learning experiences, which can lead to differences in students' critical thinking abilities in solving math problems.

Problem-solving can be seen as a finding associations from several applied rules useful in dealing with new contexts. Problem-solving is seen as the ability to apply the rules that have been mastered in a learning activity that has been passed before and as a way to get a set of rules at a higher level. Suppose someone has an association of rules that are proven and operated according to the situation. In that case, he can solve problems and successfully find new things, namely in the form of procedures or strategies that allow a person to increase independence in thinking (Dewanti, 2018). The problem-solving in research step is divided into four stages, namely (1) understanding in dealing with problems, (2) making plans to be implemented, (3) implementing plans that have been made, and (4) re-examining the results. Fisher and Scriven made several important things from critical thinking: interpretation and evaluation skills, active observation and communication, and matters relating to information and argument (Fisher, 2009). This opinion is very important in critical thinking skills it also reveals other important things, such as identifying the elements in the case under consideration, particularly the reasons and conclusions from events, identifying and evaluating assumptions, clarifying and interpreting questions and ideas, assessing acceptability, especially credibility, and evaluating different kinds of arguments. Then from this

opinion, conclusions can be drawn to be used as indicators in this study.

Table 1. Critical Thinking Ability Indicator

General Indicators	Indicator
Interpreting	Understanding a problem that is addressed by first writing down what is known and then writing down what is asked in a problem correctly.
Analyzing	Identify the relationship between statements, questions, and concepts contained in a problem that is shown in the form of a mathematical model correctly and provide explanations correctly.
Evaluate	Using the right solution to answer a problem with the right steps and calculations.
Interfering	Make conclusions from a problem correctly.

Psychologically it can be concluded that the self-determination between men and women is different with psychological factors closely related to intelligence, attention, interest, talent, discipline and so on. Another opinion states that gender differences and resilience have an influence or contribution of 86.6% on the ability to think creatively mathematically, and another 13.4% are influenced by other factors besides gender and students' mathematical resilience (Dila et al., 2018). Gender differences not only result in differences in ability but the way of acquiring mathematical knowledge is also related to gender differences. From the explanation above, it can be concluded that in this case, the teacher plays an important role in improving students' mathematical critical thinking skills, where the teacher must be able to make efforts so that mathematics learning can be followed by all students, both male and female so that they are always active and will be interested math subjects.

2. Method

The research that has been carried out aims to find out how students' mathematical critical thinking skills are in solving mathematical problems and how students' mathematical critical thinking skills are viewed from gender differences.

The research design is intended to determine students' mathematical critical thinking skills gender differences. Referring to the formulation of the problem, this research is a qualitative research design. Qualitative research has various approaches of its own so researchers can choose from these various types to suit the object to be studied (Yusanto, 2019). Meanwhile, other

opinions explain that in qualitative research, data analysis needs to be done carefully so that the data obtained can be well narrated and becomes an appropriate research result (Yulianty & Jufri, 2020). Based on the type of research above, this research uses descriptive research methods. The qualitative descriptive method is a type of research method based on the philosophy of postpositivism, which is used for research in natural object conditions (as opposed to experiments), in this case the researcher acts as the key instrument. The data collection technique in this study was carried out by applying data analysis in research took an inductive/qualitative nature, and the results obtained from qualitative research could emphasize its meaning rather than generalization (Sugiyono, 2016).

This research was conducted at Bintang Timur Junior High School, Langke Rembong, in grade VII students for the 2023/2024 academic year March. The subjects of this study were 6 students. Three male and three female students were obtained based on the results of a mathematical critical thinking ability test with the Minimum Completeness Criteria (KKM) for mathematics being 75.

Data collection techniques in this study written tests, interviews and documentation. Written tests are used to obtain data that measures students' mathematical critical thinking abilities. Interviews too conducted with several informants whom the researcher had determined as research subjects, the thing that was asked was how the students' steps in answering the questions/mathematical problems posed. A tape recorder was used to record all information during the interview to avoid data loss. Meanwhile, the documentation used in the research was photos of research activities carried out by researchers and school archives and other things considered to support research data found at schools.

Table 2. Critical Thinking Ability Test Instrument

No.	Test Questions
1.	The price of a book is 4 times the price of a pencil. The price for 2 pencils and 3 books of the same type is IDR 2,240,000.00. What is the price of a pencil and the cost of a book?
2.	The ages of Sesil and Lisa are $(5x-2)$ and $(2x+4)$ respectively. If Sesil's age is greater than Lisa's age, then determine the limits of x .

The critical thinking ability test sheet instrument was used to select research subjects by grouping students into two gender groups: the male group, which consisted of 3 people, and the female

group, which consisted of 3 people. The test is one of the most widely used measurement tools to assess the results of a person's learning process in the learning process or educational program. The learning outcomes test is a completeness test because this test measures students' mastery of the material taught by the teacher or learned by students. In this study, the test was in the form of 2 short description numbers regarding the material of a one-variable system of linear equations and done individually with the same questions for both men and women students have completed the problem, the teacher can check the test sheet by giving a score or value. A brief description in the form of a question that can be answered in one word (Widoyoko, 2014). The research subjects who were interviewed were as many as 6 students. The determination of the subject is based on the ability to obtain scores on the description test results. The criteria set were 2 students with high abilities, 2 with moderate abilities, and 2 with low abilities. In qualitative research, the data obtained in the form of words and not a collection of numbers (Miles & Huberman in Gunawan, 2014). Data analysis in this study uses three stages that must be carried out in analyzing the data, namely: (1) data reduction; (2) data presentation; (3) conclusion.

3. Result and Discussion

3.1 Subject analysis based on Student Category

The results of the analysis of the participants' critical thinking skills in mathematical solving problems are presented in the following description:

- a. Analysis of High Ability Subjects (Subject S-01 And Subject S-02)

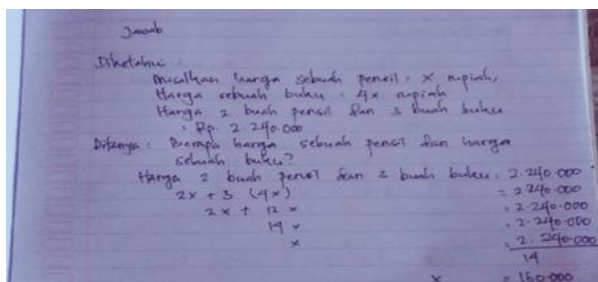


Figure 1. Subject S-01's answer to question number 1

Based on the results of the student's work above, it can be seen that the subject:

Interpreting: Understanding a is addressed by correctly writing down what is known and what is asked in a problem. Subject S-01 was able to understand question number 1. This can be seen from the step it was done, where the subject was

capable write down what was known and asked in the problem.

Analyzing: Identifying the relationship between statements, questions, and concepts contained in a problem shown in the form of a mathematical model and correctly providing explanations. The subject can to make a mathematical model of the questions given. This can be seen the work and the picture.

Evaluate: Using the right solution to answer a question with the right steps and calculations. Subjects can work on and solve problems by using the right strategy. This can be seen from the results of the problem in the picture.

Interfering: making conclusions from a problem correctly. The subject does not write a conclusion. This can be known from the subject's work.

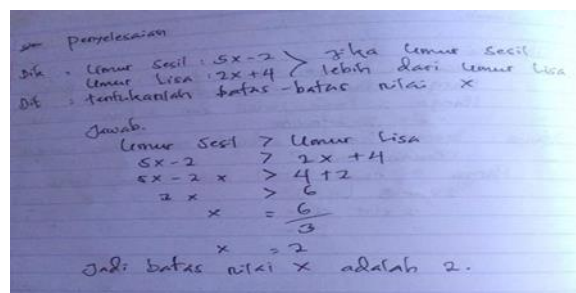


Figure 2. Subject S-02's answer to question number 2

Based on the results of the student's work above, it can be seen that the subject:

Interpreting: Understanding a problem is addressed by correctly writing down what is known and what is asked in a problem. The subject understand question number 2. This can be seen from the subject can write down what is known and asked in the problem.

Analyzing: Identifying the relationship between statements, questions, and concepts in a problem that is shown the question of mathematical model correctly and provides explanations. The subject is able to make a mathematical model of the questions given. This can be seen his work and can be seen in the picture.

Evaluate: Using the right solution to answer a problem with the right steps and calculations. Subjects can work on and solve problems using the right strategy. This can be seen from the results of the problem in the picture.

Interfering: making conclusions from a problem correctly. The subject can give the right conclusions. This can be known when the subject is able to solve the problem properly and correctly.

b. Intermediate Ability Subject Analysis (Subject S-03 and Subject S-04)

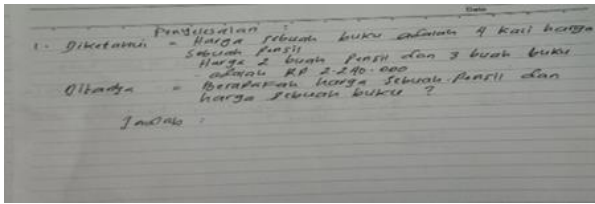


Figure 3. Subject S-03's answer to question number 1

Interpreting: Understanding a problem is addressed by correctly writing down what is known and what is asked in a problem. In question number 1, Subject S-03 was able to work on the questions so that the subject wrote down what was known and asked in the questions.

Analyzing: Identifying the relationship between statements, questions, and concepts in a problem that is shown a mathematical model correctly and provides explanations. The subject does not make a mathematical model of the questions given. This can be seen his work and can be seen in the picture.

Evaluate: Using the right solution to answer the questions a with the right steps and calculations. There is no strategy used by subject S-04 in solving question number 1. This can be seen from the results of working on the problem in the picture.

Interfering: making conclusions from a problem correctly. Subject S-03 made no conclusions in his test answers.

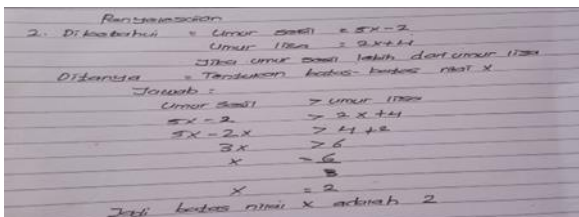


Figure 4. Subject S-04's answer to question number 2

Based on the results of the student's work above, it can be seen that the subject:

Interpreting: Understanding a problem is addressed by correctly writing down what is known and what is asked in a problem. The subject was able to understand question number 2. This can be seen from how it is done, where the subject can write down what is known and asked in the problem.

Analyzing: Identifying the relationship between statements, questions, and concepts in a problem that is shown a mathematical model correctly and provides explanations. The subject can make a mathematical model of the questions

given. This can be seen his work and can be seen in the picture.

Evaluate: Using the right solution to answer questions with the right steps and calculations. Subjects can work on and solve problems by using the right strategy. This can be seen from the results of the problem in the picture.

Interfering: making conclusions from a problem correctly. The subject is able to give the right conclusions. This can be known when the subject is able to solve the problem properly and correctly

c. Analysis of Low Ability Subjects (Subject S-05 and Subject S-06)

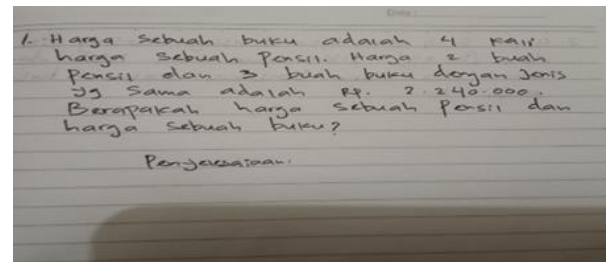


Figure 5. Subject S-05's answer to question number 1

The picture shows that the S-05 students only rewrote the questions and did not answer them at all.

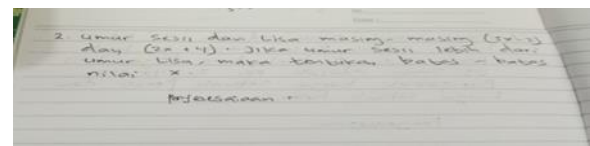


Figure 6. Subject S-06's answer to question number 2

From the picture, it can be seen that the S-06 students did not answer the test questions but only rewrote the questions.

Based on the results of interviews conducted by researchers with subject S-01 on question number 1, it was found that the subject really understood the problem but still could not solve the problem properly, so it was revealed that S-01 could: write down what was student known and asked in the problem, could make a mathematical model of the given problem, can use the right strategy in solving the problem, and cannot make conclusions from the problem. Meanwhile, from the results of interviews conducted by researchers with subject S-02 on question number 2, it was found that the subject understood the problem very well, so was revealed that S-02 could: students write down what is known and asked in the problem, students can make a mathematical model of the problem given and use the right strategy in solving the problem, and students can make

conclusions appropriately according to the context of the problem and complete.

From the results of interviews conducted by researchers with subject S-03 on question number 2, it was found that the subject understood the problem very well, so it was revealed that S-01 could: write down what is known and asked in the problem. The student also needs help to make a mathematical model of the problem that has been given, and the student also needs to use the right strategy in solving the problem and make conclusions correctly according to the context of the problem and complete it. Meanwhile, from the results of interviews conducted by researchers with subject S-04 on question number 1, it was found that the subject understood the problem but was wrong in solving the questions, so it was revealed that subject S-04 was wrong in the final calculation.

Based on the results of interviews with S-05 and subject S-06, they did not know the steps for solving the problem and did not know what formula to use, so they did not answer the questions given and only rewrote the questions asked.

4. Conclusion

From the results of the analysis and discussion presented above, it can be concluded that the analysis of students' mathematical critical thinking abilities in terms of gender differences is as follows: Based on the two linear equation system test questions given, it can be concluded that male students and female students with the ability category high in general it can be said that students can work on students' mathematical critical thinking test questions according to the criteria of mathematical thinking on predetermined indicators. Students with moderate abilities in both boys and girls can concluded that students with moderate abilities could do better on the mathematical critical thinking test questions, likewise with students with low abilities, both men and it can be concluded that students in low abilities are not at all able to do well on the mathematical critical thinking test questions. What distinguishes men and women on the accuracy working on the questions. This can be seen from the results of interviews conducted by researchers.

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