

ANALYSIS OF MATHEMATICAL CRITICAL THINKING ABILITY BASED ON STUDENTS' ABILITY LEVEL

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ABSTRACT

Analyzing and testing mathematical critical thinking skills based on the ability level of class VIII students of junior high school is the aim of this research. By understanding the level of students' abilities, educators can determine students' mathematical critical thinking abilities and develop appropriate teaching strategies to improve students' abilities. This study uses a qualitative descriptive research method. This research was conducted at one of the junior high schools in Cipatat, West Bandung Regency with heterogeneous abilities of 8 students. This research uses data collection techniques by providing mathematical critical thinking ability questions on SPLDV material which consists of 5 essay test questions based on the following indicators: (1) Checking the completeness of problem solving steps. (2) Look for alternative solutions to problems. (3) Identify spldv equations with certain characteristics. (4) Choose the best way to solve the problem from alternative ways of solving it. (5) Identifying the adequacy of data on a problem. In this study, the results of the analysis have shown that students at a high level of ability can check the completeness of problem solving steps, students with a medium level of ability have little difficulty in identifying spldv equations with certain characteristics, and students with a low level of ability have difficulty finding alternatives problem solution.

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INTRODUCTION

Education is a process for humans to become knowledgeable and skilled so that in it there are teaching, training and research activities in all fields of learning, one of which is learning mathematics. In line with that in a broad sense, education is the same as life or education is a learning experience Noor, (2018). Even according to Sulaiman & Asanudin, (2020) Education is learning that aims to develop knowledge and insight that requires a long and planned and

structured process. Therefore in mathematics education there must be mathematics learning, according to Rohmah, (2021) Mathematics learning is a process that achieves the goal of being able to receive information by carrying out activities to construct their own mathematical therefore students can be more active and involved in the learning process.

According to Syamsuri et al., (2019) mathematics has an important role which has a tremendous influence on life, mathematics is necessary so that it can be used to solve problems in life, in principle mathematics is the servant and queen of science. However, in learning, some consider mathematics to be difficult, this is a factor for students' low learning achievement Purwasih et al., (2018).

Therefore, at this time it is very necessary to learn mathematics which focuses on understanding mathematics, because in the future this understanding will have a broader meaning, namely being able to reason logically, systematically, critically and carefully so that you can think openly and objectively. this is very necessary in everyday life to deal with all changes, therefore learning mathematics must be able to develop students' thinking processes and abilities (Makhmudah, 2018). According to (Risah et al., 2021) there are various problems that makes it difficult for students to learn mathematics, namely the lack of ability of high-level students to solve mathematical problems, especially in students' mathematical critical thinking abilities that every student should have.

Mathematical critical thinking ability is an ability that can make students think to be able to evaluate a problem so that they can reveal and develop their potential. (Prihatiningtyas & Rosmaiyadi, 2020). In line with that, according to (Novtiar & Aripin, 2017) when students teach in mathematical critical thinking skills, students are expected to be able to develop patterns of thinking to be able to compete at the global level in the future. However, behind the development of students' thinking patterns, it is necessary to know that students have different abilities, students have different levels of solving mathematical problems, so it is necessary to introduce the level of ability of junior high school students in solving mathematical problems. so that it can make it easier for educators when designing learning tools and teaching mathematics. (Widayanti, 2016). The student's level of ability must be known so that the student's ability to understand mathematical material can be seen to what extent their abilities are (Haniah & Senjayawati, 2023).

According to (Rachmantika & Wardono, 2019), education is currently in the age of science with an extraordinary acceleration of scientific improvement. The acceleration of increasing knowledge is supported by the application of digital media and technology which is called the information super highway, meaning that critical thinking as a form of thinking ability must be possessed by everyone, including students, in facing problems, especially mathematical problems, according to their level of ability.

Departing from the description above that has been discussed, the researcher needs to further analyze students' mathematical critical thinking abilities based on the level of students' abilities. Therefore, this study aims to analyze the ability to think critically mathematically in terms of the level of ability in junior high school students, especially class VIII.

METHOD

The method used in this study is descriptive qualitative with the aim of analyzing and knowing the results of students' mathematical critical thinking skills based on the level of students' ability to work on mathematical critical thinking questions on the material variable system of two linear equations. According to (Nurmalasari & Erdiantoro, 2020) descriptive qualitative, namely a research method with a simple qualitative approach with an inductive

flow, the analysis in this study was carried out before going into the field, while in the field, and after finishing in the field. This research was conducted at a state junior high school located in Cipatat District, West Bandung Regency. The research subjects were 8 class VIII students, namely students with heterogeneous abilities. The data collection technique used is a written test technique, with 5 test items that describe the ability to think mathematically, each question uses indicators of mathematical critical thinking according to Hendriana et al., (2017), can be seen in Table 1.

Table 1. Indicators of Mathematical Critical Thinking

No.	Indicators of Mathematical Critical Thinking	Score
1	Check the completion of the problem solving steps	10
2	Looking for alternative solutions to problems	5
3	Typical spldv with certain characteristics	4
4	Choose the best way of solving the problem from the alternative ways of solving it	6
5	Dominate the adequacy of the data of a problem	4

In this study, several stages of activity were carried out, namely students were given a series of word problems with material on a system of two-variable linear equations. The questions were designed with the aim of testing students' understanding of the two-variable linear material exchange system as well as knowing students' mathematical critical thinking abilities. Then, students' mathematical critical thinking skills were analyzed based on students' success when answering questions. The results of working on the questions were then analyzed based on the level of student ability, the category of results of calculating student ability levels according to Indrawati et al., (2019) is shown in table 2.

Table 2. Categories of Student Ability Levels

Student scores	Category
6-13	Low
14-21	Average
22-29	High

RESULTS AND DISCUSSION

Results

Based on the results of the tests that have been completed by students in the form of descriptions of 5 questions, the test questions given are story questions in the form of a system of two-variable linear equations in which there are questions that exist in everyday life. life or what is usually called contextual problems, namely real world problems. Of the 5 items tested, after analyzing the results of their work, it turned out that there were students who already understood the steps for solving problems, but there were also those who had difficulty identifying SPLDV equations with certain characteristics. To provide more information about the statement, hhis can be seen from the results of students answers from students at high, medium, and low ability levels.

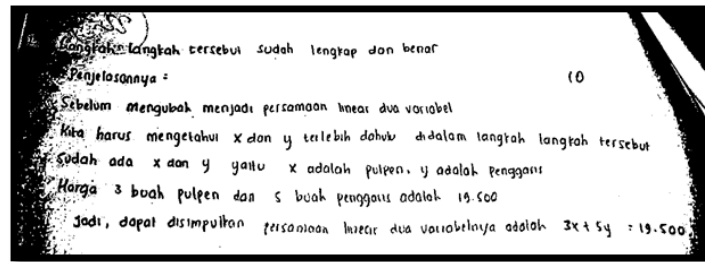


Figure 1. High Level Students to Indicator 1

Figure 1 shows the answer to high level indicator 1. Students can answer correctly and are accompanied by a r The student answered very completely and according to the steps in the process. The student answered very completely and according to the steps in the process.

$$\begin{array}{l} 2. a. x + y = 12 \\ b. x - y = 4 \\ a. 5 + 7 = 12 \\ b. 10 - 6 = 4 \end{array}$$

Figure 2. Low Level Student Answers to Indicator 2

The image is an answer from students who are at a low ability level. Based on students' answers, it can be seen that students only understand a little about the questions provided and experience difficulties when carrying out problem solving procedures. students have a little difficulty when looking for alternative solutions to problems.

3a. Bukan Persamaan linear dua variabel
b. Persamaan linear dua Variabel
c. Persamaan linear dua Variabel
d. Persamaan linear dua Variabel

Figure 3. Average Level Student Answers to Indicator 3

Figure 3 shows the average student level answers on indicator 3 are said to have not been able to understand work procedures and have not been able to solve questions correctly. students do not understand the identification process and students do not understand the characteristics of the two-variable linear equation system as a whole.

4. 5. Jalebia = 37.500
jika melakukanya 10X berarti
harga yg harus di bayar adalah 37.500
jadi lebih baik membeli
Semuanya karena harganya
lebih murah dengan harga
375.000

Figure 4. Average Level Student Answers to Indicator 4

In the figure 4, the student who answered was able to answer correctly, chose the best way to solve the problem from alternative ways of solving it in accordance with indicator 4. The student understood the meaning of the problem given and solved it using calculations.

5. Informasi tersebut kurang. Karena tidak disebutkan hari nya berapa lama dalam seminggu. 4

Figure 5. High Level Student Answers to Indicator 4

In the Figure 5, students who are at a high level of ability answer questions quite well, these students have been able to identify questions with sufficient data for an existing problem, and students are able to understand what the questions given to them mean.

The results of the analysis show variations in the level of students' critical mathematical thinking skills in solving spldv story problems. Students at high ability levels can already check the completeness of the problem solving steps, students with moderate ability levels have a little difficulty in identifying spldv equations with certain characteristics, and students with low ability levels have difficulty finding alternative problem solving. The results of students' critical thinking ability levels in solving word problems with a two-variable linear payment system in table 3.

Table 3. Percentage of Mathematical Critical Thinking Ability based on Ability Level

Mathematical Critical Thinking Ability Indicator	Score	Students' Ability Level								Total
		High	Average						Low	
		X1	X2	X3	X4	X5	X6	X7	X8	
1	Correct	10	5	8	5	5	5	2	5	45
	Wrong	0	5	2	5	5	5	8	5	35
2	Correct	3	4	3	4	1	1	2	0	18
	Wrong	2	1	2	1	4	4	3	5	22
3	Correct	2	2	0	0	2	0	2	2	10
	Wrong	2	2	4	4	2	4	2	2	22
4	Correct	5	6	6	6	6	6	6	3	44
	Wrong	1	0	0	0	0	0	0	3	4
5	Correct	2	4	3	4	2	3	3	1	22
	Wrong	2	0	1	0	2	1	1	3	10

Information :

$X(n) = \text{Students } (1,2,3,\dots,8)$

C = Correct Answer Score

W = Wrong Answer Score

In table 3 above, it is proven that overall the most students who answered correctly were in indicator 4, namely with a total score of 44 with a percentage of 92%. While overall the students who answered correctly were at least on indicator 3 with a total score of 10 with a percentage of 31%. This proves that students are able to choose the best way of solving problems from alternative ways of solving existing problems. However, it can be said that most students do not yet have the ability to identify SPLDV equations with certain characteristics.

For more details, information about the headquarters above can see at a glance the results of each student's grades after working on the SPLDV story problems. Presented starting from the lowest score to the highest score, then the scores are processed and put into the category of student ability levels so that student ability levels are included in high ability levels, medium ability levels and low ability levels as in table 4.

Table 4. Student Ability Level

Student	Student Score	Category
X8	11	Low
X7	15	Average
X6	15	Average
X5	16	Average
X4	19	Average
X3	20	Average
X2	21	Average
X1	22	High

In table 4, it is found that student X8 who has a score of 11 is included in the low ability level category, student X7 who has a score of 15 is included in the medium ability level category, student X6 who has a score of 15 is included in the medium ability level category, student X5 who has a score of 16 is included in the moderate ability category, student X4 who has a score of 19 is included in the moderate ability category, student X3 who has a score of 20 is included in the medium level ability category, student X2 who has a score of 21 included in the medium ability level category, and X1 students who had a score of 22 were included in the high level ability category.

Discussions

High Ability Level. Below is an analysis of student answer data included in the high ability level listed in Table 5.

Table 5. Analysis of Student Data from High Ability Levels

Mathematical Critical Thinking Ability Indicator	Written Test Results
Check the completion of the problem solving steps	<ul style="list-style-type: none"> • Be clear in including answers • Rewrite and explain the steps for solving the problem to find out its completeness • Using math symbols • Write sufficient conclusions in answering the problem • Have carried out the process of checking the answers again with the situation in the questions
Looking for alternative solutions to problems	<ul style="list-style-type: none"> • Be able to choose alternative solutions to problems • Does not include how to find the values of the x and y variables
Typical spldv with certain characteristics	<ul style="list-style-type: none"> • Answered fairly well regarding the two-variable linear form of sales • There is a misunderstanding of the concept of spldv so that it influences when identifying the characteristics of spldv
Choose the best way of solving the problem from the alternative ways of solving it	<ul style="list-style-type: none"> • Choose a good way of solving problems • Calculate first before choosing how to solve it
Dominate the adequacy of the data of a problem	<ul style="list-style-type: none"> • Answered quite clearly but lacked supporting data when answering

Conclusion. high-level abilities in students, students already understand when checking the completeness of the problem solving steps on indicator 1: Checking the completion of problem solving steps. This is in line with research conducted by Ikhtiar et al., (2021) students who were declared complete on the indicator checked the completeness of the problem solving steps when students wrote the information in the problem completely, used mathematical symbols completely, wrote compiling rules or completed the steps. Steps for solving questions, simply by providing a conclusion in answering the question and carrying out the process of re-checking the missing answers with the situation in the question.

Moderate Ability Level. The following is analysis data from student answers that are included in the level abilities that are being loaded in table 6.

Table 6. Analysis of Student Data from Moderate Ability Levels

Mathematical Critical Thinking Ability Indicator	Written Test Results
Check the completion of the problem solving steps	<ul style="list-style-type: none"> • Answer the questions well by explaining a little bit about the steps to solving the problem • Answering questions that are not quite right without a supporting explanation • Answering sober questions
Looking for alternative solutions to problems	<ul style="list-style-type: none"> • Able to choose alternative solutions to problems but do not solve the answer • Able to explain answers but misunderstood the SPLDV concept • Answering sober questions
Typical spldv with certain characteristics	<ul style="list-style-type: none"> • Answered fairly well regarding the two-variable linear form of sales • There is a misunderstanding of the concept of spldv so that it influences when identifying the characteristics of spldv • Unable to describe answers
Choose the best way of solving the problem from the alternative ways of solving it	<ul style="list-style-type: none"> • Answer questions with a good description • Answering questions with choices but not accompanied by supporting data • Answering sober questions
Dominate the adequacy of the data of a problem	<ul style="list-style-type: none"> • Answering questions by selecting available data instead of identifying the adequacy of data from a problem

Conclusion. It can be seen the student with moderate level abilities are less able to understand work procedures and are unable to complete them correctly using the general completion process, one of which can be seen in indicator 3: Typical spldv with certain characteristics. This is in line with the research of Septihani et al., (2020) which found that students experienced errors when reading the questions. So that in this study it can be concluded that students at the moderate level of ability when working on questions with indicators of identifying buyers of the sales system of two linear variables with certain characteristics are stated to lack understanding of the questions.

Low Proficiency Level. The following is an analysis of data from the answers of students who are included in the low ability level listed in table 7.

Table 7. Analysis of Student Data from Low Ability Levels

Mathematical Critical Thinking Ability Indicator	Written Test Results
Check the completion of the problem solving steps	• Answering a question is incomplete without a supporting explanation
Looking for alternative solutions to problems	• Not looking for alternative solutions to problems • Answering sober questions
Typical spldv with certain characteristics	• There is a misunderstanding of the concept of spldv, so it influences the identification of the characteristics of spldv
Choose the best way of solving the problem from the alternative ways of solving it	• Answering questions without counting and supported by an explanation of the answers
Dominate the adequacy of the data of a problem	• Answer questions with simple sentences

Conclusion. Students with low ability levels experience difficulties in almost all of the question indicators, but the most fatal is in indicator 2: Looking for alternative solutions to problems. This is in line with research conducted by Pebianto et al., (2019) whose findings are that students' ability to find alternatives is low because students do not understand the questions asked and students have difficulty in carrying out existing problem solving procedures.

CONCLUSION

Based on the research conducted, from the results of the analysis it can be concluded that students at a high level of ability can check the completeness of problem solving steps. Students with moderate ability levels have a little difficulty in identifying spldv equations with certain characteristics. And students with a low level of ability experience difficulty in finding alternative solutions to problems so that these students cannot solve the questions given properly and correctly. Therefore, further research is needed, so that it is hoped that it can further examine the critical thinking abilities of junior high school students in various locations and respondents.

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