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Students' Mathematical Critical Thinking Ability in Term of Self-Confidence in CORE Model Learning with Open-Ended Approach

Yunita Eka Sari[a,*], Muh. Fajar Safaatullah[a]

[a] *Department of Mathematics, Universitas Negeri Semarang, Sekaran Campus, Gunungpati, Semarang City, 50229, Indonesia*

* *E-mail address: yunitaaekasariii@students.unnes.ac.id*

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Abstract

The study aimed to: (1) to examine the effect of grade VII students' self-confidence on their the mathematical critical thinking ability of grade VII students in the CORE learning model with an open-ended approach achieved classical completeness; (2) to examine the mathematical critical thinking ability of grade VII students in the CORE learning model with an open-ended approach achieved classical completeness; (3) to examine the average mathematical critical thinking ability of grade VII students in the CORE model with an open-ended approach to that in the PBL model; and (4) to describe the mathematical critical thinking ability of grade VII students based on their self-confidence levels in the CORE learning model with an open-ended approach. This research employed a mixed-methods approach with a sequential explanatory design. The sampling technique used was simple random sampling, while subject selection applied purposive sampling. Data were collected through tests of mathematical critical thinking ability, self-confidence questionnaires, and interviews. The results showed: (1) self-confidence positively influenced mathematical critical thinking ability by 39.1%; (2) the mathematical critical thinking ability of grade VII students in the CORE model with an open-ended approach reached 81.25% classical completeness; (3) the average mathematical critical thinking ability in the CORE model was better than in the PBL model; (4) students with high self-confidence demonstrated all four stages of mathematical critical thinking (clarification, assessment, inference, and strategy/tactics), students with medium self-confidence fulfilled two stages (clarification and assessment), and students with low self-confidence achieved only the clarification stage.

1. Introduction

According to the provisions in the Law of the Republic of Indonesia Number 20 of 2003, article 37 concerning the National Education System, it was stated that knowledge and ability in mathematics were very important and must be taught to students from primary to secondary levels. The reality in the field shows that some students consider mathematics as a difficult subject, even though mathematics was important for students because it can help in solving problems in everyday life (Muna & Fathurrahman, 2023).

Mathematics was not only useful as a tool to solve complex problems, but also has a positive effect on cognitive development because mathematics can improve students' logical, analytical, systematic, critical, and creative thinking ability (Azzahra et al., 2023). Thus, critical thinking ability were an important aspect in learning mathematics. Critical thinking in learning mathematics can reduce the occurrence of errors when solving mathematical problems, so as to produce solutions with correct conclusions (Kurniawati & Ekayanti, 2020). Mathematical critical thinking ability were important abilities that enable students to understand, analyze, evaluate, and formulate solutions to mathematical problems appropriately and

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effectively. The role of teachers in improving students' mathematical critical thinking ability during the learning process was very important.

Based on the results of interviews with one of the VII grade mathematics teachers at SMP Negeri 35 Semarang, it was found that students' mathematical critical thinking ability, especially in class VII, were still underdeveloped. Students were not accustomed to developing critical thinking ability in dealing with problems, especially contextual problems. Students still have difficulty understanding the sentences in the problem and lack in using their knowledge to solve the problem, so students only write short answers that they can understand. The teacher also said that there was still a lack of student motivation and activeness when learning math in class.

Based on the results of a preliminary study of Class VII students at SMP Negeri 35 Semarang in two classes, namely VII-G and VII-H with a total of 64 students on the material of algebraic forms, an analysis of the results of the mathematical critical thinking ability test showed that there were 65.62% of students who had not succeeded in achieving the research MCC of 70. This was caused by students' difficulties in determining the ideas/concepts that would be used to solve the problem so that students were unable to reach the conclusion of the problem appropriately. This finding shows that students' mathematical critical thinking ability were not optimal and need to be improved.

In addition to paying attention to cognitive aspects, it was also important to pay attention to the affective aspects of students. One of these affective aspects was self-confidence. Hoffman & Schraw dalam Khoirunnisa & Malasari (2021) revealed that self-confidence was one of the personality factors that influence the improvement of students' critical thinking ability. Self-confidence was defined as the belief in being able to produce results, achieve goals, or carry out tasks competently (Khair & Soleh, 2021). Self-confidence in the context of education was students' belief in their abilities and ability in completing tasks or facing certain situations. In the context of mathematics learning, students' level of self-confidence can affect the way they deal with mathematical problems, their perseverance in finding solutions, and their ability to take risks in solving challenging problems. Thus, self-confidence was a relevant factor to consider in assessing students' mathematical critical thinking ability.

Based on the results of interviews and preliminary study test results, it appears that students' mathematical critical thinking ability need to be optimized so that students were able to solve problems well. In connection with these problems, a teacher must be able to organize and choose the right learning strategy to be used. There needs to be an effective learning model and approach during the learning process. One of the learning models that can provide opportunities for students to improve students' mathematical critical thinking ability was the CORE learning model.

According to Tamalene (2010) in Siregar *et al*. (2018) CORE learning model was a learning paradigm that combines a constructivist approach with student-centered learning activities and the teacher acts as a facilitator. Where according to Miller and Calfee (2004) the CORE learning model involves four steps, where students were active in constructing their own knowledge by linking and organizing new knowledge with existing ones, reflecting on the concepts learned, and expanding their understanding during the learning process. The CORE learning model allows students to relate mathematical concepts to situations in everyday life, organize their understanding through structured learning, reflect on their thinking process, and extend their understanding through further exploration.

In addition to the learning model provided by the teacher, there were other aspects that affect student outcomes in learning mathematics, such as the teacher's ability to use a learning approach. According to Gulo in Pane (2019) the learning approach was a starting point or point of view to see the problems that exist in the teaching and learning process in the classroom. The open-ended approach was one of the learning approaches that was expected to overcome these problems.

According to Khairani in Sinaga et al. (2022) open-ended approach was a learning approach that uses open problems or incomplete problems that can be answered in many ways / methods of solving or with various correct answers. With this variety of solutions and answers, it gives students freedom in solving problems. Based on the opinion of Tanjung (2019) which states that one of the approaches that can be used to improve students' mathematical critical thinking ability was the open-ended approach, because open-ended problems can stimulate important aspects of critical thinking, namely analyzing, rethinking, or generating new ideas. The open-ended approach allows students to explore a variety of possible solutions, encouraging them to think critically and analytically about complex mathematical problems.

In this study, researchers conducted research on mathematical critical thinking ability in terms of self-confidence of grade VII students in CORE model learning with an open-ended approach. The learning material used was kesebangunan. The selection of this material was because the material contains several mathematical concepts so that it can be used to measure students' mathematical critical thinking ability.

The objectives of this study were: (1) to examine the effect of grade VII students' self-confidence on their the mathematical critical thinking ability of grade VII students in the CORE learning model with an open-ended approach achieved classical completeness; (2) to examine the mathematical critical thinking ability of grade VII students in the CORE learning model with an open-ended approach achieved classical completeness; (3) to examine the average mathematical critical thinking ability of grade VII students in the CORE model with an open-ended approach to that in the PBL model; and (4) to describe the mathematical critical thinking ability of grade VII students based on their self-confidence levels in the CORE learning model with an open-ended approach.

2. Methods

This type of research was mixed methods and the research design used was sequential explanatory with quantitative research using the Posttest-Only Control Design research design. An overview of the research design can be seen in Table 1.

Table 1. Posttest-Only Control Design.

Class	Treatment	Post-test
E	X	O_1
C	-	O_2

(Source: Sugiyono, 2013)

Description:
E : Experiment Class
C : Control Class
X : Treatment (CORE model learning with open-ended approach).
O_1 : Experiment Class Post-test
O_2 : Control Class Post-test

The population in this study were all seventh grade students of SMP Negeri 35 Semarang in the 2023/2024 academic year, consisting of 8 classes, namely classes VIIA-VIIH. The sampling technique in this study used probability sampling technique, which more specifically was simple random sampling where the researcher determined the research sample randomly using a lottery. Based on the results of the lottery, class VII-G was selected as the Experiment Class which was treated with learning with the CORE model with an open-ended approach and class VII-H as the Control Class which was given learning with the PBL model. The selection of subjects in this study used purposive sampling technique based on the assessment of the results of the students' self-confidence questionnaire, where 2 research subjects were selected at each self-confidence level, namely 2 students with high self-confidence, 3 students with medium self-confidence, and 2 students with low self-confidence. Furthermore, the results of the subject's mathematical critical thinking ability test work were used as the basis for conducting interviews.

Table 2. Indicator of Mathematical Critical Thinking Ability

Stage	Indicator
Clarification	a. Stating a problem: students can determine the known information in the problem precisely and clearly. b. Analyze the meaning of the problem: students can formulate the question asked from the problem.
Assessment	a. Providing reasons that the proposed evidence/reasoning was relevant: students can dig deeper into other information that was relevant to the question in the problem. b. Determine assessment criteria: students can determine the ideas/concepts that will be used to solve the problem.
Conclusion	a. Reaching a conclusion: students can reach a conclusion from the problem. b. Generalizing: students can generalize the conclusion according to the facts in the problem.
Strategy/ tactics	a. Taking action: students can use relevant information that has been obtained previously to work on the problem coherently and correctly. b. Explaining possible actions: students can explain the steps to solve the problem that have been found well.

The instruments used in this study were mathematical critical thinking ability test instrument, self-confidence questionnaire instrument, and interview guideline instrument. The test given was a written test with description questions that were prepared based on indicators of mathematical critical thinking ability that refer to the stages of critical thinking ability Perkins & Murphy (2006). The questionnaire was used to obtain data regarding the category of self-confidence (high, medium, and low) of students by providing a set of statements related to student confidence in learning mathematics, where the questionnaire developed using a Likert Scale. The interview guide was in the form of a number of questions used as a reference to interview students regarding the answers to the mathematical critical thinking ability test. The indicators used to compile the mathematical critical thinking ability test instrument can be seen in Table 2.

Quantitative data analysis was carried out by conducting hypothesis testing with quantitative data analysis, including normality test, homogeneity test, regression test, classical completeness test, mean difference test, and proportion difference test. The normality test in this study used the Kolmogorov Smirnov test, while the homogeneity test in this study used the Levene test. Regression test was conducted using simple regression test and used to determine whether there was an effect of self-confidence of grade VII students on mathematical critical thinking ability in CORE model learning with open-ended approach. Classical completeness test was conducted using binomial test and used to determine whether the mathematical critical thinking ability of grade VII students in CORE model learning with open-ended approach reached classical completeness. The mean difference test was conducted using t-test (Independent t-Test) and used to determine whether the average mathematical critical thinking ability of grade VII students in CORE model learning with open-ended approach was better than the average mathematical critical thinking ability of grade VII students learning PBL model.

Qualitative data analysis was carried out through data reduction, data presentation, and conclusion drawing. Data validity in this study was carried out using technical triangulation and source triangulation. Technical triangulation was carried out by comparing data from the results of the mathematical critical thinking ability test with data from interviews with students. While source triangulation was done by comparing the results of mathematical critical thinking ability of various subjects of self-confidence category.

3. Result & Discussion

3.1. Quantitative Data Analysis

3.1.1 Normality Test Analysis

The normality test was used to determine whether the mathematical critical thinking ability test score data from the sample class has a normal distribution. The hypothesis tested was as follows.

H_0 : the mathematical critical thinking ability test data comes from a normally distributed population

H_1 : mathematical critical thinking ability test data was not normally distributed

Test criteria: if the *Sig.* Value > 0.05 then H_0 accepted.

The output of the Kolmogorov-Smirnov test results using SPSS 26.0 software can be seen in Table 3 below.

Table 3. Normality Test Output of MCTA Test Results

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
MCTA Test Results	.069	64	.200*	.985	64	.615

*. This was a lower bound of the true significance.
a. Lilliefors Significance Correction

Obtained Sig value. = 0.200 > 0.05, so H_0 accepted, which means that the data from the mathematical critical thinking ability (MCTA) test was normally distributed.

3.1.2 Homogeneity Test Analysis

Homogeneity test to determine whether the data characteristics of the mathematical critical thinking ability test scores of the sample classes taken were uniform (homogeneous) or not. The hypothesis tested was as follows.

H_0 : $\sigma_1{}^2 = \sigma_2{}^2$ (the variance of the test results of the mathematical critical thinking ability of the two classes was the same = homogeneous)

H_1 : $\sigma_1{}^2 \neq \sigma_2{}^2$ (the variance of the test results of the mathematical critical thinking ability of the two classes was not the same = not homogeneous)

Test criteria: if the *Sig.* Value > 0.05 then H_0 accepted.

The output of the Levene test results assisted by SPSS 26.0 software can be seen in Table 4. below.

Table 4. Homogeneity Test Output of MCTA Test Results

Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
MCTA Test Results	Based on Mean	1.985	1	62	.164
	Based on Median	1.760	1	62	.189
	Based on Median and with adjusted df	1.760	1	56.914	.190
	Based on trimmed mean	1.959	1	62	.167

Based on the output of the Test of Homogeneity of Variances table, the Sig value was obtained. Based on Mean = 0.164 > 0.05, so H_0 accepted, which means that the variance of the test results of the mathematical critical thinking ability of the two classes was the same = homogeneous.

3.1.3 Regression Test Analysis

Regression test was conducted to determine whether there was an effect of self-confidence of grade VII students on mathematical critical thinking ability in CORE model learning with an open-ended approach. The hypothesis tested was as follows.

$H_0 : \beta_1 = 0$ There was no effect of self-confidence of grade VII students on mathematical critical thinking ability in CORE model learning with an open-ended approach.

$H_1 : \beta_1 \neq 0$ There was an effect of self-confidence There was no effect of self-confidence of grade VII students on mathematical critical thinking ability in CORE model learning with an open-ended approach.

Test criteria: if the *Sig*. value < 0.05 then H_0 rejected.

ANOVA[a] output table of simple regression test assisted by SPSS 26.0 software can be seen in Table 5. below.

Table 5. ANOVA[a] Simple Regression Test Output

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3814.886	1	3814.886	19.251	.000[b]
	Residuals	5945.114	30	198.170		
	Total	9760.000	31			

a. Dependent Variable: Self-Confidence
b. Predictors: (Constant), Experimental Class MCTA

Based on the ANOVA table output[a] obtained Sig value. = 0.000 < 0.05 then H_0 rejected. That is, there was an effect of self-confidence on students' mathematical critical thinking ability. Coefficients table[a] simple regression test output can be seen in Table 6. following.

Table 6. Coefficients[a] Simple Regression Test Output

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	17.455	16.890		1.033	.310
	MCTA Experimental Class	.950	.216	.625	4.388	.000

a. Dependent Variable: Self-Confidence

The regression equation can be seen from the output of the Coefficients table[a] on Unstandardized Coefficients B, the value was obtained a = 17.455 and b = 0.950. So the regression equation was $\hat{y} = 17.455 + 0.950x$. By looking at the regression coefficient value which was positive, self-confidence has a positive effect on students' mathematical critical thinking ability. Model Summary Table[a] simple regression test output can be seen in Table 7. below.

Table 7. Model Summary[a] Simple Regression Test Output

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.625[a]	.391	.371	14.077

a. Predictors: (Constant), Experimental Class MCTA

Based on the output of the Model Summary table[a] on R Square. Obtained the value of R square or $R^2 = 0.391 = 39.1\%$. This means that the effect of self-confidence There was no effect of self-confidence of grade VII students on students' mathematical critical thinking ability in CORE model learning with an open-ended approach was as follows 39.1% and 60.9% others were caused by other factors.

The results showed that the higher the self-confidence of students, the higher their mathematical critical thinking ability. This was supported by research findings Melyana & Pujiastuti (2020) that the factors that influence the high and low self-confidence of students include: (1) students with good self-confidence tend not to be afraid to take risks in solving problems and tend to have many ideas in working on the problems at hand; (2) students with poor self-confidence tend to answer questions in accordance with the knowledge gained and prioritize memorization, so that these students were not brave in making decisions when solving problems. This research was also supported by the findings of Hajar & Minarti (2019) that the lack of self-confidence in students results in less motivation in achieving success in answering math problems. He also found that other factors that can affect students' mathematical critical thinking ability were willingness to learn and solve math problems, learning motivation and student self-efficacy.

3.1.4 Analysis of Classical Completeness Test

The classical completeness test was conducted to determine whether the test results of mathematical critical thinking ability of grade VII students who followed the CORE model learning with an open-ended approach reached the desired classical completeness standard. The Minimum Completeness Criteria (MCC) in this study was set at 70. The criteria for classical completeness were met if more than or equal to 75% of the students in the class have reached or exceeded the predetermined standard score of 70. The hypothesis tested was as follows.

$H_0 : \pi = 74.5\%$ the test results of mathematical critical thinking ability of grade VII students in CORE model learning with an open-ended approach have not yet reached classical completeness, namely 75%.

$H_1 : \pi > 74.5\%$ the test results of mathematical critical thinking ability of grade VII students in CORE model learning with an open-ended approach have reached classical completeness, namely 75%.

Test criteria: if the P-value or Sig. (1-tailed) > 0.05 then H_0 rejected.

The output of the Binomial Test results assisted by SPSS 26.0 software can be seen in Table 8 below.

Table 8. Binomial Test Output

Binomial Test

		Category	N	Observed Prop.	Test Prop.	Exact Sig. (1-tailed)
Experimental Class MCTA Test Results	Group 1	<= 70	6	.19	.25	.278[a]
	Group 2	> 70	26	.81		
	Total		32	1.00		

a. Alternative hypothesis states that the proportion of cases in the first group < .25.

Based on the Binomial Test table output, the value of Exact Sig. (1-tailed) = 0.278 > 0.05 then H_0 rejected. This means that the percentage of students in the experimental class who were classically complete learning on the test of mathematical critical thinking ability of grade VII students in CORE model learning with an open-ended approach was proportionally more than 75%.

3.1.5 Mean Difference Test Analysis

The mean difference test was conducted to determine whether the average mathematical critical thinking ability of grade VII students in CORE model learning with an open-ended approach was better than the average mathematical critical thinking ability of grade VII students in PBL model learning. The hypothesis tested was as follows.

$H_0 : \mu_1 = \mu_2$ the average test results of mathematical critical thinking ability of grade VII students in CORE model learning with open-ended approach was the same as the average test results of mathematical critical thinking ability of grade VII students in PBL model learning

$H_1 : \mu_1 \neq \mu_2$ the average test results of mathematical critical thinking ability of grade VII students in CORE model learning with open-ended approach was different from the average test results of mathematical critical thinking ability of grade VII students in PBL model learning.

Test criteria: if the Sig. value < 0.05 then H_0 rejected.

The output of the t-test results (Independent t-Test) assisted by SPSS 26.0 software can be seen in Table 9 below.

Table 9. Independent t-Test Output of MCTA Test Results

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
MCTA Test Results	Equal variances assumed	1.985	.164	3.401	62	.001	11.563	3.399	4.768	18.357
	Equal variances not assumed			3.401	58.024	.001	11.563	3.399	4.758	18.367

Based on the Independent Samples Test table output, the Sig value was obtained. (2-tailed) = 0.001 < 0.05 then H_0 rejected. This means that the average test results of mathematical critical thinking ability of grade VII students in CORE model learning with an open-ended approach were different from the average test results of mathematical critical thinking ability of grade VII students in PBL model learning.

The Group Statistics table of the Independent t-Test output can be seen in Table 10 below.

Table 10. Group Statistics Independent t-Test Output of MCTA Test

Group Statistics

	Class	N	Mean	Std. Deviation	Std. Error Mean
MCTA Test Results	Experiment Class	32	77.19	11.682	2.065
	Control Class	32	65.63	15.273	2.700

By looking at the output of the Group Statistics table, it was obtained a large difference in the average test results of the mathematical critical thinking ability of the experimental class of 77.19 and the average test results of the control class of 65.63.

3.2. Qualitative Data Analysis

The results of the questionnaire and the average test results of mathematical critical thinking ability for each category of self-confidence of students in class VII-G at SMP Negeri 35 Semarang were shown in Table 11 below.

Table 11. Questionnaire Results and Average Mathematical Critical Thinking Ability Test Results for Each Self-Confidence Category

Category Self-Confidence	Many Students	Percentage	Average Test Results Critical Thinking
High	12	37%	84.6
Medium	15	47%	76.6
Low	5	16%	61.2

From these results, it was found that self-confidence has a positive and significant relationship with students' mathematical critical thinking ability. This means that high self-confidence affects students' mathematical critical thinking ability even though the contribution was not that large.

In the implementation of CORE model learning with an open-ended approach, in the first stage the teacher was more dominant in learning, in the second and fourth stages students were more dominant in learning, then in the third stage teachers and students together dominate learning. In this CORE model learning, it can be seen that students dominate or were more active in learning, where student activeness during learning was due to students discussing with their groupmates to solve problems then students also present the results of their discussions. As with research conducted by Ayudia & Mariani (2022) students were more interested and active in teaching and learning activities when using the CORE learning model because they can discuss with their groupmates and find ideas and information that help them understand the material. In line with the research of Friscillia et al. (2021) the increase in students' mathematical critical thinking ability in classes that apply the CORE learning model was due to students' active participation in group discussions, where they can build and explore new concepts during learning.

3.2.1 Mathematical Critical Thinking Ability of Students with High Self-Confidence

The following is one of the results of data analysis carried out on one of the subjects with high self-confidence category in question number 2.

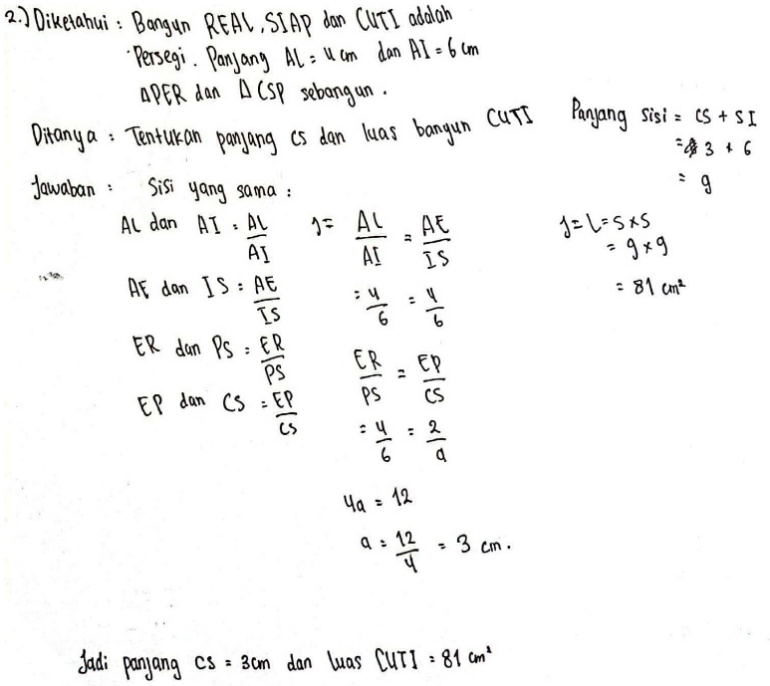

Figure 1. Work Results of Subjects with High Self-Confidence on Question Number 2

From the results of these answers, triangulation was then carried out with the results of interviews with the subjects. The following are the results of the analysis of the mathematical critical thinking ability of subjects with high self-confidence in question number 2, presented in Table 12. as below.

Table 12. Results of Data Analysis for Subjects with High Self-Confidence on Question Number 2

Stage of MCTA	Indicators of MCTA	Test	Interview	Conclusion	
Clarification	a. Stating a problem	Able to Write	Able to Say	Capable	Capable
	b. Analyze the meaning of the problem	Able to Write	Able to Say	Capable	
Assessment	a. Providing reasons that the proposed evidence/reasoning was relevant	Able to Write	Able to Say	Capable	Capable
	b. Determine assessment criteria	Able to Write	Able to Say	Capable	
Conclusion	a. Reaching a conclusion	Able to Write	Able to Say	Capable	Capable
	b. Generalizing	Able to Write	Able to Say	Capable	
Strategy/ tactics	a. Taking action	Able to Write	-	Capable	Capable
	b. Explaining possible actions	-	Able to Say	Capable	

The analysis showed that subjects with high self-confidence category were able to fulfill the four stages of mathematical critical thinking ability, namely clarification, assessment, inference and strategy/tactics. At the clarification stage, students with high self-confidence category were able to identify relevant information in the problem and express the questions asked clearly based on this information. Students with high self-confidence category have a good ability to understand the mathematical problems given. At the assessment stage, students with high self-confidence category were able to explore more deeply other information related to the questions in the problem and choose the right ideas or concepts to solve the

problem effectively. At the inference stage, students with high self-confidence category were able to reach the conclusion of the problem and generalize the conclusion based on the facts given in the problem. At the strategy/tactic stage, students with high self-confidence category were able to utilize relevant information that has been obtained previously to solve the problem systematically and precisely and can also describe the steps of solving the problem clearly.

The results of this exposure were in line with the findings of the study Melyana & Pujiastuti (2020) that students who have good self-confidence were able to express known information correctly, as well as express initial ideas and solution strategies that were clear and appropriate, so that they can answer questions correctly. Also reinforced by research Rohmat & Lestari (2019) that students who have a high level of self-confidence tend to have good critical thinking ability. Students with a high level of self-confidence tend not to give up easily when facing challenges, including in solving difficult math problems (Umbara & Priatna, 2022). Thus, it can be concluded that students who have a high level of self-confidence will always be confident in their ability to solve difficult problems, which in turn will improve their mathematical critical thinking ability.

3.2.2 Mathematical Critical Thinking Ability of Students with Medium Self-Confidence

The following is one of the results of data analysis carried out on one of the subjects with medium self-confidence category in question number 2.

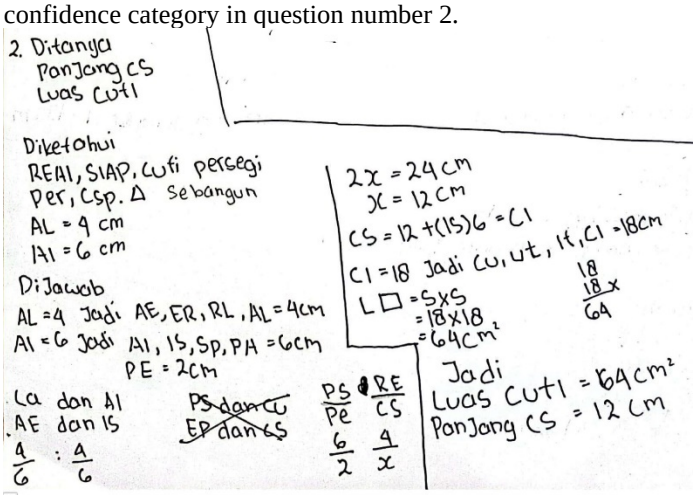

Figure 2. Work Results of Subjects with Medium Self-Confidence on Question Number 2

From the results of these answers, triangulation was then carried out with the results of interviews with the subjects. The following are the results of the analysis of the mathematical critical thinking ability of subjects with medium self-confidence in question number 2, presented in Table 13. as below.

Table 13. Results of Data Analysis for Subjects with medium Self-Confidence on Question Number 2

Stage of MCTA	Indicators of MCTA	Test	Interview	Conclusion	
Clarification	a. Stating a problem	Able to Write	Able to Say	Capable	Capable
	b. Analyze the meaning of the problem	Able to Write	Able to Say	Capable	
Assessment	a. Providing reasons that the proposed evidence/reasoning was relevant	Able to Write	Able to Say	Capable	Capable
	b. Determine assessment criteria	a Little Less Able	Able to Say	Capable	
Conclusion	a. Reaching a conclusion	Didn't Write	Able to Say	Less Able	Less Able
	b. Generalizing	Didn't Write	Able to Say	Less Able	
Strategy/ tactics	a. Taking action	Less Accurate	-	Less Accurate	Less Able
	b. Explaining possible actions	-	Able to Say	Capable	

The analysis showed that subjects with medium self-confidence category were only able to fulfill two stages of mathematical critical thinking ability, namely clarification and assessment. Students with medium self-confidence category were less able to fulfill the stages of inference and strategy/tactics. At the clarification stage, students with medium self-confidence category were able to identify the information available in the problem and formulate the questions asked appropriately based on the contents of the problem. At the assessment stage, students with medium self-confidence category were able to more deeply investigate other information relevant to the questions in the problem and determine the right ideas or concepts to solve the problem effectively. At the inference stage, students with medium self-confidence category have not been able to draw conclusions from the problem appropriately so that they have not been able to generalize the conclusion according to the facts in the question. At the strategy/tactic stage, students with medium self-confidence category had difficulty in using relevant information that they had previously obtained to solve the problem in a structured and appropriate manner.

The results of the above explanation were in line with the results of the study Putri *et al*. (2022)) that students with medium self-confidence categories do not have a high enough sense of optimism and responsibility to be able to solve the problems or problems given, which results in less than optimal results and only mastering mathematical critical thinking ability at a medium level. Khoirunnisa & Malasari (2021) also found that students with a medium level of self-confidence could solve critical thinking problems, but were less thorough in analyzing the problem, which resulted in errors in the answers given. In addition, students who have a medium level of self-confidence tend to hesitate and fear making mistakes when working on math problems (Umbara & Priatna, 2022). Overall, the conclusion that can be drawn was that students who have a medium level of self-confidence can actually reach a higher stage of critical thinking if they were more confident in their abilities.

3.2.3 Mathematical Critical Thinking Ability of Students with Low Self-Confidence

The following is one of the results of data analysis carried out on one of the subjects with low self-confidence category in question number 2.

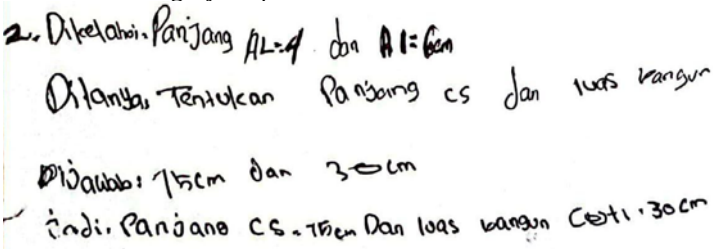

Figure 3. Work Results of Subjects with Low Self-Confidence on Question Number 2

From the results of these answers, triangulation was then carried out with the results of interviews with the subjects. The following are the results of the analysis of the mathematical critical thinking ability of subjects with low self-confidence in question number 2, presented in Table 14. as below.

Table 14. Results of Data Analysis for Subjects with low Self-Confidence on Question Number 2

Stage of MCTA	Indicators of MCTA	Test	Interview	Conclusion	
Clarification	a. Stating a problem	Able to Write	Able to Say	Capable	Capable
	b. Analyze the meaning of the problem	Able to Write	Able to Say	Capable	
Assessment	a. Providing reasons that the proposed evidence/reasoning was relevant	Didn't Write	Didn't Say	Not Able	Not Able
	b. Determine assessment criteria	Didn't Write	Didn't Say	Not Able	
Conclusion	a. Reaching a conclusion	Not Exactly	Not Exactly	Not Exactly	Not Able
	b. Generalizing	Not Exactly	Not Exactly	Not Exactly	
Strategy/ tactics	a. Taking action	Didn't Write	-	Not Able	Not Able
	b. Explaining possible actions	-	Didn't Say	Not Able	

The analysis showed that subjects with low self-confidence category were only able to fulfill one stage of mathematical critical thinking ability, namely clarification. Students with low self-confidence category were unable to fulfill the stages of assessment, inference, and strategy/tactics. At the clarification stage, students with low self-confidence category were able to identify the information available in the problem and formulate the questions asked appropriately based on the content of the problem. At the assessment stage, students with low self-confidence category were unable to more deeply investigate other information relevant to the questions in the problem and determine the right ideas or concepts to solve the problem effectively. At the inference stage, students with low self-confidence category cannot draw conclusions from the problem appropriately so that they cannot generalize the conclusion according to the facts in the question. At the strategy/tactic stage, students with low self-confidence category had difficulty in using relevant information that they had previously obtained to solve the problem in a structured and appropriate manner. The subject did not write down the strategy in answering the question, during the interview the subject mentioned that the subject guessed the answer.

The results of the above explanation were in line with the results of the study Khoirunnisa & Malasari (2021) that students with low self-confidence categories have low mathematical critical thinking ability. This was also reinforced by the results of research Hajar & Minarti (2019) that students tend to have a low level of mathematical critical thinking ability due to a lack of self-confidence when facing math. The results of research conducted by Melyana & Pujiastuti (2020) also stated that students who lack self-confidence tend to answer questions only based on the knowledge they have, rely more on memorization, and do not dare to take risks in dealing with problems. Thus, it can be concluded that students who have a low level of self-confidence do not have the courage to convey their opinions completely in providing the steps of solution, because they still have difficulty in connecting their understanding in solving problems. This shows that students have difficulty in solving problems accurately due to their lack of mathematical critical thinking ability.

4. Conclusion

Based on the results of research and discussion on mathematical critical thinking ability in terms of self-confidence of grade VII students in CORE model learning with open-ended approach, it shows that: (1) There was a positive influence of self-confidence of grade VII students on mathematical critical thinking ability in CORE model learning with open-ended approach of 39.1%; (2) mathematical critical thinking ability of grade VII students in CORE model learning with open-ended approach reaches 81.25% classical completeness; (3) The average mathematical critical thinking ability of grade VII students in CORE model learning with open-ended approach was better than PBL model learning; (4) Students with high self-confidence category were able to fulfill all four stages of mathematical critical thinking ability namely clarification, assessment, inference and strategy/tactics. Students with medium self-confidence category were only able to fulfill two stages of mathematical critical thinking ability, namely clarification and assessment. Students with low self-confidence category were only able to fulfill one stage of mathematical critical thinking ability, namely clarification.

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