Analysis Of Students' Critical Thinking Abilities in Solving Mathematical Problems on Rectangular Material

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Abstract. Critical thinking ability are needed in solving mathematical problems to determine initial ideas so that they can determine solutions well. Critical thinking ability is the ability to understand and think carefully so that you can decide and conclude an idea effectively. This research aims to determine students' critical thinking abilities in solving mathematical problems on rectangulars. This research was conducted at SDN Cisitu Bandung with the research subjects being class V students. The research method used was descriptive qualitative. The data collection techniques used in this research were tests and interviews. The data was analyzed by data reduction, data presentation, and drawing conclusions. The research results show that students' critical thinking abilities in solving problems vary. This can be seen from the achievement of critical thinking indicators by students. This research obtained the results: 1) students with high problem solving abilities have high critical thinking abilities, because they can fulfill all critical thinking indicators; 2) students with moderate problem solving abilities have a moderate critical thinking ability because they can fulfill 5 critical thinking indicators; 3) students with low problem solving abilities have low critical thinking abilities because they are able to fulfill 2 critical thinking indicators. abstract describes problems, objectives, methods, results, and conclusions. There are no quotes in the abstract section.

Keywords: Creative Thinking Ability, Mathematical Problem Solving, Rectangular.keyword.

INTRODUCTION

The results of the 2018 Program for International Student Assessment (PISA) study (OECD, 2018) placed Indonesia in the lowest 7th place among 72 other countries in the mathematics category. Based on the results of this study, it can be concluded that students' high-level thinking abilities in Indonesia are still relatively low. One of the high-level thinking skills is critical thinking ability. The problem that is often encountered in learning mathematics is the lack of critical thinking skills in solving word problems. At the elementary school level, there are still many problems related to solving story problems that contain mathematical critical thinking skills. It is still often found that students lack the ability to identify, understand a concept, and are lacking in analyzing or evaluating mathematical problem solving (Zetriuslita et al., 2016). Mathematics is a basic science studied at all levels of education in Indonesia. The Merdeka Curriculum gives students more freedom of thought in understanding problems, developing problem-solving strategies, and proposing new ideas.

Thinking is a person's ability to remember, consider something and be able to make decisions about the problems they face (Sulthoniyah, 2017). The thinking process can be defined as an activity that occurs internally in the human brain, so to find out how students think in solving problems, something is needed that can stimulate students' thinking processes (Kusaeri et al., 2018). Thus, thinking is the ability to remember and stimulate events that involve the brain to remember something and make decisions about a problem. The thinking ability that must be developed is the ability to think critically. So critical thinking skills are one of the competencies that students must have when studying mathematics. So, the teacher's main activity is not only explaining the material, but also training and guiding students to think critically and creatively in solving problems (Amanda & Nusantara, 2020).

Critical thinking skills need to be trained optimally in mathematics learning in order to develop students' critical thinking abilities. Astuti (2018) states that critical thinking is self-

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knowledge in deciding a problem that results in analysis, interpretation, evaluation and intervention, using concrete evidence by showing evidence, concepts, methodology, criteria or contextual considerations as the basis for decision making. Thinking ability is the ability to process information mentally or cognitively. More formally, thinking is the rearrangement or cognitive manipulation of both information from the environment and symbols which are symbolic representations of an event. According to Hendriana et al., (2017) critical thinking skills are an essential mathematical basis and need to be possessed by students studying mathematics. To develop critical mathematical thinking skills, students are expected to have a fighting attitude in solving mathematical problems (Munawwarah et al., 2020, Seftiani et al., 2021). So that students are able to think critically and analytically, process information, explore ideas, analyze arguments, and make rational decisions.

Based on several opinions, researchers conclude that critical thinking is a process of receiving, absorbing and processing information in the surrounding environment through the five senses, then reorganizing and processing it by the brain to understand and draw conclusions which are considered knowledge. This thinking is the impact or result of the learning process in the classroom. So a student's success in a lesson is determined by the student's level of thinking. One of the abilities mastered by students is the ability to think at a high level because the ability to think at a high level is one of the stages of thinking that cannot be separated from everyday life. Every student is directed to have high-level thinking patterns because high-level thinking abilities enable someone to think critically with the help of knowledge and experience in an effort to determine decisions and solve problems in new situations.

In field conditions, it shows that students' abilities in solving mathematical problems are still relatively low (Asih & Ramdhani, 2019). Apart from that, there are students who don't like mathematics because it is difficult to do when given problems, especially those related to HOTS questions (Megawati et al., 2023). Students are less able to complete problem solving questions (Sopian & Afriansyah, 2017). Many students have difficulty understanding problems, especially multifaceted problems, so students often make mistakes when solving the problems given. This is in accordance with research conducted by Fauzi & Arisetyawan (2020) which shows that students at SD Negeri Asmi 033 Bandung City have difficulty answering multifaceted questions. These difficulties include students having difficulty using concepts; students have difficulty using the principles; and students have difficulty solving story problems. Mathematics learning in elementary school education units has several scopes including numbers, geometry, measurement and data processing. In mathematics learning, knowledge that can be honed and developed is related to knowledge that has been systematically organized including rules, ideas, logical reasoning and logical structures (Ekowati et al., 2019). One of the subjects of mathematics studied in elementary school is about quadrilaterals. Learning mathematics on the concept of quadrilaterals is very important to learn for elementary school students because there are many objects around students that are related to quadrilaterals and can encourage logical thinking and can help students hone problem solving skills.

Problem solving is central in mathematics learning (Rahmadi, 2015). This is understandable because problem solving is close to everyday life. In addition, problem solving involves optimal thinking processes. So that the process of solving problems in mathematics can be carried out well, one of the steps that can be taken is by respecting the differences of each student (Rahmani & Widyasari, 2017). By indepth observation of students, it can be realized that there are various types of differences in thinking. Critical thinking skills are needed to determine initial ideas in solving mathematical problems. Several studies conducted previously found that students' critical thinking skills at SD Muhammadiyah 19 Surabaya could be obtained and improved through the use of problem based learning models (Sa'diah et al., 2023).

Analysis of primary school students' critical thinking skills in mathematics learning shows that 86% of students fall into the critical category. This means that most students are able to think critically in learning mathematics (Azizah et al., 2018). Research by Sartika (2019) shows the results that one approach that brings and develops the competence of fifth grade students at SD Asy - Syafiiyah Internasional Medan to incorporate critical thinking into learning and make students active is the Realistic Mathematics Approach (PMR).

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The results of this research can be said that critical thinking skills are really needed by students to solve mathematical problems. In this research, researchers will use indicators from Facione. The indicators of critical thinking abilities according to Facione (in Faradisa et al., 2022) consist of interpretation, analysis, inference, evaluation, explanation and self-regulation. Each indicator of critical thinking ability is explained as follows. In the interpretation indicator, individuals can write down what is asked about the question clearly and precisely. In indicator analysis, students can write down the relationship between the concepts used in solving problems. In the inference indicator, individuals can conclude from what is asked logically. On the evaluation indicator, individuals can write down the problem solving. In indicator explanation, individuals can provide reasons for the conclusions drawn. In the self-regulation indicator, individuals can look back at the written answers.

Sulistiani & Masrukan (2016) stated that developing critical thinking skills and abilities allows students to become accustomed to facing challenges and solving problems by analyzing their own thoughts to decide on choices and draw conclusions, so that quality graduates are produced. So it can be said that critical thinking is very important, because it is closely related to quality graduates. Critical thinking skills are important to understand a subject in mathematics so that students are able to face global challenges. This involves the ability to carefully identify, understand and evaluate the information or problems encountered, as well as the ability to develop deep understanding.

Realizing how important it is to develop students' critical thinking skills since elementary school, mathematics learning must be implemented that involves students more actively in the learning process itself. In line with research by Azizah et al., (2018) who said that critical thinking skills can be applied in elementary schools because they use an independent curriculum so that students can familiarize themselves with critical thinking skills in learning mathematics about quadrilateral material. So critical thinking skills need to be applied from elementary school so that students have sufficient provisions to study the problems they face. A polygon is a two-dimensional geometric shape consisting of straight sides connected to form a closed circuit. Solving multi-faceted material questions requires students' good critical thinking skills to be able to analyze problems, identify questions, and determine solutions systematically and correctly.

Based on this background, researchers will analyze students' critical thinking abilities in solving mathematical problems in quadrilaterals in elementary schools. The aim of this research is to describe students' critical thinking abilities in quadrilateral material and to find out the indicators of critical thinking abilities that students master best.

METHOD

The method used in this research is a descriptive qualitative method. The purpose of this research is to describe the findings of the analysis of students' critical thinking skills in solving mathematical problems in quadrilaterals in elementary school. This research was carried out at SDN 053 Cisitu Bandung. The subjects of this research were class V students at SDN 053 Cisitu Bandung. The selection of subjects in this study used a purposive sampling technique with certain considerations, namely a) class teacher suggestions; and b) students can communicate well. The data collection techniques used in this research were tests and interviews. Tests of students' critical thinking abilities and interviews were aimed at 3 students including one subject with high problem solving abilities, one subject with medium problem solving abilities and one subject with low problem solving abilities. This is intended to obtain the information needed for research based on the guidelines that have been prepared. Testing the validity of the data in this study used technical triangulation, namely by comparing the results of critical thinking ability tests, interview results, and field note results. The data analysis techniques used in this research are (1) data reduction, (2) data presentation, and (3) drawing conclusions.

RESULTS

The results of this research were obtained through a mathematics learning process which was carried out using the Problem Based Learning Model. The data on the results of the critical thinking ability test was taken by providing questions describing problem solving on rectangular

material. The critical thinking ability test instrument includes six indicators of critical thinking ability by Facione, namely interpretation, analysis, inference, evaluation, explanation and self-regulation. In the interpretation indicator, students can write what is asked about the question clearly and precisely. In indicator analysis, students can write down the relationship between the concepts used in solving problems. In the inference indicator, students can conclude from what is asked logically. On the evaluation indicator, students can write down the problem solving. In indicator explanation, students can provide reasons for the conclusions drawn. In the self-regulation indicator, individuals can look back at the written answers.

The data obtained from critical thinking ability tests and interviews were analyzed and triangulated to obtain valid data. Valid data is used to determine students' critical thinking processes at each level of students' critical thinking in solving problems. The data obtained is presented in the following table.

Table 1. Research Subject

No.	Subject	Problem Solving Ability Score	Subject Category with Problem Solving Ability
1.	S1	100	Tinggi
2.	S2	88	Sedang
3.	S3	45	Rendah

Based on the results of the problem-solving ability test and recommendations from the class teacher who teaches class V at SDN 053 Cisitu Bandung, 3 research subjects were selected, including 1 subject with high problem-solving ability, called the S1 subject, namely QS, 1 subject with medium problem-solving ability, called the S2 subject, namely AFA, and 1 subject with low solving ability is called the S3 subject, namely MRRA. The results of the interview showed that subject S1 already understood the problem presented, then subject S2 was less careful because he did not double-check the answers he had made, while subject S3 did not understand the strategy for solving the questions and still made mistakes in answering critical thinking ability test questions.

Results of Analysis of Critical Thinking Ability of Students with High Problem Solving Ability (S1)

Based on the test results, it shows that S1 subjects have met all indicators of critical thinking abilities. The interpretation indicator is fulfilled which is marked by writing the information from the question clearly and precisely. Then the analysis indicator is shown to write down the relationship between the concepts used in solving the problem correctly. In the inference indicator, it can be seen that subject S1 can conclude from what is asked logically. In the evaluation indicator, you have written down the problem solving based on the strategy used. In the explanation indicator, subject S1 has provided reasons for the conclusions drawn in solving the questions. Finally, in the self-regulation indicator, subject S1 can recheck the answers that have been given. Based on the test results, it was also confirmed by the interview results, namely that all indicators of the questions asked were fulfilled, students were able to answer them. In the interpretation indicator, in interview activities students are able to explain the problems presented in the questions. In indicator analysis, students are able to explain the relationship between the concepts contained in the question. In the inference indicator, students can explain what is asked in the question. In the indicator evaluation, students can explain the strategies used in solving the questions. In indicator explanation, students can provide reasons for the conclusions they have reached. Then, on the seld-regulation indicator, students are confident in the answers they have written.

The following is an example of the results of student work on undergraduate subjects. This question was taken, selected and presented because the weight of the question is to measure high knowledge with a C6 level of thinking which includes indicators of critical thinking, namely interpretation, analysis, explanation, inference, evaluation and self-regulation. Apart from that, in working on this question students need abilities that refer to all indicators of critical thinking ability so that this question item is taken to analyze and compare the abilities of each S1, S2 and S3 subject. The results of subject S1's work are presented in the following figure.
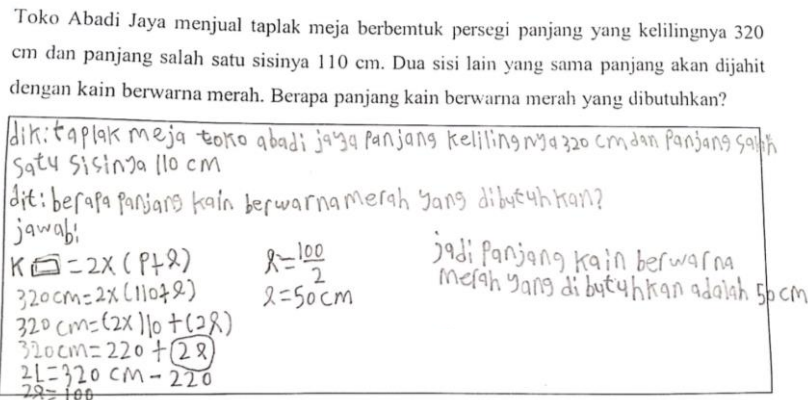
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Figure 1. S1 Subject Work Results

Based on Figure 1, the information that subject S1 obtained was that there was a rectangular tablecloth with one side 110 cm. The other two sides of the tablecloth will be sewn with red cloth. Subject S1 stated what was asked in the question, namely how long the red cloth was needed for the tablecloth. The results of the S1 subject's work have met the interpretation indicators with the criteria of being able to write information from the questions clearly and precisely. Next, subject S1 found the length and width of the quadrilateral by stating the length and width of the quadrilateral based on the perimeter formula. Based on the test results, S1 subjects have fulfilled the analysis indicators with the criteria of being able to write the relationships between the concepts used in solving questions clearly and precisely.

Based on the previous S1 subject's answers, the length and width were obtained. So subject S1 concluded that. From the test results, S1 subjects have fulfilled the explanation indicators with the criteria of being able to provide reasons for the conclusions drawn clearly and precisely. After obtaining several possibilities beforehand. From the test results, S1 subjects have met the inference indicators with the criteria of being able to conclude logically from what is asked. From the test results, S1 subjects have met the indicators of evaluation and self-regulation with the criteria of being able to write down problem solutions clearly and precisely and being able to review the answers given.

The results of written tests and interviews state that the interpretation indicators are in line with research conducted by Azizah et al., (2018), and Marfu'ah & Julaeha (2021) which states that students with high critical thinking abilities can Write what is known and what is asked from the question accurately and completely. The indicator analysis is in line with the research results of Munira et al., (2020) which states that students have fulfilled the analysis indicators if students can identify the relationship between statements, questions, and the concepts given in the questions. Azizah et al., (2018) agree with this research on inference indicators that students who have high critical thinking skills can make these strategies correctly because they has gone through the interpretation and analysis stage so that he really understands the problem and can solve it. The results of research on evaluation and self-regulation indicators are in line with research that students with a high level of critical thinking can re-examine answers according to the initial plan and by using other methods, can draw clear conclusions. From this description, S1 subjects fulfill the six indicators of critical thinking abilities, namely interpretation, analysis, inference, evaluation, explanation and self-regulation.

Results of Analysis of Students' Critical Thinking Ability with Medium Problem Solving Ability (S2)

Based on the test results, it shows that the Master's subject has met five indicators of critical thinking ability. The interpretation indicator is fulfilled which is marked by writing the information from the question clearly and precisely. Then the analysis indicator is shown to write down the relationship between the concepts used in solving the problem correctly. In the inference indicator, it can be seen that the S2 subject can conclude from what is asked logically. In

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the evaluation indicator, you have written down the problem solving based on the strategy used. In the explanation indicator, the S2 subject has provided reasons for the conclusions drawn in solving the questions. Finally, on the self-regulation indicator, subject S2 has not been able to recheck the answers that have been given. Based on the test results, it was also strengthened by the results of the interview, namely by fulfilling the five indicators of the questions asked, students were able to answer them. In the interpretation indicator, in interview activities students are able to explain the problems presented in the questions. In indicator analysis, students are able to explain the relationship between the concepts contained in the question. In the inference indicator, students can explain what is asked in the question. In the indicator evaluation, students can explain the strategies used in solving the questions. In indicator explanation, students can provide reasons for the conclusions they have reached. Then, on the seld-regulation indicator, students are not sure about the answers they have written.

In line with this, the following is data on the critical thinking abilities of master's subjects in solving mathematical problems on problems with the concept of the perimeter of a rectangle which includes indicators of critical thinking, namely interpretation, analysis, explanation, inference and evaluation. The results of subject S2's work are presented in the following figure.

Figure 2. S2 Subject Work Results

Based on Figure 2, the information that subject S2 obtained was that there was a rectangular tablecloth that had a perimeter of 320 cm and one side of 110 cm. Subject S2 stated what was asked in the question, namely the length of red cloth needed. The results of the Master's subject's work have met the interpretation indicators with the criteria of being able to write information from the questions clearly and precisely. Next, subject S2 found the length and width of the quadrilateral by stating the length and width of the quadrilateral based on the perimeter formula. Based on the test results, the master's subject has fulfilled the analysis indicators with the criteria of being able to write the relationship of the concepts used in solving questions clearly and precisely.

Based on the answers obtained by the previous Master's subject in terms of length and width, the test results of the Master's subject have fulfilled the explanation indicators with the criteria of being able to provide reasons for the conclusions drawn clearly and precisely. After obtaining several possibilities beforehand. From the test results, the Master's subject has met the inference indicators with the criteria of being able to conclude logically from what is asked. From the test results, the Master's subject has met the evaluation indicators but has not yet produced the self-regulation indicators. Students have not written down the problem solutions clearly and precisely and can look back at the answers given.

Based on the overall answers of the Master's subject, it can be seen that the Master's subject has fulfilled critical thinking skills on the interpretation indicator. This is in accordance with research by Suryani et al., (2020) that students with moderate problem solving abilities already understand the problem as indicated by writing what is known and what is asked about the question correctly. In the second indicator, namely analysis, S2 subjects can express ideas from the information known in questions regarding the concept of the perimeter of a rectangle. S2 subjects have fulfilled the third indicator, namely inference. This result is in line with the research

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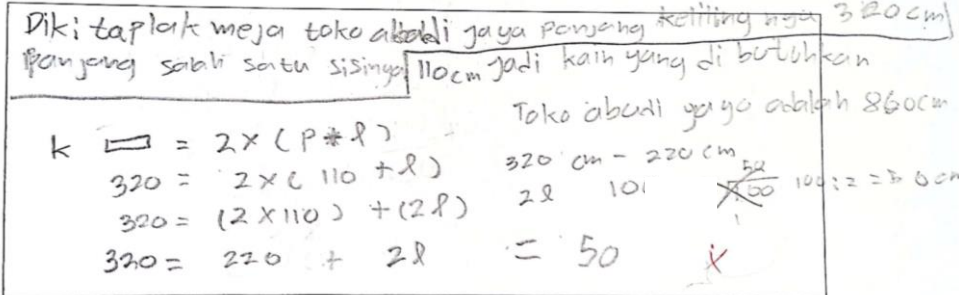
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results of Munira et al., (2020) that students with moderate critical thinking skills can use the right strategy in solving problems completely but make mistakes in the calculations. The S2 subject was declared to have met the evaluation indicators because the S2 subject was able to suspect and find other alternatives in solving problems. Master's subjects are declared able to write final results by providing reasons for the conclusions drawn and meeting the indicators of critical thinking ability in the explanation aspect. This is in line with research by Kempirmase et al., (2019) that students with moderate critical thinking skills can make appropriate conclusions according to the context of the problem. S2 subjects also cannot review the work process in solving the questions presented. From this description, the Master's subject meets five indicators of critical thinking ability, namely interpretation, analysis, inference, evaluation, explanation and does not meet the indicators of self-regulation critical thinking ability.

Results of Analysis of Students' Critical Thinking Ability with Low Problem Solving Ability (S3)

Based on the test results, it shows that S3 subjects only meet two indicators of critical thinking ability. The interpretation indicator is fulfilled which is marked by writing the information from the question clearly and precisely. Then the analysis indicator is shown to write down the relationship between the concepts used in solving the problem correctly. In the inference indicator, it has not been seen that S2 subjects can conclude logically from what is asked. In the evaluation indicator, the problem solving has not been written down based on the strategy used. In the explanation indicator, S3 subjects have not provided reasons for the conclusions drawn in solving the questions. Finally, on the self-regulation indicator, subject S3 has not been able to recheck the answers that have been given. Based on the test results, it is also strengthened by the results of the interview, namely by fulfilling two indicators of the questions asked, students are able to answer. In the interpretation indicator, in interview activities students are able to explain the problems presented in the questions. In indicator analysis, students are able to explain the relationship between the concepts contained in the question. In the inference indicator, students cannot explain what is asked in the question. In the evaluation indicator, students were unable to explain the strategy used in solving the questions. In the explanation indicator, students are also unable to provide reasons for the conclusions they have reached. Then, on the seld-regulation indicator, students did not find the right answer.

In line with this, the following is data on the critical thinking abilities of PhD subjects in solving mathematical problems based on critical thinking indicators, namely interpretation and analysis.

Figure 3. S3 Subject Work Results

Based on Figure 3, the information that subject S3 obtained was that there was a rectangular tablecloth that had a perimeter of 320 cm and one side of 110 cm. The results of the S1 subject's work have met the interpretation indicators with the criteria of being able to write information from the questions clearly and precisely. Next, subject S3 found the length and width of the

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quadrilateral by stating the length and width of the quadrilateral based on the perimeter formula. Based on the test results, the S3 subject has fulfilled the analysis indicators with the criteria of being able to write the relationship of the concepts used in solving questions clearly and precisely. Based on the answer, subject S3 was wrong in the number substitution process, so it did not meet the inference indicators. Subject S3 was not seen using the right strategy in solving the questions and made mistakes in the calculations. The S3 subject was stated to have not met the evaluation indicators because the S3 subject had not been able to predict and find other alternatives in solving the problem. The S3 subject was declared unable to write down the final results by providing reasons for the conclusions drawn, so the S3 subject did not meet the indicators of critical thinking ability in the explanation aspect. S3 subjects also have not been able to re-examine the work process in solving the questions presented.

Based on the overall answers of the S3 subject, it can be seen that the S3 subject has fulfilled critical thinking skills in the interpretation and analysis indicators. Because S3 can categorize and group information that is known and asked about from the questions. S3 subjects can also express ideas from the information known in the questions. S3 subjects have not met the critical thinking indicators, namely inference, evaluation, explanation because S3 subjects have not been able to determine the formula correctly and solve the problems in the questions. So, S3 subjects have not been able to find the final result of solving the problem. This is in line with research by Azizah et al., (2018) and Fatmawati et al., (2014) which states that students in the low category show that students do not write down how to do things, and cannot answer or make conclusions. Munira et al., (2020) stated that students with low abilities were still unable to conclude the results of their answers correctly. S3 subjects have not been declared to meet the final critical thinking ability indicator, namely self-regulation, because S3 subjects are still confused about how to solve it and cannot determine the formula to be used. From this description, the S3 subject meets two indicators of critical thinking ability, namely interpretation and analysis. However, it has not met the indicators of inference, evaluation, explanation and self-regulation.

DISCUSSION

Based on the results above, it is known that students in solving quadrilateral questions have diverse abilities in mathematical critical thinking skills in identifying questions and answering according to the intended concept. In this case, there are differences in critical thinking abilities in each subject which refer to six indicators. The differences in critical thinking abilities mastered by each subject are explained as follows.

Subject High Level of Problem Solving Ability (S1)

Based on the results of data collection obtained during the research, the following is data on the critical thinking abilities of undergraduate subjects in solving mathematical problems based on critical thinking indicators, namely interpretation, analysis, inference, evaluation, explanation and self-regulation.

1. Interpretation
    Based on the results of critical thinking ability tests and interviews, it shows that undergraduate subjects can categorize and group known information and can understand the meaning of the problem in the problem clearly, precisely and thoroughly. So, it can be concluded that the S1 subject meets the critical thinking indicators of interpretation.
2. Analysis
    In the critical thinking ability indicator in the analysis aspect, S1 subjects were able to grasp the stimulus given in the problem so that S1 subjects could have an overview and sketch of the problem presented in the question regarding the perimeter of a rectangle. So it can be concluded that the S1 subject meets the analysis indicators.
3. Inference
    In the inference aspect, S1 subjects are declared to meet this indicator because S1 subjects can write down problem solutions. Subject S1's solution was to get the final result correctly, and included how to get the length and width of the sides of the rectangle.
4. Evaluation

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In the critical thinking ability indicator, the evaluation aspect of undergraduate subjects can find other alternatives and find the right answer. The processing steps using other alternative methods are detailed and ordered by understanding the explanation of the completion steps to obtain answers. So, it can be concluded that the S1 subject is declared to meet the critical thinking indicators for the evaluation aspect.

5. Explanation

Based on the results of written tests and interviews, the S1 subject was declared capable because the subject was able to write answers as final conclusions that were in accordance with the calculation results. So, S1 subjects can be declared to meet the indicators of critical thinking in the explanation aspect.

6. Self-regulation

Subject S1 can review the answers written by answering the problem in the question, namely that subject S1 is confident in the final answer given on the grounds that subject S1 has done the calculations and has used the correct formula. Thus, S1 subjects can be declared to meet the critical thinking indicators in the self-regulation aspect.

The subject has fulfilled all indicators of critical thinking. Interpretation indicators are achieved with the criteria of being able to write information from the questions clearly and precisely. Indicator analysis is achieved with the criteria of being able to write down the concepts used in solving problems clearly. Inference indicators are achieved by being able to conclude from what is asked logically. Evaluation indicators are achieved by being able to write down problem solutions clearly and precisely. This appears in the test results of the subject calculating the possibilities that arise correctly. The explanation indicator is achieved by being able to provide reasons for the conclusions drawn clearly and precisely. The self-regulation indicator is achieved by being able to look back at the answers given clearly and precisely.

Subject Medium Problem Solving Ability Level (S2)

Based on the results of data collection obtained during the research, the following is data on the critical thinking abilities of Master's subjects in solving mathematical problems based on critical thinking indicators, namely interpretation, analysis, inference, evaluation and explanation. This is explained as follows:

1. Interpretation

The results of critical thinking ability tests and interviews show that Masters subjects can categorize and group known information even though statements regarding known information are written in the discussion section. S2 subjects already understand the meaning of the problem asked in the question. So, it can be concluded that the S2 subject meets the interpretation indicators.

2. Analysis

In the second indicator, namely analysis, S2 subjects can express ideas from the information known in the problem into a sketch of a triangle in a circle by adding symbols for angle names, known angle and side sizes, and the radius of the circle. Thus, Master's subjects have met the indicators of critical thinking ability in the analysis aspect.

3. Inference

The S2 subject has fulfilled the third indicator, namely inference, because the subject can determine the formula and solve the problem in the problem by deciding the concept used in the solution using the square area formula. The solution concept used is correct, but subject S2 has not yet got the final result correctly due to lack of accuracy in carrying out calculations when finding the length of the side of a square.

4. Evaluation

In the evaluation aspect, the Master's subject is stated to have met this indicator because the Master's subject can guess and find other alternatives in solving internal problems.

5. Explanation

S2 subjects can write down the final results of the problem and provide written reasons for the answers to the questions presented in the problem. Thus, meeting the indicators of critical thinking ability in the explanation aspect.

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6. Self-regulation

   The S2 subject also cannot review the work process in solving the questions presented because the S2 subject is not yet sure of the answer based on the reasons for solving the questions. Thus, the S2 subject was declared not to have met the critical thinking indicators for the self-regulation aspect.

   Master's subjects have met five indicators of critical thinking. Interpretation indicators are achieved with the criteria of being able to write information from the questions clearly and precisely. Indicator analysis is achieved with the criteria of being able to write down the concepts used in solving problems clearly. Inference indicators are achieved by being able to conclude from what is asked logically. Evaluation indicators are achieved by being able to write down problem solutions clearly and precisely. This appears in the test results of the subject calculating the possibilities that arise correctly. The explanation indicator is achieved by being able to provide reasons for the conclusions drawn clearly and precisely. The self-regulation indicator has not been achieved because students have not been able to review the answers given clearly and precisely.

Subject Low Problem Solving Ability Level (S3)

Doctoral subjects' critical thinking in solving mathematical problems is based on critical thinking indicators, namely interpretation and analysis.

1. Interpretation

   Because S3 can categorize the main issues, group the information that is known, and already understands the meaning of the problem asked in the question but has not written in detail about the area of the rectangle and the length of the sides in question.

2. Analysis

   In the analysis indicator, the S3 subject has fulfilled it because he can express ideas from the information known in the questions.

3. Inference

   The S3 subject did not meet the third indicator, namely inference, because the S3 subject was not precise in determining the formula used so he could not find the answer regarding the area of the rectangle. Subject S3 made a mistake in entering the known value from the formula.

4. Evaluation

   In the evaluation indicators, the S3 subject is stated to have not met the critical thinking ability indicators because the S3 subject has not been able to guess and find a formula to solve the problem with other alternatives because the S3 subject does not yet understand the problem solving in the problem.

5. Explanation

   The S3 subject was stated to have not met the critical thinking ability indicators in the explanation aspect because the S3 subject had not been able to draw final conclusions and had not been able to provide reasons for decision making because the S3 subject had not worked to the end and found the final answer.

6. Self-regulation

   Subject S3 has not met the last critical thinking ability indicator, namely self-regulation, for the reason that S3 cannot review the work process in solving the questions presented for the reason that subject S3 is still confused about how to solve it and cannot determine the formula to be used.

   S3 subjects only met two indicators of critical thinking. Interpretation indicators are achieved with the criteria of being able to write information from the questions clearly and precisely. Indicator analysis is achieved with the criteria of being able to write down the concepts used in solving problems clearly. The indicators of inference, evaluation, explanation and self-regulation are still not visible. S3 subjects have not been able to predict and find other alternatives in solving problems. The S3 subject was declared unable to write down the final results by providing reasons for the conclusions drawn, so the S3 subject did not meet the indicators of critical thinking ability in the explanation aspect. S3 subjects also have not been able to re-examine the work process in solving the questions presented.

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CONCLUSION

Based on the results of the analysis of critical thinking skills towards problem solving, the following results were obtained; (1) students with high problem solving abilities fulfill all indicators of critical thinking abilities including interpretation, analysis, inference, evaluation, explanation and self-regulation, (2) students with moderate problem solving abilities fulfill five indicators of critical thinking abilities including interpretation, analysis, inference, evaluation, and explanation and (3) students with low problem solving abilities fulfill two indicators of critical thinking abilities including interpretation, analysis, and self-regulation.

Based on the research that has been carried out, the suggestions that researchers give are: (1) the need to pay attention to differences in students' problem solving abilities in learning in order to maximize critical thinking abilities; (2) teachers should encourage and motivate by increasing the practice of critical thinking questions so that they have critical thinking habits, so that students' critical thinking abilities are better; (3) Students should further hone their critical thinking skills by diligently reading and doing critical thinking exercises. Teachers are advised to provide more critical thinking practice questions and HOTS-based practice questions and provide guidance to students in interpreting solutions to problem solving using words or written text to improve students' verbal representation abilities; and (4) it is necessary to carry out similar follow-up research using the same theme using a variety of measuring instruments and using more research subjects and more varied abilities in order to improve the results of this research better.

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