



Students' Critical Thinking in Solving Geometric Problems

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ABSTRACT

In the 21st century, students are expected to have abilities that are considered important to face challenges. One of the goals of the education system is to educate students to think critically. The purpose of this research is to determine the extent to which researchers analyze students' critical thinking abilities, especially in solving geometry problems. The research method used is literature study. Based on 12 articles relevant to critical thinking, problem solving in geometry, After obtaining articles related to the question, the researcher then analyzed and concluded the results. This article's meta data is in the form of a table. The articles studied are articles that have been indexed by SINTA. The results of research on 5 articles stated that students' critical thinking in solving problems experienced difficulties and errors in solving them, especially in analysis and evaluation indicators, where the problem was that students were unable to determine the right strategy in solving questions. 7 Other articles stated that students were able to solve the questions well. This is because students illustrate, examine and interpret the questions they are working on first so they can evaluate the questions well. Critical thinking research still needs to be carried out, especially on geometry material because from several previous findings researchers only focused on critical thinking skills in solving problems but did not examine in more depth the strategies used when thinking critically to solve problems.

Keywords: critical thinking; geometry; problem solving

INTRODUCTION

In the 21st century, students are expected to have abilities that are considered important to face challenges. as regulated in the Education System Law Number 20 of 2003, which is expected to be able to answer the challenges faced by communities throughout the world. One of the goals of the education system is to educate students to think critically (Soleh et al., 2020; Rahmi et al., 2023). Critical thinking is a skill that students must have in the 21st century. This is in line with the idea that one of the goals expected from the education system is students' ability to think critically (Massa, 2014; Nilson et al., 2014; Radulovic & Stancie, 2017; Tiruneh et al., 2017). Critical thinking is systematic and meaningful thinking that is based on goals and reasons that are focused on making reliable decisions (Ennis, 2011; Dwi et al., 2016; Inayah et al., 2021). Syafruddin S.I and Heni P (2020), critical thinking ability is an ability that requires students to be able to identify, collect, process the information obtained and draw conclusions.

Selvina et al (2018) stated that critical thinking skills will give students the skills to be able to solve the problems they face logically and in an orderly manner. Critical thinking is also useful for all aspects of every individual's life (Septian et al., 2022; Palwa et al., 2024). So critical thinking skills are a rational thinking process for analyzing a problem that

determines ideas and ideas to provide solutions that are in accordance with the knowledge they have, so that critical thinking skills are applied in the learning process, namely students can analyze. problems in a more specific direction to find a solution and students can conclude the actual situation of the problem given accurately and accurately.

According to Minister of National Education Regulation Number 22 of 2006 which sets content standards for secondary schools, all students must be taught mathematics to develop logical, analytical, systematic, critical, creative thinking skills and the ability to work together. Mathematics learning material that can provide an important role in critical thinking is geometry material. According to Watan S and Sugiman (2018) stated that one of the Geometry materials is a mathematics topic which has an important role in the school curriculum. The goal of learning geometry is to teach students to think critically, solve problems, and have high critical thinking skills. Based on several previous studies and how important it is for someone to have critical thinking skills in the 21st century, it is hoped that there will be many efforts to improve students' critical thinking skills. However, in reality there are still many students who experience difficulties when thinking critically in solving problems, especially in geometry material, so researchers are interested in conducting literature regarding critical thinking skills in solving problems in geometry material. Another factor is that previous researchers only focused on identifying and explaining the results of their abilities. critical thinking of low and high students only. Seeing this, the researcher wants to know and explain what strategies students use in solving problems in geometry material, whether it is difficulty or ease in solving the problem.

RESEARCH METHODS

The research method used is literature study. Where a literature review is an approach or method of proving a problem, or a literature review is a scientific process that produces a report aimed at focusing research or scientific studies (Cahyono, Sutomo, Hartono, 2019). For this research, researchers collected journal articles from the Google Scholar database and published them between 2016 and 2023 from the junior high school level. From various articles about critical thinking skills, especially in solving geometric problems, the researcher chose 12 articles that were relevant to keywords and used qualitative methods in their research. After obtaining articles related to the question, the researcher then analyzed and concluded the results. The meta data for this article is in the form of a table containing the author's name, year of publication, title and research results included in the article. The articles selected are articles indexed by Sinta.

RESULTS AND DISCUSSION

Research on the analysis of critical thinking skills has been carried out by many previous researchers. The results of this research are about the analysis and summary of the article. presented in Table 1.

Table 1. Description of Research Related to Students' Critical Thinking in Solving Geometry Problems

Researcher	Research Title	Research result
Hidayanti Dwi, As'ari and Tjang (2016)	ANALYSIS OF CRITICAL THINKING ABILITY OF CLASS IX JUNIOR HIGH SCHOOL STUDENTS ON DEVELOPMENT MATERIAL	The research results show that students' critical thinking skills are still relatively low, especially in analysis and evaluation indicators in solving problems. In the analysis indicators, many students immediately draw conclusions, while in the evaluation indicators students are less able to evaluate the accuracy of what they do in solving problems. From his explanation, the problem was caused by students not being able to apply mathematical concepts correctly and students immediately making decisions to solve problems without investigating the problem first.
Jafar Sidik, Heris and Ratna S (2018)	ANALYSIS OF MISTAKES OF CLASS IX JUNIOR HIGH SCHOOL STUDENTS IN FLAT SIDED ROOM BUILDING MATERIALS SOLVING CRITICAL THINKING QUESTIONS	The research results stated that students found errors in working on the questions. Many factors cause errors, including errors in understanding a concept, errors in calculations and confusion in understanding the problem so that students do not know the steps in solving the problem. What students do to solve problems is to write down the information contained in the problem.
Anik Putri (2018)	PROFILE OF MATHEMATICAL CRITICAL THINKING ABILITY OF JUNIOR HIGH SCHOOL STUDENTS SPACE BUILDING MATERIAL CLASS VIII FLAT SIDE	The results of the research show that students' critical thinking abilities are in the medium category, because during learning students are trained to solve problems in books and those given by the teacher, thus requiring students to practice analyzing problems and choosing appropriate problem solving strategies. What students do to solve problems is to focus on problem solving.
Kurniasih & Dori (2019)	STUDENTS' CRITICAL THINKING ON QUARTERIAL MATERIAL	The results of the research show that students' critical thinking in rectangular material is not able to interpret and the ability to analyze the average student does not understand the right concepts to use so they cannot create mathematical models to solve problems. Then regarding the ability to conclude, students have not yet drawn the right conclusions based on relevant

		information and concepts. This is because students do not write down the information and understand the problems in the questions and answer the questions directly.
Septiana R, Yusti S dan Luvy S (2019)	ANALYSIS OF JUNIOR HIGH SCHOOL STUDENTS' MATHEMATICAL CRITICAL THINKING ABILITIES	The description of students' mathematical critical thinking abilities in flat-sided geometry material shows that students have not met the indicators in making decisions, where according to these indicators students have not been able to analyze and evaluate questions. This is because students forget and do not know the formula in the questions given. As for what students do in solving problems in the questions, students write down information and illustrate the shapes contained in the questions.
Dewi Dara et al (2019)	ANALYSIS OF MATHEMATICAL CRITICAL THINKING ABILITY JUNIOR HIGH SCHOOL STUDENTS ON CIRCLES AND BUILDING MATERIALS FLAT SIDED ROOM	In his research, it was stated that students were unable to formulate the right questions with the right reasons. In solving this problem, it is caused by students' lack of understanding when determining a formula that will be used to determine a systematic solution in solving the problem. This shows that students have not met the inference indicators. What students do in solving problems is to write down the information contained in the problem.
Nastiti M.A, Hepsi N, dan Novaliyosi (2020)	ANALYSIS OF MATHEMATICAL CRITICAL THINKING ABILITY JUNIOR HIGH SCHOOL STUDENTS WITH ONLINE LEARNING	States that the mathematical critical thinking skills carried out show that students are in the medium category. This is because most students have fulfilled the indicators for building simple skills, making further explanations, and determining strategies and tactics in solving a problem, while the indicators that have not been met are providing simple explanations and drawing conclusions.
Agustiana & Adi (2021)	ANALYSIS OF CRITICAL THINKING ABILITY JUNIOR HIGH SCHOOL STUDENTS' MATHEMATICS ON	The results of the research state that students have not been able to solve problems systematically or according to seasonal indicators. This can be seen from the students' answers which went straight

	BUILDING MATERIALS FLAT SIDED ROOM	to the solution without paying attention to the work steps and not paying close attention to the questions given.
Siskandani, Novel, and Isna (2020)	ANALYSIS OF STUDENT ERRORS ON ABILITIES QUESTIONS CRITICAL THINKING MATERIALS FOR BUILDING FLAT SIDED SPACES CLASS 8 SMP	Analysis of errors made by students when solving critical thinking skills questions states that there are 3 errors, namely conceptual errors, procedural errors and mistakes. The most frequently made errors are procedural errors, where students' ability to manipulate completion steps includes indicators that have not been met, namely evaluation indicators.
Alfarisi, Intan and Ahmad (2021)	ANALYSIS OF STUDENTS' MATHEMATICS CRITICAL THINKING SKILLS ON FLAT-SIDED BUILDING MATERIALS IN CLASS VIII SMP NEGERI 2 MESJID RAYA	The research results show that students' critical thinking abilities are generally at a low classification level and very low. This is because when solving problems, students focus on solving but do not follow the steps to solve the problem, and students are not able to evaluate answers so that it can influence students in writing the correct conclusion from the problem.
Erlita & Dori (2022)	CRITICAL THINKING ABILITY OF INNER MTS STUDENTS SOLVING PROBLEMS OF HOUSE BUILDING RECTANGLE	The research results show that students' critical thinking abilities are in the medium category. Where students can write down what they know, can determine the concepts used in solving questions but in the process they still make mistakes and answer questions not completely. As for determining the problems and strategies of high and medium category students. They illustrate and write down the information in the problem first in the sense of following the work steps.
Kinayafadia and Edi (2023)	STUDENTS' CRITICAL THINKING ABILITY ON MATERIAL GEOMETRY	These results illustrate students' critical thinking skills in geometry material, that the analysis aspect with pictorial questions shows that students' results are better than those without pictures. Likewise, in the evaluation and conclusion aspects, the data shows that students' answers are better with pictures than questions without pictures. Meanwhile, to find out and solve problems, students carry out illustrations again to determine the correct concept.

In total, 12 articles were used. Where the literature published in 2016 is 1 article, 2018 is 2 articles, 2019 is 1 article, 2020 is 3 articles, 2021 is 3 articles, 2022 is 1 article, and 2023 is 1 article. Based on the 12 articles reviewed, there are 5 articles that include articles Hidayanti Dwi, As'ari and Tjang (2016), Kurniasih & Dori (2019), Agustiana & Adi (2021), Siskandani, Novaliyosi, and Isna (2020), Alfarisi, Intan and Ahmad (2021) show that Students experience difficulties and errors in solving critical thinking questions, especially on evaluation indicators, where the problem is that students are unable to determine the right strategy in solving questions. This is because students are not careful in understanding the questions and do not follow the correct steps for working on the questions, making it difficult for students to determine strategies. Then there are 7 other articles that show critical thinking skills in the moderate and good categories. Jafar Siddique, Heris and Ratna S (2018), Anike Putri (2018), Septiana R, Yusti S and Luvy S (2019), Dewi Dara et al (2019), Nastiti MA, Hepsi N, and Novaliyosi (2020), Erlita & Dori (2022), Kinafadia and Edi (2023) stated that students were able to solve the questions well. This is because students illustrate, examine and interpret the questions they are working on first so they can evaluate the questions well.

These 12 articles show that there are differences in the research results, this can be seen from the strategies used by students. 5 articles show results where students experience difficulties in the evaluation aspect when solving geometry problems because they do not pay attention to the analysis and interpretation aspects. However, 7 articles show results where students are able to solve problems well, especially in the evaluation aspect because they pay attention to the analysis and interpretation aspects.

CONCLUSION

One of the goals of the education system is to educate students to think critically. Critical thinking is a skill that students must have in the 21st century. According to Minister of National Education Regulation Number 22 of 2006 which sets content standards for secondary schools, all students must be taught mathematics to develop logical, analytical, systematic, critical, creative thinking skills and abilities. cooperate. Mathematics learning material that can provide an important role in critical thinking is geometry material.

Many studies have been conducted on critical thinking, but this research prioritizes critical thinking in solving geometry, according to the results of previous researchers' studies. students' critical thinking in solving problems experienced difficulties and errors in solving them, especially in analysis and evaluation indicators, where the problem was that students were unable to determine the right strategy in solving these questions. Critical thinking research still needs to be carried out, especially on geometry material because from several previous findings researchers only focused on critical thinking skills in solving problems but did not examine in more depth the strategies used when thinking critically to solve problems.

It is hoped that this research can provide an overview of the results of critical thinking research that has been carried out by previous researchers to find out what future researchers should do that is truly urgent and necessary. The solutions or efforts that can be made so that students can use the right strategies when thinking critically, especially in geometry material, are trying to link daily activities to the problems that will be given so that later students can illustrate and imagine them, then pay attention to the learning process and direct students to the following stages. strategy stage that makes it easier.

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