Analysis of Critical Thinking Skills of Grade IX Students in Opportunity Material Reviewed from Self-Regulated Learning

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Abstract
Critical thinking skills are very important and closely related to how students manage their learning process independently. The purpose of this study is to analyze the ability to think critically on opportunity materials reviewed from self-regulated learning in junior high school students in grade IX. The method used is qualitative with a descriptive approach. The research was carried out at Putra Harapan Boarding School Purwokerto with the research subject grade IX students. The research instruments used were in the form of essay questions designed based on indicators of critical thinking ability and self-regulated learning (SRL) questionnaires. Based on the students, they are grouped into high, medium, and low categories. Respondents were taken one student from each category by purposive sampling. Data analysis includes reduction, data presentation, and Conclusions. The results of the study were that students in the high SRL category met the achievement of correct and complete critical thinking skills. Students in the SRL category are meeting the critical thinking indicators appropriately but need to emphasize the aspect of argument analysis. In contrast, low SRL students cannot achieve complete critical thinking skills.
Keywords: Critical thinking skills, Opportunities, Self-Regulated Learning

Introduction

Critical thinking skills are one of the important competencies that students must possess in facing the challenges of the 21st century, especially in mathematics learning. Analysis results (Siregar, 2024) indicate that every student needs to have critical thinking skills. This skill can be developed through cooperation between teachers and students, where teachers play a crucial role in designing varied and challenging problems to encourage students to think solutions and generate creative ideas. These critical thinking skills serve as an important foundation in shaping human resources that are sharp-minded, innovative, and capable of competing globally. Various efforts have been made to enhance this ability, but the results still show a significant gap. Research findings (Al-Islami, S., Prihatin, I., & Hartono, 2025) It is revealed that students with high self-efficacy tend to have better critical thinking skills, while students with low self-efficacy face more obstacles in achieving critical thinking indicators. In research (Siswanto, 2024), data shows that the percentage of students' thinking ability on critical thinking indicators includes focus at 43.33%, reasoning at 35.00%, and inference at 46.66%. Meanwhile, the situational indicator has a percentage of 61.11%, clarity at 40.83%, and an overview at 31.66%. Based on these results, it can be concluded that students' thinking abilities fall into the low category.

In mathematics learning, the development of critical thinking skills is closely related to how students manage their learning process independently. Self Regulated Learning (SRL) is an approach that allows students to plan, monitor, and evaluate their learning process actively. Students who have a good SRL tend to be better able to overcome obstacles in learning mathematics, solve problems critically, and show a responsible attitude towards their learning outcomes. This approach is one of the internal factors that is believed to support the strengthening of critical thinking skills, including in solving mathematical problems in opportunity materials.

This research is motivated by the need to understand the relationship between critical thinking skills and the level of self-regulated learning (SRL) of students, especially in the context of opportunity material in grade IX of junior high school. Opportunity material requires students to comprehend the concept of uncertainty, perform probability calculations, and infer possible events based on available data. These processes require reflective and analytical thinking, which are central to critical thinking skills (Rahmaini & Ogylva Chandra, 2024; Ahmatika, 2017). By reviewing students' critical thinking skills from the SRL perspective, this research aims to provide practical implications for developing effective, student-centered mathematics learning strategies.

Critical thinking is an intellectual thinking process in which a person is able to assess the quality of his thoughts, one uses reflective, independent, clear, and rational thinking. (Ahmatika, 2017). Critical thinking is one of the most important 21st century skills and is closely related to learning mathematics (Rahmaini & Ogylva Chandra, 2024). A person who learns mathematics is expected to develop into an individual capable of thinking critically and creatively to ensure that they are on the right track in solving mathematical problems or understanding mathematical material, while also verifying the correctness of their thought processes (Rahmaini & Ogylva Chandra, 2024; Ahmatika, 2017; Bali & Tartila, 2023). By being a critical individual in learning mathematics, a person will be triggered to be creative. A person will try to find solutions with various alternatives to gain clarity or be able to distinguish between right and wrong (Ahmatika, 2017)

Indicators of students' critical thinking abilities used are understanding problems, providing arguments, making inductions and the ability to make decisions or actions. Mathematical critical thinking skills are thinking skills that aim to be able to determine rational decisions or actions through what is believed to be a truth and can be done correctly (Septiana et al., 2019)

However, critical thinking skills have not been explored properly. Good learning outcomes do not always have the ability to think critically because they require different ways of pursuing. The studies that have been carried out are for example the research that has been carried out (Septiana et al., 2019). stated that the mathematical critical thinking skills of junior high school students in Rancabali District are still very low. The average value of critical thinking ability of grade IX students was 29.64% at very low criteria. Based on this research (Fitri et al., 2023), it shows that students are not used to solving non-routine problems with critical thinking.

There are two major factors contributing to the underdevelopment of critical thinking during education. First, teaching often emphasizes the completeness of material rather than conceptual understanding. Second, classroom practices are dominated by lecture-based instruction, where teachers are more active while students remain passive, engaging primarily in listening and copying. Teachers tend to provide examples and routine exercises without promoting analytical reasoning or problem-solving skills (Ahmatika, 2017; Septiana et al., 2019). Then the teacher gives examples of questions, followed by giving practice questions that are routine and do not practice critical skills; Finally, the teacher gave an assessment. (Ahmatika, 2017)

According to (Natassya et al., 2023) said that high critical thinking skills are only possessed by students who have high learning motivation. The self-regulated learning model has a positive influence on critical thinking skills (Bali & Tartila, 2023). However, another study said that there was no effect of interaction between the Self Regulated Learning model on critical thinking skills (Fajriah & Amir, n.d.). Self-regulated learning is a combination of skills and will. Strategic learners are learners who learn to plan, control and evaluate cognitive/affective motivations, behaviors and contextual processes (Mukhid, 2008). The importance of students having self-regulated learning is to have a positive perspective and have motivation that pushes them towards improvement in learning. This skill to learn based on self-regulation is one of the provisions to become a lifelong learner. Students who are used to doing SRL will be used to being independent by involving cognition, metagonucleation and motivation in learning and learning anything including mathematics. (Ahmad 2023).

All materials in mathematics can improve critical thinking skills, including chances. According to (Noverli et al., 2024) Opportunities are closely related to critical thinking skills. Of course, with maximum effort in the learning process and the use of tools that are able to

improve critical thinking skills, namely the ability to evaluate, analyze, and compile information carefully and logically. The purpose of this study is to analyze students' ability to think critically on opportunity material reviewed from the perspective of self-regulated learning in grade IX students. The research focuses on how different SRL levels (high, medium, and low) affect the achievement of critical thinking indicators. The problem formulation can be stated as follows: (1) How do students with high SRL demonstrate critical thinking skills in solving opportunity problems? (2) How do students with medium SRL demonstrate these skills? (3) How do students with low SRL demonstrate these skills? This study is limited to a small sample of three students representing the three SRL levels, so the findings cannot be generalized but provide an in-depth understanding of patterns and characteristics within the studied context.

Method

This study uses a descriptive qualitative approach to describe students' critical thinking skills in solving opportunity problems from the perspective of self-regulated learning (SRL). The research was conducted at a junior high school, with grade IX students as subjects. The focus was to identify how students with different SRL characteristics demonstrated critical thinking skills. This study was limited to one school, three participants (high, medium, and low SRL), and did not generalize findings beyond the research context. The purposive sampling technique was used because it allowed selection of students representing distinct SRL categories (high, medium, low), which is essential for qualitative comparison (Gusmawan et al., 2021).

The research instruments included essay tests and an SRL questionnaire. Essay items were designed based on established indicators of critical thinking—understanding problems, providing arguments, induction, and making decisions—adapted from Ahmatika (2017) and Rahmaini & Ogylva Chandra (2024). Instruments were reviewed by two mathematics education experts for content validity and piloted on a small group of students to ensure clarity and reliability. The SRL questionnaire was adapted from validated tools in previous studies (Mukhid, 2008; Bali & Tartila, 2023). Data analysis employed the Miles and Huberman model (Thalib, 2022).

The data analysis technique uses the Miles and Huberman model, which consists of three stages: data reduction, data presentation, and conclusion drawing (Thalib, 2022).

Through this analysis, the relationship between students' critical thinking skills and self-regulated learning can be mapped more systematically and objectively.

Results and Discussion

Students in the Self-Regulated Learning Category High

Test Results

S1 subjects showed high critical thinking skills. Based on the results of the essay test consisting of four questions, S1 was able to answer correctly and completely. In the first question about the probability of a simple event, S1 not only answered the final result correctly, but was also able to explain the logical steps taken in succession. In the question of comparing two opportunities, S1 is able to use a comparison strategy and provide the right mathematical reasons.

Interview Results

In the interview, S1 said, "I usually learn by making my own schedule and making sure I understand the concepts before moving on to practice questions. If there is a difficult question, I try to find out first from the internet or books, then ask the teacher if I am still confused." This shows that S1 is active in planning and evaluating their learning process, which is a characteristic of high self-regulated learning. These findings are in line with research by Mahrufah & Rijanto, 2024, which states that students with high SRL tend to have a mature learning strategy, be able to set goals, and evaluate their progress periodically.

Students in the Self Regulated Learning Category Are Medium

Test Results

Subject 2 showed fairly good results on the test, with most of the answers correct but incomplete in the reasoning aspect. In some questions, S2 is able to answer correctly but does not explain the reason behind the answer in depth. Especially in the question that asks for the analysis of two possible events, S2 provides the correct numerical answer, but does not include adequate supporting steps or arguments.

Interview Results

S2 explained, "I usually learn if there is a rehearsal. But I am trying to understand the practice questions from the book. Sometimes when I'm confused, I ask friends or watch YouTube." This shows that S2 has sufficient self-regulation, but has not been maximized in the planning and reflection stages of learning. These results are in line with findings from a study by Gusmawan et al., 2021, which showed that students with moderate SRL levels have

fluctuating internal motivation and inconsistent learning strategies. It also shows that students with SRL are able to understand the basic material, but have difficulty in the aspects of deep analysis that are part of high-level critical thinking.

Students in the Low Self-Regulated Learning Category

Test Results

Subjects S3 showed low test results. Of the four questions given, only one question was answered correctly, even without a complete explanation. S3 seems to have difficulty understanding the context of opportunities and is unable to identify the right solution steps. There is no systematic problem-solving strategy.

Interview Results

S3 said, "I usually don't study much unless I am told. Sometimes I see answers from friends or questions during lessons. It's about difficult opportunities because of the number of numbers." This answer shows that S3 lacks an independent learning strategy, does not plan the learning process, and does not reflect on their understanding. This finding is in accordance with research from Roslinda et al., 2022 which states that students with low SRL tend to show low critical thinking skills, because they are not used to solving nonroutine problems that require reasoning. In addition, this also shows that low SRL correlates with low performance in mathematical critical thinking problems.

This study aims to analyze the critical thinking skills of grade IX junior high school students in solving mathematics problems in opportunity materials reviewed from their self-regulated learning (SRL) level. A total of three students were selected as research subjects representing the high, medium, and low SRL categories. The instrument used is an essay test with indicators of critical thinking skills that include understanding problems, formulating arguments, inducing, and making decisions based on the calculation of opportunities. The maximum score of the test is 25 points. The assessment is carried out objectively based on rubrics developed from the critical thinking grid. The results of the analysis showed that there was a significant difference in the achievement of critical thinking skills between the three students based on their SRL level. To clarify these results, they are presented in Table 1.

Table 1. The results of the analysis of critical thinking skills based on the level of self-regulated learning.

Subject	SRL Levels	Test score (maximum 25)	Predicate	Achievement of Critical Thinking Indicators
S1	High	23/25	High	Able to understand problems, formulate logical arguments, make accurate inductions, and make the right decisions
S2	Medium	16/25	Medium	Understand some of the problems, the arguments are not completely logical, the conclusions are still general.
S3	Low	9/25	Low	Lack of ability to understand problems, weak arguments, unable to draw appropriate conclusions.

From the data, it can be seen that there is a positive correlation between the level of SRL of students and their critical thinking skills. Students with high SRL show excellent performance in solving critical thinking-based math problems. He was able to do all the problems correctly, explain logical mathematical reasons, and verify the results of his calculations using an alternative approach. Meanwhile, students with SRL have adequate critical thinking skills, but there are still weaknesses in the aspects of argumentation and decision-making. Students with low SRL showed weakness in almost all critical thinking indicators.

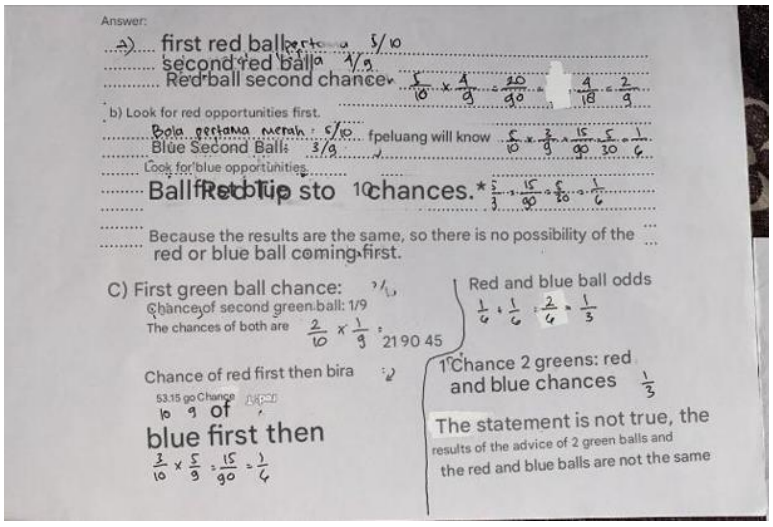

Figure 1. Results of the work from subject 1

In Figure 1, subject 1 who has a high SRL shows a very high achievement of critical thinking skills. He is able to answer all questions correctly, use appropriate probability formulas, and formulate logical and mathematical arguments. The thought process shown also reflects a deep understanding of the concept of opportunity as well as the ability to

evaluate the solutions produced. This subject was able to examine the results of the calculation using the combination method as an alternative approach and conclude the similarity of the results logically. Subject 1's performance reflects the close relationship between SRL and systematic critical thinking skills.

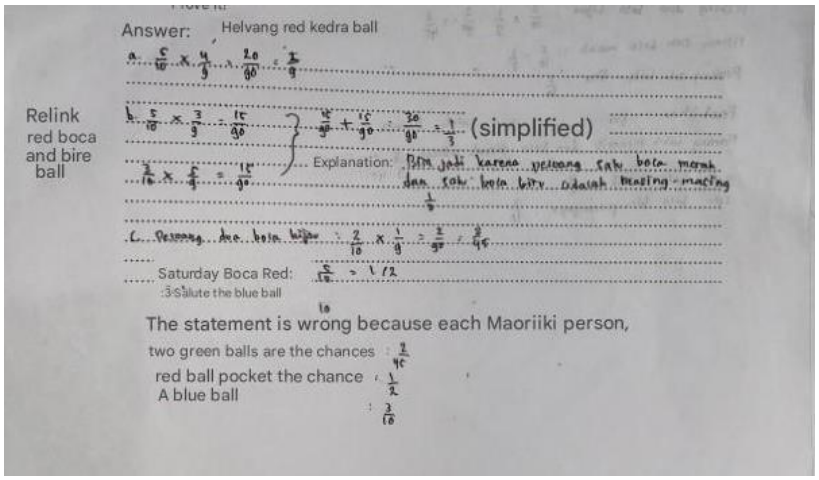

Figure 2. Results of the work from subject 2

Meanwhile, subject 2, in figure 2, is in the SRL category showing sufficient results, with the score being in the middle between subjects 1 and 3. He is able to understand the essence of the problem in the problem, but is not completely correct in formulating arguments or evaluating the results of his calculations. Several indicators of critical thinking are met, although there are still mistakes in the application of formulas or conclusions.

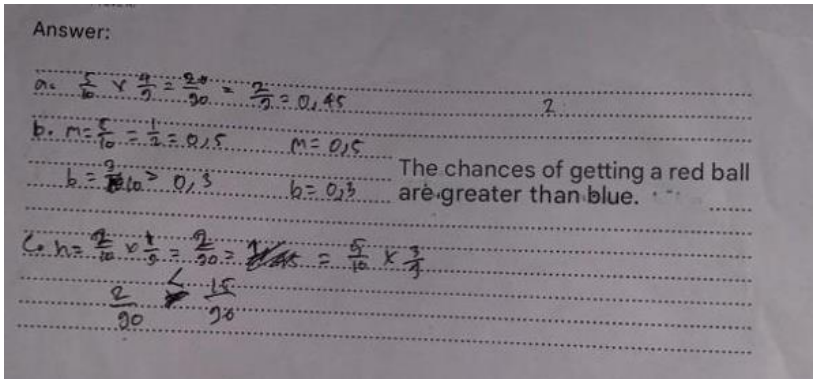

Figure 3. Results of the work from subject 3

In contrast, subject 3, as seen in figure 3, which had a low SRL showed much lower results than the other subjects. He is only able to solve a small part of the questions given, and the answers given tend to be incomplete and illogical.

Discussion

The results of this study indicate that self regulated learning (SRL) has a significant influence on students' critical thinking skills, especially in mathematics learning on

opportunity materials. Students with high SRL consistently perform better in solving problems that require critical, analytical, and reflective thinking. This ability does not appear instantly, but through a learning process that involves systematic planning, monitoring, and self-evaluation. As explained by Kesuma (2021), SRL is an active process in which students take over responsibility for their own learning process, which includes setting goals, choosing learning strategies, and reflecting on learning outcomes. In this context, SRL not only supports the achievement of learning outcomes, but also plays an important role in shaping a critical and structured way of thinking for students.

The results of this study are consistent with the research of Mahrufah, M., & Rijanto, T. (2024) which states that students' active involvement in the learning process through the SRL approach is able to improve high-level thinking skills such as critical thinking. This is strengthened by (Mukhid, 2008) which emphasizes that SRL is a combination of skills and will that make students independent learners. Students who are able to manage their time, have a learning strategy, and are able to motivate themselves internally will be better prepared to face the challenges of non-routine and complex math problems. This study is also in line with the findings (Natassya et al., 2023), which suggest that high motivation in SRL greatly contributes to high critical thinking skills. This means that SRL not only serves as a learning method, but also as a foundation for students to develop the scientific attitudes and logical reasoning needed in mathematical learning.

Furthermore, these results are in line with the findings (Rahmaini & Ogylva Chandra, 2024) which state that critical thinking is a 21st-century skill that is very essential in mathematics learning. Unfortunately, many students are not familiar with questions that require critical thinking because the learning method in the classroom is still dominated by lectures and practice routine questions. This is strengthened by (Ahmatika, 2017) which states that students' low critical thinking skills are influenced by learning models that are more oriented towards the completeness of the material than on understanding concepts. Students become passive in the learning process and only copy information from the teacher without any independent exploration of the mathematical concepts being learned. Therefore, the application of learning approaches that encourage self-regulation such as SRL is very important to change the learning paradigm to be more active and reflective.

Cependant, il est également important de noter que toutes les études n’ont pas montré une influence cohérente entre les compétences de respiration autorétractique et la pensée critique. (Fajriah & Amir, s.d.) indiquent que, dans certains contextes, aucune interaction

significative n'a été observée entre le modèle de NMS et la capacité de pensée critique. Cela montre que l'efficacité de la SRL dépend fortement du contexte de mise en œuvre, du soutien de l'environnement d'apprentissage et de la volonté des élèves d'adopter des stratégies d'apprentissage autonomes. Par conséquent, le rôle des enseignants dans la facilitation et la direction du processus de SRL est très crucial. Les enseignants doivent guider les élèves pour qu'ils soient capables de reconnaître leurs propres forces et faiblesses, et les aider à choisir les stratégies d'apprentissage qui conviennent le mieux à leurs styles d'apprentissage respectifs. Ainsi, la SRL peut vraiment être un moyen d'améliorer la qualité de la pensée critique de manière continue.

Overall, the results of this study provide a clear picture that critical thinking skills do not only depend on conceptual knowledge of mathematics, but also on students' ability to manage the learning process independently and reflectively. Mathematics learning that only emphasizes the achievement of final results without paying attention to students' thinking processes will find it difficult to cultivate critical thinking skills. Therefore, it is important for teachers to integrate SRL principles in learning design, such as providing opportunities for students to set learning goals, design completion strategies, and self-evaluate their learning outcomes. In the long run, SRL-based learning can help create lifelong learners who are able to think critically, creatively, and responsibly about their own learning process.

Conclusion and Suggestion

Based on the results of the study, it can be concluded that there is a close relationship between the level of self-regulated learning (SRL) of students and their critical thinking ability in solving math problems in opportunity materials. Students with a high SRL category are able to demonstrate complete and appropriate critical thinking skills in accordance with the specified indicators, such as making inferences, evaluating arguments, and explaining logically. Students with the SRL category are moderately able to achieve most of the indicators of critical thinking ability, although they still need reinforcement in the aspect of argument analysis. Meanwhile, students with low SRL have difficulty meeting the critical thinking indicators as a whole. These findings confirm that SRL plays an important role in supporting the development of students' critical thinking skills, so learning that encourages self-regulation needs to be part of a pedagogical strategy in mathematics learning. Research in.

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