

ISRG Journal of Multidisciplinary Studies (ISRGJMS)



ISRG PUBLISHERS

Abbreviated Key Title: isrg j. multidiscip. Stud.

ISSN: 2584-0452 (Online)

Journal homepage: <https://isrgpublishers.com/isrgjms/>

Volume – IV, Issue - VI (June) 2026

Frequency: Monthly



CRITICAL THINKING ABILITY OF GRADE X STUDENTS ON EXPONENT MATERIAL

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| Received: 02.06.2026 | Accepted: 06.06.2026 | Published: 09.06.2026

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Abstract

Critical thinking is one of the objectives of implementing an in-depth curriculum, but the critical thinking ability of students at SMAN 4 Tana Toraja is still not optimal because students are less able to provide explanations such as analyzing mathematical problems. This study aims to analyze the mathematical critical thinking ability of class X students of SMAN 4 Tana Toraja on exponential material. The method used in this study is descriptive qualitative. Data collection techniques used are interviews and test questions. The main instrument is the researcher himself and the supporting instrument used is a description of one problem. The subjects of this study were five class X students of SMAN 4 Tana Toraja who were selected using a purposive sampling technique. Thus, it can be concluded that the mathematical critical thinking ability of class X students of SMAN 4 Tana Toraja on exponential material is still low. This is evident from the results of interviews that there are still many students who still do not understand the steps that must be taken to answer questions correctly and precisely.

Keywords: *Critical Thinking, Exponent*

INTRODUCTION

Mathematics is a compulsory subject for all students, from elementary school to higher education. This is so that students can think logically, analytically, systematically, and critically (Hesti, Novianti, and Tarigas 2021). Many students view mathematics as a difficult subject. Many students still struggle with and fear learning mathematics. Mathematics is a subject that is always connected to everyday life, allowing students to develop mathematical concepts and abilities based on their knowledge and experience (Marfu'ah

and Julaeha 2021).

Objects that can be used for mathematics learning are not limited to quantities in the form of numbers and their operations, which have little mathematical significance. Rather, the emphasis is on relationships, patterns, forms, and structures. Students' understanding and absorption of the material, as well as their performance, are indicators of the success of the mathematics

learning process. The better their understanding and absorption of the material, as well as their academic performance, the higher their learning success. However, in reality, student achievement in mathematics remains low (Safitri and Mustika Sari 2024).

Mathematics is often described as a science dealing with abstract concepts. It is a universal science that underpins the development of modern technology and plays a crucial role in various areas of life, helping develop human thinking skills during the learning process (Anita and Ramlah 2021). Mathematics is crucial for all students to learn, as increasingly modern technology requires individuals with logical, critical, and systematic thinking skills.

Critical thinking is an important thinking skill for students. This is because critical thinking is a process that leads to conclusions about what we should believe and what actions we will take (Sumarmo et al. 2012). This is in line with (Álvarez-Huerta, Muela, and Larrea 2022), who state that critical thinking is the ability to understand problems and develop reasonable solutions, such as through analysis, interpretation, and essay conclusions. Critical thinking is an important skill for students, especially in developing their abilities both in subjects and in the learning process. Therefore, critical thinking is something that must be developed in every subject, because this ability is not an innate talent and does not develop naturally.

Steven (1991) defines critical thinking as thinking correctly to acquire relevant and reliable knowledge (Johanson 2019). Critical thinking involves reasoning, reflective thinking, responsibility, and expert thinking. Based on this understanding, a person is said to be a critical thinker if they can acquire knowledge carefully, not easily accepting opinions but considering them using reasoning, so that the conclusions are reliable and accountable (Hesti et al. 2021)

(Facione and Facione 2013) stated that critical thinking is self-regulation in deciding something that results in interpretation, analysis, evaluation, and inference, as well as explanation using evidence, concepts, methodologies, criteria, or contextual considerations that form the basis for making decisions. (Choy and Cheah 2009) define critical thinking as a complex process that requires high-level cognitive in processing information.

Critical thinking skills are abilities that students have when they are able to analyze facts, generalize and organize ideas to solve problems, defend these ideas, compare them, then test their arguments and draw a conclusion.

However, in this study, the researcher used 4 indicators of critical thinking skills proposed by (Ennis 1993) to determine the extent of the critical thinking skills of class X high school students. The four indicators are:

1. *Elementary Clarification* (provide a simple explanation) namely doing identification of the problem by focusing on questions and what is known about the problem.
2. *Advance Clarification* (providing further explanation) namely identifying the relationship between concepts in the problem by creating a mathematical model and appropriate explanation.
3. *Strategies and tactics* (determining strategies and techniques) namely choosing and using the right way to solve problems, and calculating them precisely and correctly.
4. *Inference* (conclude) that is, make a conclusion

From the description above, it can be concluded that students'

critical thinking skills are one ability that must be developed in students because if faced with a problem, students can find solutions to mathematical problems with correct and appropriate steps.

Based on the interviews conducted, it can be concluded that students' critical thinking skills in solving math problems are still low. This is evident from the average mathematics learning outcomes, which are still below the Minimum Completion (KKM) score. The low average student scores may be due to the fact that during the learning process, students' critical thinking skills are still low.

In mathematics learning, many students still rely on a teacher or assume that the teacher is the sole source of information, leading to students lacking confidence in solving math problems without first being explained by the teacher. Furthermore, teachers are often lacking in providing examples of practice problems, making students unaccustomed to solving them.

From the information above, it is known that students' critical mathematical thinking skills are one of the things that teachers must continue to develop in the learning process. Therefore, this study aims to determine and analyzing students' ability to think critically in high school mathematics on exponent material.

METHOD

The method used in this study is descriptive qualitative which aims to analyze students' mathematical critical thinking skills on exponent material with data collection techniques in the form of interviews and essay tests. The research instrument used is the main instrument, namely the researcher himself and the supporting instruments used in the form of one essay question and interviews. The instrument used has been validated by data experts. The subjects of this study were five high school students in grade X who were selected using a purposive sampling technique. The data analysis technique in this study is analyzing the answers of each subject with guidelines from four indicators proposed by Ennis, namely *elementary clarification* (give a simple explanation), *advance clarification* (provide further explanation), *strategies and tactics* (providing strategies and techniques) and *inference* (conclude).

RESULTS AND DISCUSSION

Based on the results of the analysis of student data consisting of four research subjects, critical thinking skills are guided by four indicators, namely *elementary clarification* (give a simple explanation), *advance clarification* (provide further explanation), *strategies and tactics* (providing strategies and techniques) and *inference* (conclude) in solving problems on the exponent material. The research results were obtained from the analysis of each subject's answers which will be explained below.

Question

A bacterial colony initially numbers 100. Every 20 minutes, the number of bacteria doubles. What will be the number of bacteria after 3 hours?

1. STUDENT A

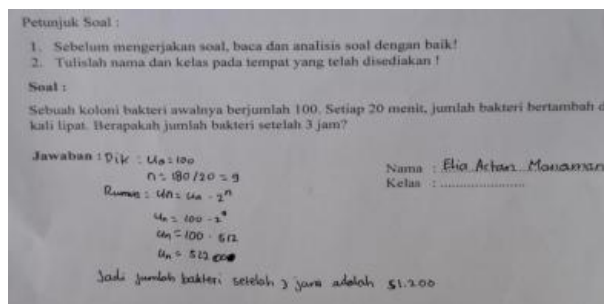


Figure 1. Student A's Answer

Based on the results of the answers in Figure 1, Student A is able to answer questions but have not yet fulfilled the four indicators of critical thinking skills. Student A able to identify problems by writing down known elements in the problem, but student A has not written what is asked in the question, so in this case, Student A has not fulfilled the indicators *Elementary Clarification* (give a simple explanation).

Student A is able to identify the relationship between concepts in problem even though the symbol used is the *n*th quarter row symbol (U_n) However, students are already able to create mathematical models and appropriate explanations. In this case, student A fulfills the indicators *advance clarification* (give further explanation). Student A can choose strategies and techniques to complete the questions so that student A is able to fulfill the third indicator, namely *strategies and tactics* (determine strategies and techniques and also student A writes conclusions on the results of the answers to the questions so that in this case student A fulfills the indicators that the fourth is *inference* (conclude). From the interview conducted by student A already sure about the mathematical model but still making mistakes in naming the symbols.

2. STUDENT B

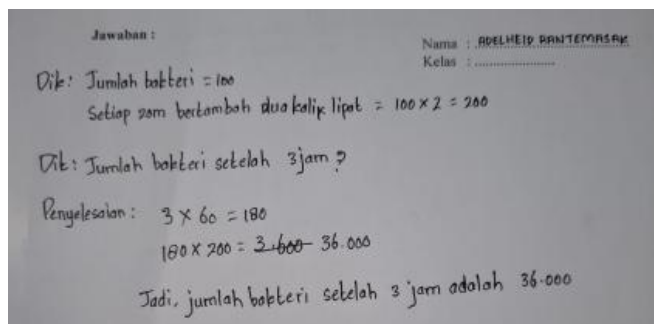


Figure 2. Student B's Answer

Based on the results of the answers in Figure 2, student B is able to do identification of the problem and has focused on what is being asked and what known in the problem so that in this case student B fulfills the indicators elementary clarification (providing a simple explanation). Student B is not yet able to identify the relationship between the concepts in the problem because it is not yet create a mathematical model with proper explanation so that at this stage Student B has not fulfilled the advance clarification indicator (providing an explanation) Furthermore).

Student B is not able to use the right method to solve the problem. problems and are unable to calculate them accurately and correctly so that student B also not yet able to fulfill the strategies and tactics indicators (determining strategies and technique). In the fourth indicator, students are able to draw conclusions but the conclusions

drawn do not meet the inference indicators because the conclusions drawn was not made correctly. From the interview conducted, student B understood the question, what what is known and asked but not yet able to determine the strategy and technique overall.

3. STUDENT C

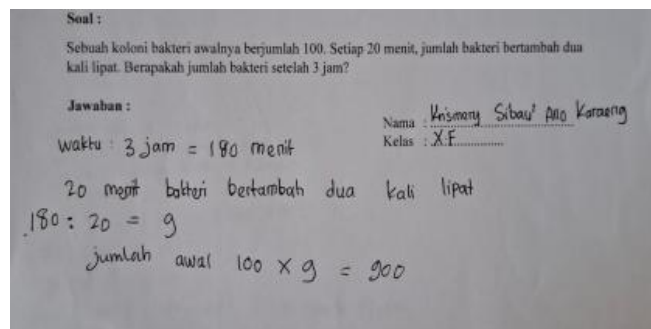


Figure 3. Student C's Answer

Based on the results of the answers in Figure 3, student C has answered the question correctly. but have not yet fulfilled the four indicators of critical thinking skills. Initially, students C is able to identify because he writes down what he knows. especially the issue of time so that in this case student C fulfills the indicators Elementary Clarification (providing a simple explanation). Student C is unable to identify the relationship between concepts in the problem so that Student C was unable to create a mathematical model and appropriate explanation. This means, Student C did not fulfill the advance clarification indicator (providing an explanation) continued). Student C cannot determine strategies and techniques to solve the problem. In this case, student C does not fulfill the Strategies and tactics indicator (determining strategies and techniques). Student C was unable to draw conclusions and at the time Student C's interview was only able to provide a simple explanation and was unable to meet the inference indicators.

4. STUDENT D

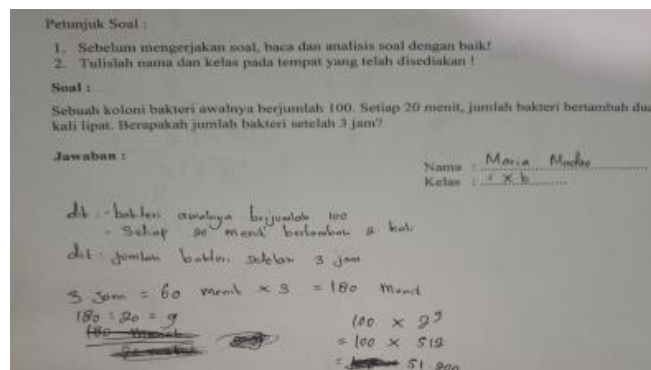


Figure 4. Student D's Answer

Based on the results of the answers in Figure 4, student D was able to answer questions but have not yet fulfilled the four indicators of critical thinking skills. Student D able to identify problems by writing down known elements in the problem and write down what is asked in the question, so that in this case Student D has fulfilled the Elementary Clarification indicator (providing an explanation) simple).

Student D is able to identify the relationship between concepts in problems so that student D is able to create mathematical models and explanations that right. This means that students have fulfilled the second indicator, namely advance clarification (providing

further explanation). Student D can choose a strategy and techniques for solving problems. In this case, student D is able to fulfill the indicators Strategies and tactics (determining strategies and techniques). Student D did not write down conclusion on the results of the answers to the questions so that in this case student D is not able to fulfilling the inference indicator (concluding). During the interview with student D information was obtained that student D understood the steps that should be used but did not write a conclusion from the answer.

5. STUDENT E

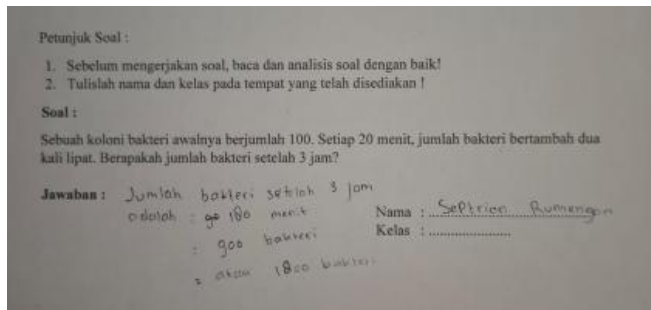


Figure 5. Student E's Answer

Based on the results of the answers in Figure 5. Student E has answered the question but has not yet fulfilled the four indicators of critical thinking skills. Student E does not write down what is known and what is asked in the question. In this case Student E did not fulfill the Elementary Clarification indicator (providing an explanation) simple).

Then Student E was unable to identify the relationship between concepts in the problem so that student E is unable to make a model mathematics and proper explanation. This means that student E does not meet the indicators The second is advance clarification (providing further explanation). Student E does not can choose strategies and techniques to solve problems. In this case, student E unable to fulfill the Strategies and Tactics indicators (determining strategies and technique). Student E did not write a conclusion on the results of the answer to the question so that in In this case, student E was unable to fulfill the inference indicator (drawing conclusions). At the time Interview with student E obtained information that student E did not know the steps steps that must be used in answering questions.

This research focuses on four indicators of critical thinking skills, namely elementary clarification, advance clarification, strategies and tactics, serta inference. The results of the study showed that the four research subjects were not yet able to fulfilling the four indicators indicates low ability students' critical thinking in solving exponential problems. This finding is consistent with previous studies that highlighted the low ability Students' critical thinking in the context of mathematics. Research by (Kuncoro et al. 2021) shows that students often have difficulty in developing understanding mathematical concepts in depth, as seen in students' difficulties in create a mathematical model in this research.

This study also revealed that some students experienced difficulties in creating mathematical models, which can be linked to the effectiveness of the model learning model used. According to (Agustito, Kuncoro, and Arif 2022), the learning model learning that emphasizes understanding concepts and application in context can actually improve students' abilities in creating mathematical models.

From the research results, it can be seen that although some students can provide simple explanations and choose strategies or tactics, but The implementation is not always accurate. This is in line with the findings (Koten et al. 2023), which states that students' ability to apply strategies and tactics often influenced by a lack of in-depth understanding of the concept. In addition, students are less able to conclude the results of the answers to questions. This limitation can be attributed to lack of training in inference skills.

Conclusion

Based on the results of the analysis and discussion of the research from the four indicators which has been explained above, it can be concluded that critical thinking skills The mathematical ability of Class X students is still low. This can be seen from the results of the analysis and The interview results showed that of the five students, none of the students fulfilled the requirements. the four indicators of critical thinking skills in the material on exponential sequences. The results of This study shows that students A and B were only able to fulfill the indicators advance clarification (providing further explanation). Likewise with Student C too only able to fulfill the Elementary Clarification indicator, namely providing simple explanation. Student D has fulfilled three indicators but has not yet fulfill the inference or conclusion indicators. Meanwhile, student E was not able to fulfill the four indicators of critical thinking skills.

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