Analysis of Critical Mathematical Thinking Skills in Level 1 Cadets of Surabaya Maritime

Tanti Diyah Rahmawati[1*], Agus Dwi Santoso[2], Vigih Heri Kristanto[3], Ambar Prisetia Rini[4]

[1,2,3,4]Politeknik Pelayaran Surabaya
Dekai, Papua Pegunungan, Indonesia
Jalan Gunung Anyar Lor, Surabaya, Indonesia
[1]t4nt1dr@gmail.com; [2]agusbp2ipsby@gmail.com; [3]vigihhery@gmail.com; [4]ambarpristia@gmail.com

ABSTRAK

Kemampuan berpikir kritis dibutuhkan seseorang untuk mengajukan dan menganalisis informasi, membuat kesimpulan berdasarkan bukti, dan mengevaluasi proses berpikirnya sendiri. Dalam konteks taruna, kemampuan berpikir kritis matematis penting karena banyak tugas yang membutuhkan pemecahan masalah dalam mengambil keputusan. Penelitian ini bertujuan mengetahui bagaimana kemampuan berpikir kritis matematis pada seorang taruna. Penelitian ini menggunakan metode deskriptif. Subjek penelitian yaitu taruna Politeknik Maritim Surabaya Jenjang 1 Program Studi Teknologi Rekayasa Permesinan Kapal. Data dikumpulkan melalui tes uraian berpikir kritis dan dianalisis secara deskriptif sesuai dengan indikator kemampuan berpikir kritis. Hasil penelitian menunjukkan kemampuan berpikir kritis subjek memiliki berbagai Interpretasi dari kategori rendah, cukup dan tinggi. Pada indikator Analisis, 64% subjek berada pada kategori cukup, pada tahap evaluasi, 71 % termasuk katefori tinggi, dan pada indikator inferensi, 74 % juga pada kategori tinggi. Secara keseluruhan kemampuan taruna dalam berpikir kritis memiliki persentase 64,75% dengan kategori cukup.

Kata Kunci: Analisis; Keterampilan berpikir kritis matematis, Level 1

ABSTRACT

Critical thinking skills are needed by someone to submit and analyze information, make conclusions based on evidence, and evaluate their thinking processes. Mathematical critical thinking skills are important in cadets because many tasks require problem-solving when making decisions. This study aims to determine how mathematical critical thinking skills are in a cadet. This study uses a descriptive method. The study subjects were cadets of the Surabaya Maritime Polytechnic Level 1, Ship Machinery Engineering Technology Study Program. Data were collected through critical thinking essay tests and analyzed descriptively according to the indicators of critical thinking skills. The results showed that the subjects' essential skills of thinking had various interpretations from the low, sufficient, and high categories. In the Analysis indicator, 64% of subjects were in the sufficient category, in the evaluation stage, 71% were in the high category, and in the inference indicator, 74% were also in the high category. Overall, the cadets' ability to think critically had a percentage of 64.75% with a sufficient category.

Keywords: Analysis; Critical mathematical thinking Skills; Level 1

Cara Sitasi:

Rahmawati, T. D., Santoso, A. D., Kristanto, V. H., & Rini, A. P. (2024). Analysis of Critical Mathematical Thinking Skills in Level 1 Cadets of Surabaya Maritime. *Plusminus: Jurnal Pendidikan Matematika, 4*(1), 47-54.

1. INTRODUCTION

Cadets of Surabaya Maritime Polytechnic have several different academic backgrounds. Admission of cadets to Surabaya Maritime Polytechnic has 2 paths, namely the Nursery Pattern path and the independent path. Where both paths go through a selection stage, both academic, psychological and health selection. With the input of cadets from various regions, heterogeneous cadets, besides that there has never been any research on analyzing critical thinking in cadets, therefore the researcher wants to conduct research on how mathematical critical thinking skills are in cadets, especially in the context of mathematics education (Tajuddin et al., 2023). Basically, mathematical critical thinking skills emerge with the involvement of a person to ask relevant questions, analyze information, make conclusions based on evidence, and evaluate their own thinking process (Iswara, Darhim, & Juandi, 2021; Diva & Purwaningrum, 2023).

In the context of cadets, mathematical critical thinking skills are important because many problems require resolution and making the right decisions so that they can be used as alternative solutions (Arini & Juliadi, 2018). Mathematical critical thinking skills also require someone to understand the problem intellectually (Yanti & Prahmana, 2017). A similar opinion was also expressed by Men (2017), mathematical critical thinking skills are making a decision or conclusion that is obtained from the process of critical, logical and reflective thinking. Critical thinking can also be interpreted as thinking logically with the right reasons and reflectively by producing a decision is thinking reasonably and reflectively by emphasizing making decisions about what needs to be done. In addition, thinking skills require cognitive processes to get the right conclusion (Ennis, 2011; Aprilia & Diana, 2023). Critical thinking is also an intellectual skill that plays an important role in education in individual and social life (Kozikoğlu, 2019).

The indicators of critical thinking consist of five aspect, namely interpretation, analyze, evaluate, and inference (Mardarani & Apriyono, 2023). Interpretation refers to understand a problem by writing down the information obtained, analyze referes to identify a problem and write it in the form of a mathematical model correctly, evaluate refers to solve a problem correctly, and inference refers to making a conclusion from the problem (Andriani & Suparman, 2018; Luritawaty, Herman, & Prabawanto, 2022; Cahyani, Fathani, & Faradiba, 2023).

Mathematics is a science that is useful in real life and is closely related to the mastery of other sciences including in the field of shipping (Sari et al., 2021; Prajono, Gunarti, & Anggo, 2022) .Based on data obtained through observations and interviews with cadets of the Surabaya Maritime Polytechnic, cadets are required to be creative and critical in accordance with technological developments in the 21st century and must be able to solve a problem by making the right decision on board. (Siburian et al., 2019; Rizky & Sritresna, 2021) also said that critical thinking is very much needed by graduates of education, especially to solve problems. Thus, the purpose of this study is to find out how to analyze mathematical critical thinking skills in Surabaya

Maritime Polytechnic cadets. Thus, the analysis of mathematical critical thinking skills in cadets requires a systematic and holistic approach to understand and improve their abilities in the context of maritime education. Therefore, the purpose of this study is to find out how to analyze mathematical critical thinking skills in Surabaya Maritime Polytechnic cadets.

2. METHOD

The research was conducted at the Surabaya Maritime Polytechnic. This research method uses a descriptive method with a quantitative approach. While the research subjects are cadets of the Surabaya Maritime Polytechnic Level 1 in the Ship Machinery Engineering Technology Study Program. Data collection techniques are in the form of tests. The test is in the form of mathematical descriptive questions that require cadets to think critically. The results are then analyzed descriptively according to the critical thinking indicators. Using the critical thinking indicator formula $(\%) = \frac{\sum score}{\sum maximum\ score} \times 100\%$. The results are then converted into the critical thinking criteria on Table 1.

Table 1. Critical Thinking Skills Criteria

Percentage (%)	Criteria
$0 < N \leq 44$	Very low
$44 < N \leq 63$	low
$63 < N \leq 72$	Enough
$72 < N \leq 81$	High
$81 < N \leq 100$	Very high

(Herunata et al., 2020)

3. RESULT AND DISCUSSION

Critical thinking skills according to the opinion (Facione, 2011) namely interpretation, analysis, evaluation and inference. Critical thinking skills in cadets vary, with categories of low, sufficient and high. The test results of cadets of Surabaya Shipping Polytechnic Level 1 TRPK Study Program at the critical thinking indicator stage (see Table 2).

Table 2. Test results according to critical thinking ability indicators

Critical Thinking Skills	Percentage (%)	Criteria
Interpretation	50	low
Analyze	64	Enough
Evaluate	71	High
Infererence	74	High
Percentage Average	64,75	Enough

a. Result

The results of the Critical Thinking Skills of the 1st-year Maritime Polytechnic Cadets in the Ship Operations Machinery Technology Study Program with the Critical Thinking Indicator have various Interpretations of 50% with moderate criteria. Where some cadets wrote what was known and what was asked but were not correct. The cadets' skills in mastering and writing meanings in understanding questions need to be trained again. This skill can be trained with problem-solving exercises for cadets in working on descriptions (Astuti et al., 2020). While in the Analysis indicator with a percentage of 64% with sufficient criteria, the answers to the cadet worksheets show that cadets can write mathematical models correctly but there are errors in their explanations. Interpretation skills are measured by distributing questions after which the cadets make connections between concepts, problems, and statements from the questions given.

Students' skills in identifying a problem between or problem statements and concepts are categorized as large. This skill can be trained by carrying out observation and experimental activities in inquiry-based education (Arsal, 2017) At the evaluation stage, 71% of the high criteria were that some cadets completed the questions correctly and completely but made several mistakes in calculating the answers. The cadets' skills in making conclusions in solving problems found were still relatively low. This skill needs to be continuously trained through a learning process that invites cadets to practice the concepts they have learned to dismantle, analyze, and draw conclusions from a problem (Ridho et al., 2020) Finally, in the inference indicator, 74% of the high criteria, the cadets had made conclusions from their answers correctly, according to the context but not yet complete as expected in the critical thinking scoring guidelines. Overall, the cadets' critical thinking ability when viewed from 4 indicators has a percentage of 64.75% with a sufficient category. Here are some of the results of students' work in working on critical thinking questions (see Figure 1).

Figure 1. Picture of cadets' answers to critical thinking test questions

From the results of the analysis of the descriptive answers, the cadets have answered according to the critical thinking indicators that with the interpretation indicator the cadets wrote what was known completely then the cadets analyzed writing a mathematical model about the length of the wire according to the questions given correctly and gave the correct reasons completely. At the Evaluation stage, this cadet used the right strategy in solving the problem so that he got the remaining wire from the beam frame and also showed the stage in the inference indicator. At this stage the cadets made conclusions correctly according to the context asked. The following picture is an example of a cadet's answer that shows several critical thinking indicators that do not all appear.
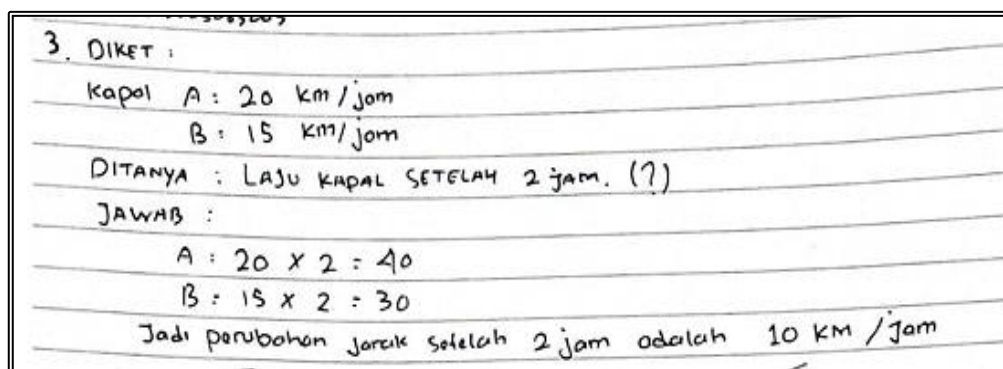

Figure 2. Picture of cadets' answers to critical thinking test questions

b. Discussion

From the results of the cadet's answers above, several indicators are seen that are incomplete, one of which does not show the analysis indicator. At the analysis stage, the cadet did not appear to make a mathematical model of the given question. The analysis of the question should have been able to use a picture or mathematical model of a ship sailing at a certain speed and calculating the change in distance between the ships. The cadet also did not evaluate in solving the question. The strategy used was inappropriate and incomplete, but the cadet carried out the Inference stage, namely making a conclusion with a score of 1 because making a conclusion was inappropriate and did not match the question given. In a study on critical thinking (Ridho et al., 2020), Mts Wahid Hasyim Batang students on the subject of material classification and its changes had an achievement of 35.2% with a low category. The results of the critical thinking ability of each indicator have different achievements. The indicator provides a basic understanding with a percentage of 31% including the low category, the indicator of building basic skills has a percentage of 61% including the high category, the formulating marker has a percentage of 17% in the very low category, the marker of sharing further descriptions has a percentage of 46%, and the strategy and method marker has a percentage of 20% with a very low category.

4. CONSLUSION

The results of the Critical Thinking Ability of the 1st Grade Maritime Polytechnic Cadets in the Ship Operations Machinery Technology Study Program with the critical thinking indicator have various Interpretations from the low, sufficient and high categories. As many as 50% with moderate criteria. In the Analysis indicator with a percentage of 64% with a sufficient category. At the evaluation stage 71% are included in the high category and the inference indicator 74% is also in the high category. Overall, the cadets' critical thinking ability when viewed from 4 indicators has a percentage of 64.75% with a sufficient category. With the results of the critical thinking of the Surabaya Maritime Polytechnic cadets, further research can be developed on the creation of modules that can be used by Maritime Polytechnic cadets to think critically or other research developments.

ACKNOWLEDGMENT

REFERENCES

Andriani, I., & Suparman. (2018). Deskripsi bahan Ajar Matematika Berbasis PMRI Untuk Mengembangkan Kemampuan Berpikir Kritis Siswa Smp Kelas VII. *Seminar Nasional Pendidikan Matematika Ahmad Dahlan 2018*, *6*(0), 221 – 226.

Aprilia, I. S., & Diana, H. A. (2023). Pembelajaran CORE Terhadap Kemampuan Berpikir Kritis Matematis Siswa Taruna Terpadu Bogor. *Plusminus: Jurnal Pendidikan Matematika*, *3*(1), 83-92.

Arini, W., & Juliadi, F. (2018). Analisis Kemampuan Berfikir Kritis Pada Mata Pelajaran Fisika Untuk Pokok Bahasan Kelistrikan dan Penerapannya dalam Kehidupan. *Fisika*, *10*(1), 1 – 11.

Arsal, Z. (2017). The Impact of Inquiry-Based Learning On The Critical Thinking Dispositions of Pre-Service Science Teachers. *International Journal of Science Education*, *39*(10), 1326 – 1338. https://doi.org/10.1080/09500693.2017.1329564

Astuti, N. H., Rusilowati, A., Subali, B., & Marwoto, P. (2020). Analisis Kemampuan Pemecahan Masalah Model Polya Materi Getaran, Gelombang, dan Bunyi Siswa SMP. *UPEJ Unnes Physics Education Journal*, *9*(1), 1 – 8.

Cahyani, I. D., Fathani, A. H., & Faradiba, S. S. (2023). Brain-based learning dalam meningkatkan kemampuan berpikir kritis siswa smp. *Jurnal Inovasi Pembelajaran Matematika: PowerMathEdu*, *2*(1), 113-122.

Ennis, R. (2011). Critical Thinking: Reflection and Perspective Part I. *Inquiry: Critical Thinking Across the Disciplines*, *26*(1), 4 – 18.

Facione, P. A. (2011). *Critical Thinking: What It Is and Why It Counts*. In Insight assessment (ISBN 13: 978-1-891557-07-1).

Fulgensius Efrem Men. (2017). Proses Berpikir Kritis Siswa SMA Dalam Pengajuan Soal Matematika Berdasarkan Tingkat Kemampuan Matematika. *Jurnal Pendidikan Dan Kebudayaan Missio*, *9*(1), 35 – 42. https://doi.org/10.36928/jpkm.v9i1.115

Herunata, H., Amayliadevi, R., & Widarti, H. (2020). Analisis Keterampilan Berpikir Kritis Pada Indikator Memberikan Penjelasan Lebih Lanjut Materi Hidrokarbon. *J-PEK (Jurnal Pembelajaran Kimia)*, *5*(1), 47 – 58. https://doi.org/10.17977/um026v5i12020p047

Iswara, E., Darhim, & Juandi, D. (2021). Students' Critical Thinking Skills in Solving on The Topic of Sequences and Series. *Plusminus: Jurnal Pendidikan Matematika*, *1*(3), 385-394.

Kozikoğlu, İ. (2019). Investigating Critical Thinking in Prospective Teachers: Metacognitive Skills, Problem Solving Skills And Academic Self-Efficacy. *Journal of Social Studies Education Research*, *10*(2), 111 – 130.

Luritawaty, I. P., Herman, T., & Prabawanto, S. (2022). Analisis Cara Berpikir Kritis Mahasiswa pada Materi Bangun Ruang Sisi Datar. *Mosharafa: Jurnal Pendidikan Matematika*, *11*(2), 191-202.

Mardarani, F. D., & Apriyono, F. (2023). Kemampuan berpikir kritis dalam pemecahan masalah ditinjau dari self-concept matematis. *Jurnal Inovasi Pembelajaran Matematika: PowerMathEdu*, *2*(2), 243-252.

Prajono, R., Gunarti, D. Y., & Anggo, M. (2022). Analisis kemampuan berpikir kritis matematis peserta didik smp ditinjau dari self-efficacy. *Mosharafa: Jurnal Pendidikan Matematika*, *11*(1), 143-154.

Ridho, S., Ruwiyatun, R., Subali, B., & Marwoto, P. (2020). Analisis Kemampuan Berpikir Kritis Siswa Pokok Bahasan Klasifikasi Materi dan Perubahannya. *Jurnal Penelitian Pendidikan IPA*, *6*(1), 10 – 15. https://doi.org/10.29303/jppipa.v6i1.194

Rizky, E. N. F., & Sritresna, T. (2021). Peningkatan kemampuan berpikir kritis dan disposisi matematis siswa antara guided inquiry dan problem posing. *PLUSMINUS: Jurnal pendidikan matematika*, *1*(1), 33-46.

Sari, A. C., Ilmiyah, N., & Lestari, I. Y. (2021). Analisis Berpikir Kritis Pada Masa Pandemi (Covid-19) Ditinjau Dari Gender. *Journal of Mathematics Education and Science*, *4*(2), 91 – 100. https://doi.org/10.32665/james.v4i2.246

Siburian, J., Corebima, A. D., Ibrohim, & Saptasari, M. (2019). The Correlation Between Critical and Creative Thinking Skills On Cognitive Learning Results. *Eurasian Journal of Educational Research*, *2019*(81), 99 – 114. https://doi.org/10.14689/ejer.2019.81.6

Tajuddin, A. T., Sujadi, I., Slamet, I., & Hendriyanto, A. (2023). Mathematical Critical Thinking: Analysis of Middle School Students' Thinking Processes in Solving Trigonometry Problems. *Mosharafa: Jurnal Pendidikan Matematika*, *12*(4), 703-720.

Yanti, O. F., & Prahmana, R. C. I. (2017). Model Problem Based Learning, Guided Inquiry, dan Kemampuan Berpikir Kritis Matematis. *Jurnal Review Pembelajaran Matematika*, *2*(2), 120 – 130. https://doi.org/10.15642/jrpm.2017.2.2.120-130

AUTHOR BIOGRAPHY

	Tanti Diyah Rahmawati, M.Pd. Born in Sorong, on July 21, 1988. Lecturer at Surabaya Maritime Polytechnic. Completed undergraduate studies in Mathematics Education at the University of Muhammadiyah Malang in 2010. Completed postgraduate studies in Mathematics Education at the University of Muhammadiyah Malang in 2017.
	Dr. Agus Dwi Santoso, S.T., M.T., M.Pd. Born in Surabaya, on August 19, 1978. Lecturer in Ship Electrical Engineering Technology at Surabaya Maritime Polytechnic. Completed undergraduate studies in Electrical Engineering at Universitas PGRI Adi Buana, Surabaya 2005 Completed postgraduate studies in Educational Technology at Universitas PGRI Adi Buana Surabaya 2012, Completed postgraduate studies in Marine Control System Engineering at ITS Surabaya in 2012 and completed doctoral studies in Educational Technology at Surabaya State University 2019.
	Vigih Heri Kristanto, M.Pd. Born in Madiun, on October 24, 1986. Lecturer at the Surabaya Maritime Polytechnic. Completed undergraduate studies in Mathematics Education at Widya Mandala Catholic University Madiun 2009. Completed postgraduate studies in Mathematics Education at Sebelas Maret University Surakarta 2012.
	Ambar Prisetia Rini, M.Pd. Born in Lampung, on June 11, 1989. Lecturer at Surabaya Maritime Polytechnic. Completed undergraduate studies in Mathematics Education at Ma'arif University, Lampung in 2013. Completed postgraduate studies in Mathematics Education at the University of Lampung in 2018.