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AN ANALYSIS OF STUDENTS' CRITICAL THINKING ABILITY PROFILE IN MATHEMATICS LEARNING

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Abstract

This study aims to analyze the profile of elementary school students' critical thinking ability in mathematics learning and identify differences based on gender. The research was conducted at SDN Pucungkidul 1 Tulungagung, involving 30 fourth- and fifth-grade students selected through purposive random sampling. Data collection was carried out using a critical thinking ability test, which consisted of five indicators: problem interpretation, conceptual analysis, argument evaluation, logical inference, and metacognitive reflection. The data were analyzed quantitatively using descriptive statistics to observe the students' average score trends, and a comparative test was conducted to identify differences based on gender. The findings indicate that the conceptual analysis indicator had the highest score, while metacognitive reflection had the lowest score, suggesting that students still struggle to evaluate their own thinking processes. Additionally, there was a tendency for differences in critical thinking abilities between male and female students, although statistical tests showed varying levels of significance. These findings imply the need for more adaptive and reflective learning strategies to enhance students' critical thinking awareness in mathematics learning.
Keywords: Critical Thinking, Mathematic, Elementary Education

INTRODUCTION

Critical thinking skills are one of the essential skills that students must have in the 21st century. According to Alec Fisher, critical thinking is a logical and reflective thinking process that

is used to make rational decisions about what to believe or do.[1] In an era filled with rapid and complex information flows, critical thinking is the main provision for students to sort, analyze, and conclude information logically and rationally.[2] However, various studies show that the critical thinking skills of students in Indonesia, especially at the elementary school level, are still relatively low.[3] Several previmous studies at each level of education have shown this. At the junior high school level, for example, only a small number of students meet several indicators of critical thinking.[4] Likewise, research from [5]describes that students show low performance in most aspects of critical thinking. The same thing happens at the elementary school level, as many as 85% of fifth grade elementary school students show very low critical thinking skills in solving science problem.[6] This is also in line with the low results of national assessments and various international studies such as the Programme for International Student Assessment (PISA), which show that many students have difficulty understanding and solving problems that require reflective and analytical thinking.[7]

Mathematics, as a discipline based on logic and problem solving, has a strategic role in developing critical thinking skills. According to Schoenfeld, effective mathematics learning not only teaches operational procedures, but also helps students develop reflective and analytical thinking skills.[8] Through mathematics learning, students are not only taught arithmetic operations, but also how to analyze patterns, identify errors, and make decisions based on existing evidence.[9] Therefore, identifying students' critical thinking profiles in the context of mathematics learning is crucial, especially at the elementary school level, where the foundation of logical and systematic thinking begins to be built.[10] However, the results of previous studies show that the critical thinking

[1] Alec Fisher, "Critical Thinking. An Introduction (2nd Ed)," in *Critical Thinking. An Introduction (2nd Ed)*, 2011.

[2] Peter A Facione, "Critical Thinking : What It Is and Why It Counts," *Insight Assessment*, 2015.

[3] Siti Zubaidah, "Keterampilan Abad Ke-21: Keterampilan Yang Diajarkan Melalui Pembelajaran. In Seminar Nasional Pendidikan (Vol. 2, No. 2, Pp. 1-17).," *Seminar Nasional Pendidikan Dengan Tema "Isu-Isu Strategis Pembelajaran MIPA Abad 21*, 2016.

[4] Nisrina Hani Prasetyo and Dani Firmansyah, "Analisis Kemampuan Berpikir Kritis Matematis Siswa Kelas VIII Dalam Soal High Order Thinking Skill," *Jurnal Educatio FKIP UNMA*, 2022, https://doi.org/10.31949/educatio.v8i1.1958.

[5] Siti Muthmainah Darmawan and Attin Warmi, "Kemampuan Berpikir Kritis Matematis Siswa Madrasah Aliyah Kelas 12 Pada Materi Statistika," *Jurnal Educatio FKIP UNMA*, 2022, https://doi.org/10.31949/educatio.v8i1.1980.

[6] Siti Luthfah Ridwan, "Peningkatan Kemampuan Berpikir Kritis Dan Hasil Belajar Peserta Didik Melalui Model Pembelajaran Discovery Learning," *Jurnal Didaktika Pendidikan Dasar*, 2021, https://doi.org/10.26811/didaktika.v5i3.201.

[7] OECD, *Education at a Glance 2019*, *Education at a Glance: OECD Indicators*, 2019, https://doi.org/10.1787/f8d7880d-en.

[8] Alan H Schoenfeld, "Learning To Think Mathematically : Sense-Makingin Mathematics," *In D. Grouws (Ed.), Hand book for Re Searchon Mathemati Cs Tea Ching and Learnin g (Pp. 334-370). New York: MacMillan.*, 1992.

[9] J. Kilpatrick, J. Swafford, and B. Findell, *Adding It up: Helping Children Learn Mathematics. National Academies Press.*, *Academic Emergency Medicine*, 2001.

[10] Fisher, "Critical Thinking. An Introduction (2nd Ed)."

skills of elementary school students in mathematics learning are still at a low to moderate level. Based on the analysis of five indicators of critical thinking skills, namely: interpretation problem, analysis conceptual, evaluation argument, conclusion logical, and reflection metacognitive.

Critical thinking includes five main indicators that are the basis for assessing the extent to which a person can think logically, reflectively, and systematically.[11] First, interpretation, which is the ability to understand and explain the meaning of information, statements, or data obtained. Interpretation allows individuals to distinguish between relevant and irrelevant information in a particular context. Second, analysis, which refers to the ability to identify relationships between concepts, ideas, or arguments. Analysis helps a person in describing the logical structure of a thought and understanding how information is interrelated.

Next, evaluation is the ability to assess the credibility of arguments and evidence provided. Evaluation involves skills in determining the validity of a claim, distinguishing fact from opinion, and recognizing bias or errors in thinking in an argument, Fourth, inference, which relates to the ability to draw conclusions based on available evidence and premises.[12] Inference involves both inductive and deductive thinking processes to produce reasonable decisions or predictions. Finally, self-regulation is a person's ability to reflect on and control their own thinking processes. Self-regulation allows individuals to identify weaknesses in their thinking and adjust thinking strategies to be more effective.[13]

These five indicators are interrelated and form a comprehensive critical thinking skill. According to Facione, critical thinking is not only an academic skill, but also a fundamental element in everyday life that allows individuals to think more rationally, make decisions based on evidence, and avoid logical errors.[14] Therefore, critical thinking education must be integrated into the learning process from an early age so that students are able to develop a more analytical and reflective mindset in facing various intellectual challenges in the future.

In this study, it was found that the indicator with the highest score was Conceptual Analysis. This shows that students have a fairly good understanding in distinguishing and connecting mathematical concepts. According to Ennis critical thinking involves a deep understanding of concepts before they can be applied in solving problems.[15] In addition, the Problem Interpretation

[11] P A Facione, *Think Critically* (Pearson Education, 2011).

[12] Linda Paul, Richard; Elder, "The Miniature Guide to Critical Thinking: Concepts & Tools," *The Foundation for Critical Thinking*, 2008.

[13] Diane F. Halpern, *Sex Differences in Cognitive Abilities, Fourth Edition*, *Sex Differences in Cognitive Abilities, Fourth Edition*, 2013, https://doi.org/10.4324/9780203816530.

[14] Facione, *Think Critically*.

[15] R H Ennis, *The Nature of Critical Thinking: An Outline of Critical Thinking Dispositions and Abilities* (University of Illinois, 2011).

indicator also showed relatively high results, which means that students have a fairly good ability to identify important information in math problems.

However, the students' Argument Evaluation and Logical Inference indicators are still relatively low, indicating that students have difficulty in assessing the validity of a solution and drawing conclusions based on available evidence. This is in line with the findings Diane which state that critical thinking skills include aspects of evaluation and inference which are often challenging for students who are not yet accustomed to an evidence-based approach.[16] The indicator with the lowest score is Metacognitive Reflection, indicating that students are not yet accustomed to consciously controlling and evaluating their own way of thinking. According to Neil, metacognitive reflection is an important component in the development of critical thinking, because it helps students identify weaknesses in their thinking strategies and make more effective improvements.[17]

Although there is a slight difference in scores between male and female students, the results of this study are not strong enough to conclude that gender factors have a significant effect on students' critical thinking skills in mathematics. A study conducted by Mercer and Howe showed that cognitive differences between males and females in critical thinking skills tend to be small, but still depend on learning experience factors and educational environment.[18]

To improve students' critical thinking skills, learning strategies are needed that emphasize more on concept exploration, self-reflection, and evidence-based problem solving. Implementation of methods such as *Problem-Based Learning* (PBL) and *Inquiry-Based Learning* (IBL) can be a solution that can be considered in encouraging students to be more active in to improve students' critical thinking skills, learning strategies are needed that emphasize more on concept exploration, self-reflection, and evidence-based problem solving. Implementation of methods such as *Problem-Based Learning* (PBL) and *Inquiry-Based Learning* (IBL) can be a solution in encouraging students to be more active in evaluating arguments and drawing conclusions based on available evidence[19]. In addition, approaches such as Scaffolding proposed by Vygotsky can also help students improve their understanding gradually through teacher guidance.[20]

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[16] Diane F. Halpern, *Thought and Knowledge: An Introduction to Critical Thinking, Fifth Edition*, *Thought and Knowledge: An Introduction to Critical Thinking, Fifth Edition*, 2013, https://doi.org/10.4324/9781315885278.

[17] Neil Mercer and Christine Howe, "Explaining the Dialogic Processes of Teaching and Learning: The Value and Potential of Sociocultural Theory," *Learning, Culture and Social Interaction*, 2012, https://doi.org/10.1016/j.lcsi.2012.03.001.

[18] Janet Shibley Hyde and Marcia C. Linn, "Gender Similarities in Mathematics and Science," *Science*, 2006, https://doi.org/10.1126/science.1132154.

[19] Mercer and Howe, "Explaining the Dialogic Processes of Teaching and Learning: The Value and Potential of Sociocultural Theory."

[20] L. S. Vygotsky, "Interaction between Learning and Development. From: Mind and Society (Pp. 79-91). Cambridge, MA: Harvard University Press.," in *Readings on the Development of Children*, 1997.

As a very important skill in the 21st century, critical thinking must be an integral part of the learning process in schools, especially in subjects that require in-depth analysis such as mathematics. Various studies have shown that students in Indonesia still face challenges in developing critical thinking skills optimally, which can be caused by learning approaches that still focus on procedural memorization rather than in-depth exploration of concepts.[21] Therefore, it is important for educators to develop learning strategies that emphasize more on analysis, evaluation, and reflection, so that students are accustomed to thinking logically and systematically in solving mathematical problems. According to Richard Paul and Linda, critical thinking not only improves understanding of academic concepts, but also forms more rational thought patterns in everyday life.[22]

By understanding and applying the five indicators of critical thinking—interpretation, analysis, evaluation, inference, and metacognitive reflection—students can develop deeper and more adaptive thinking skills.[23] However, to achieve this goal, changes in teaching methods are needed that emphasize reflective discussion, evidence-based problem solving, and providing constructive feedback to students.[24] Thus, critical thinking education should be a major focus in the elementary school curriculum to equip students with thinking skills that are useful not only in the academic world but also in facing complex challenges in real life.

Furthermore, the results of this study can be the basis for the development of more evidence-based curriculum and pedagogical interventions, especially in the context of elementary school mathematics education. Teachers can develop activities that emphasize more on evidence-based discussions, collaborative problem solving, and reflection-based learning to improve students' critical thinking skills from an early age. Given these findings, learning strategies based on metacognition and reflective discussions need to be applied to improve students' critical thinking skills.

RESEARCH METHODS

Study This use approach descriptive quantitative for analyze profile ability think critical student school base in learning mathematics as well as identify difference based on type sex. According tor J W Creswell eapproach descriptive quantitative aiming for describe a phenomenon

[21] Zubaidah, "Keterampilan Abad Ke-21: Keterampilan Yang Diajarkan Melalui Pembelajaran. In Seminar Nasional Pendidikan (Vol. 2, No. 2, Pp. 1-17)."

[22] Richard Paul and Linda Elder, "Critical Thinking: The Nature of Critical and Creative Thought.," *Journal of Developmental Education*, 2006.

[23] Facione, *Think Critically*.

[24] Halpern, *Sex Differences in Cognitive Abilities, Fourth Edition*.

in a way systematic through collection and numerical data analysis.[25] Respondents study consists of from 30 students grades IV and V at SDN 1 Pucungkidul were selected through purposive random sampling technique, which allows election sample based on characteristics certain relevant with objective study.[26]

Data collection was carried out through test think critical based on arranged mathematics based on indicator think critical developed by Facione, namely Interpretation Problems, Analysis Conceptual, Evaluation Argument, Conclusion Logical, and Reflection Metacognitive.[27] In addition that, semi- structured interviews done for dig understanding more deep related strategy think student in finish question mathematics, as recommended by Michael Quinn Patton in study qualitative.[28]

Data obtained analyzed use statistics descriptive for describe trend profile think critical student in a way general. According to Borg and Gall, statistics descriptive can give clear picture about distribution And data trends.[29] In addition that, test comparative (t- test) is used For know whether there is significant difference between student man And Woman in think critical, appropriate with recommended method by Andy in analysis statistics inferential.[30] Analysis qualitative from results interview used For complete findings quantitative with give description more Details about pattern think student.[31]

This study aims to provide a clearer mapping of the characteristics of critical thinking of elementary school students in the context of mathematics learning and its implications for the development of more inclusive and effective learning strategies. Thus, the results of this study are expected to be the basis for designing a learning approach that is more in line with students' needs, as emphasized by Vygotsky in the theory of cognitive development.[32]

[25] J W Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, ed. 4th (SAGE Publications, 2014).

[26] Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif, Dan R&D* (Alfabeta, 2019).

[27] P.A. Facione, "The California Critical Thinking Skills Test - College Level. Experimental Validation and Content Validity.," *California Academic Press*, 1990.

[28] Michael Quinn Patton, "Qualitative Research and Evaluation Methods. Thousand Oaks," *Cal.: Sage Publications*, 2002.

[29] W.R Borg and M.D Gall, "Educational Research an Introduction Fourth Edition," *Longman Inc*, 1983.

[30] Andy P. Field, *Discovering Statistics Using IBM SPSS Statistics: 5th Edition*, *SAGE Publications, Inc.*, 2018.

[31] Hans Gerd Ridder et al., "Qualitative Data Analysis. A Methods Sourcebook," *Zeitschrift Fur Personalforschung*, 2014.

[32] Vygotsky, "Interaction between Learning and Development. From: Mind and Society (Pp. 79-91). Cambridge, MA: Harvard University Press."

RESULTS AND DISCUSSION

A. Analysis of Elementary School Students' Critical Thinking Ability

This study revealed that the critical thinking skills of elementary school students in mathematics learning are still in the low to medium category. Based on descriptive statistical analysis, the average score obtained by students was 28.37 with a standard deviation of 14.91. The score ranges from 8 to 68, with most students (15 students) in the low category and 13 students in the medium category. Only 2 students reached the high category. This finding is in line with research conducted by Zubaidah, which revealed that students' critical thinking skills in Indonesia are still relatively low, especially in subjects that require analytical skills such as mathematics. To provide a clearer picture of the distribution of students' critical thinking skills in mathematics learning, the following is data on the scores obtained by students in this study. This data reflects the distribution of scores and categories of students' critical thinking levels, which are grouped into three main categories, namely low, medium, and high.

As explained by Facione, critical thinking involves several key skills, including interpretation, analysis, evaluation, inference, and metacognitive reflection.[33] The results of this study indicate that the majority of students still have difficulty in thinking critically in depth, especially in the aspects of argument evaluation and metacognitive reflection. Most students are in the low category, with only a few students managing to achieve a high level of critical thinking. This is consistent with the findings of Deti, which revealed that the critical thinking skills of Indonesian students are still relatively low, especially in subjects that require analytical skills such as mathematics.[34]

Furthermore, Halpern emphasized that critical thinking skills develop through systematic practice in evaluating arguments and drawing conclusions based on existing evidence.[35] Unfortunately, many students still rely on procedural-based learning without in-depth reflection on the concepts they are learning.[36] Therefore, low scores on several critical thinking indicators can be an indication that mathematics learning at the elementary school level still needs to be improved with an approach that encourages more exploration of concepts and in-depth reflection. The following table shows the distribution of students' critical thinking ability scores, which includes the number of students in each category and the average score for each aspect of critical thinking.

[33] Facione, *Think Critically*.
[34] Deti Ahmatika, "Peningkatan Kemampuan Berpikir Kritis Siswa," *Jurnal Handayani*, 2023.
[35] Arfika Riestyan Rachmantika and Wardono, "Peran Kemampuan Berpikir Kritis Siswa Pada Pembelajaran Matematika Dengan Pemecahan Masalah," *Prosiding Seminar Nasional Matematika*, 2019.
[36] Halpern, *Sex Differences in Cognitive Abilities, Fourth Edition*.

Table 1. Distribution of Critical Thinking Ability Scores Among Students

Category	Score Range	Number of Students
Low	0 - 18.5	15
Currently	18.6 - 32.75	13
Tall	> 32.75	2

The table shows that the majority of students still have difficulty in thinking critically in depth when solving mathematical problems. Based on descriptive statistical analysis, the average score obtained by students was 28.37 with a standard deviation of 14.91. The score ranges from 8 to 68, with most students (15 students) in the low category and 13 students in the medium category. Only 2 students reached the high category. This finding is in line with research conducted by Siti Zubaidah, which revealed that students' critical thinking skills in Indonesia are still relatively low, especially in subjects that require analytical skills such as mathematics.[37]

Table 2. Distribution of Students' Critical Thinking Ability Scores in Mathematical Problem-Solving

No.	Critical Thinking Ability Indicators	Ability Description	Average Score	Ability Category	Percentage of Students in Each Category (%)
1.	**Problem Interpretation**	Identify important information in the question and formulate the problem clearly.	7.47	Good	High (30%) Medium (50%) Low (20%)
2.	**Conceptual Analysis**	Understand, differentiate, and connect mathematical concepts logically.	8.27	Good	High (40%) Medium (45%) Low (15%)
3.	**Argument Evaluation**	Assess the appropriateness of solutions and critique arguments based on available evidence.	4.97	Moderate	High (20%) Medium (50%) Low (30%)
4.	**Logical Conclusion**	Drawing valid conclusions based on available patterns or information.	4.17	Moderate	High (15%) Medium (50%) Low (35%)
5.	**Metacognitive Reflection**	Evaluate one's own way of thinking and control problem-solving strategies.	3.50	Low	High (10%) Medium (40%) Low (50%)

[37] Siti Zubaidah, "Mengenal 4C: Learning and Innovation Skills Untuk Menghadapi Era Revolusi Industri 4.0 [Introduction to 4C: Learning and Innovation Skills to Face the Industrial Revolution 4.0]," in *2nd Science Education National Conference*, 2018.

The distribution of students' critical thinking ability scores shows that the majority of students still have difficulty in thinking critically in depth when solving mathematical problems. This can be caused by learning methods that are still oriented towards procedural memorization without encouraging deeper exploration of concept.[38] According to Facione, critical thinking involves interpretation, analysis, evaluation, inference, and reflection. In this study, it was found that students had the best ability in the conceptual analysis indicator with an average score of 8.27.[39] This shows that students are quite able to understand, differentiate, and connect the mathematical concepts they learn.

In addition, the problem interpretation indicator has an average score of 7.47, which indicates that students are able to identify important information in mathematics problems and formulate problems quite well. However, the ability to evaluate arguments and draw logical conclusions is still moderate, with scores of 4.97 and 4.17, respectively. This indicates that students still have difficulty in assessing the right solution and drawing logical conclusions based on existing evidence. This finding is in line with research Wira Suciono, Rasto Rasto, and Eeng, which states that critical thinking skills develop through continuous practice in evaluating arguments and drawing conclusions systematically.[40]

The most worrying thing is the low metacognitive reflection score, which is 3.50. This shows that students still experience obstacles in evaluating their own way of thinking and in reflecting on the strategies used to solve problems. A low score on this indicator indicates that students are not yet accustomed to consciously controlling their thinking processes. According to Tomy, metacognition is an important element in learning that allows students to monitor and adjust their thinking strategies to be more effective.[41] Therefore, a learning approach is needed that emphasizes more on reflection and monitoring of students' thinking strategies, such as through reflective discussions, metacognitive journaling, and guidance in developing problem-solving plans more systematically.

In addition to the analysis based on indicators, this study also found a tendency for differences in critical thinking skills based on gender. Male and female students showed different performance patterns in completing critical thinking test questions. Although not all of these

[38] Nurul Hayati and Deni Setiawan, "Dampak Rendahnya Kemampuan Berbahasa Dan Bernalar Terhadap Kemampuan Berpikir Kritis Siswa Sekolah Dasar," *Jurnal Basicedu*, 2022, https://doi.org/10.31004/basicedu.v6i5.3650.

[39] Facione, *Think Critically*.

[40] Wira Suciono, Rasto Rasto, and Eeng Ahman, "Analisis Faktor-Faktor Yang Mempengaruhi Keterampilan Berpikir Kritis Siswa Dalam Pembelajaran Ekonomi Era Revolusi 4.0," *SOCIA: Jurnal Ilmu-Ilmu Sosial*, 2021, https://doi.org/10.21831/socia.v17i1.32254.

[41] Tomy Suganda, Parno Parno, and Sunaryono Sunaryono, "Analisis Kemampuan Berpikir Kritis Siswa Topik Gelombang Bunyi Dan Cahaya," *Jurnal Pendidikan Fisika*, 2022, https://doi.org/10.24127/jpf.v10i1.4118.

differences were statistically significant, these findings support research Denti which revealed that there are variations in critical thinking between males and females, especially in information processing and problem-solving strategies.[42] Therefore, it is important for educators to design learning strategies that are more inclusive and responsive to students' cognitive needs based on gender differences.

The results of this study provide important implications for the world of education, especially in the context of mathematics learning in elementary schools. The curriculum and teaching strategies need to be adjusted to emphasize more on critical thinking aspects, not just procedural-based problem solving. Teachers can apply *Inquiry-Based Learning* methods, argument-based discussions, and *Problem-Based Learning* to train students in reflective and analytical thinking. In this way, students are not only able to solve math problems, but can also develop broader critical thinking skills that are useful in everyday life.

Overall, this study confirms the importance of implementing more adaptive, reflection-based, and metacognitive reinforcement-oriented learning strategies to help students improve their critical thinking skills in early mathematics learning. By understanding students' critical thinking ability profiles more deeply, educators and policymakers can design more effective interventions to support children's cognitive development in the future.

B. Differences Ability Think Critical Based on Type Sex

If reviewed based on type gender, there are 20 students man and 10 students Woman in this study. Analysis more carry on show that there is trend difference in pattern think critical between student man and women, even though the difference Not yet significant in a way statistics. Results This in line with studies conducted by Ardani and Shinta, which states that difference cognitive between man And Woman in ability think critical tend small, but still depends on factor experience Study And environment education.[43] Difference in average scores based on type sex can seen on Table 2.

Table 2. Average Critical Thinking Skills Scores Based on Gender

Gender	Average Score
Man	29.5
Woman	26.1

[42] Denti Ismiati, Depi Ardian Nugraha, and Muhamad Zulfikar Mansyur, "Pengaruh Gender Dan Gaya Belajar Terhadap Kemampuan Berpikir Kritis Matematik Peserta Didik," *Didactical Mathematics*, 2021, https://doi.org/10.31949/dm.v3i1.1448.

[43] Ardani and Shinta Hapsari, "Profil Berpikir Kritis Siswa SMP Dalam Memecahkan Masalah Matematika Ditinjau Dari Gaya Kognitif Dan Jenis Kelamin," *MATHEdunesa*, 2018.

Although there is a slight difference in scores between male and female students, these results are not strong enough to conclude that gender factors have a significant effect on students' critical thinking skills in mathematics. When viewed based on gender, this study involved 20 male students and 10 female students. The results of the analysis showed that there was a tendency for differences in critical thinking patterns between male and female students, although this difference was not statistically significant. The data showed that the average critical thinking score of male students was 29.5, while female students obtained an average score of 26.1. Although the difference is small, this finding is interesting to study further in the context of the learning environment and social factors that may influence the development of critical thinking between these two groups.

This finding is in line with research conducted by Hafidz, , and Aurora, which states that cognitive differences between men and women in critical thinking skills tend to be small and are more influenced by learning experiences and educational environmental factors than biological factors.[44] This is reinforced by Syarwa who emphasized that although there are variations in the cognitive strategies used by men and women, these differences are not large enough to be a major factor in academic disparities.[45] In other words, factors such as teaching methods, parenting patterns, and opportunities to develop analytical thinking skills play a greater role in shaping critical thinking skills than gender alone.

However, some other studies have shown that gender differences in critical thinking may be more pronounced in areas that are oriented towards problem solving and logic, such as mathematics.[46] argue that males tend to use more analytical and direct problem-solving approaches, while females rely more on reflective and connection-based approaches to previous experiences. This may explain why in some studies, male students tend to excel in conceptual analysis aspects, while female students are better at reflection and argument evaluation.

Although the results of this study have not shown significant differences, these findings are still relevant to consider how more inclusive learning strategies can be implemented to support the development of critical thinking in all students, regardless of gender. This is in line with the recommendations Halpern, which states that cognitive differences between genders can be minimized with educational approaches designed to accommodate various thinking styles.[47] Therefore, educators need to design learning methods that emphasize exploration of concepts and

[44] Ahmad Aunil Hafidz, Widya Kusumaningsih, and Aurora Nur Aini, "Analisis Kemampuan Pemecahan Masalah Matematika Ditinjau Dari Motivasi Belajar Siswa Berdasarkan Gender," *Imajiner: Jurnal Matematika Dan Pendidikan Matematika*, 2019, https://doi.org/10.26877/imajiner.v1i6.4867.

[45] Muhammad Syarwa Sangila et al., "Penalaran Matematis Antara Siswa Laki-Laki Dan Perempuan Yang Bergaya Kognitif Impulsif Dalam Memecahkan Masalah Matematika," *Al-TA'DIB*, 2019, https://doi.org/10.31332/atdb.v12i1.1201.

[46] Paul, Richard; Elder, "The Miniature Guide to Critical Thinking: Concepts & Tools."

[47] Halpern, *Sex Differences in Cognitive Abilities, Fourth Edition*.

reflection of thinking in a balanced way, so that both male and female students can develop their critical thinking skills optimally.

C. Analysis Indicator Ability Think Critical

For get better understanding in-depth, analysis to five indicator main ability think critical done. Average score for every indicator can seen in Table 3.

Table 3. Average Score of Each Critical Thinking Ability Indicator

No	Indicator	Average Score
1.	Problem Interpretation	7.74
2.	Conceptual Analysis	8.27
3.	Argument Evaluation	4.97
4.	Logical Conclusion	4.17
5.	Metacognitive Reflection	3.50

From the data, the Conceptual Analysis indicator has the highest score, which is 8.27. This shows that students have a relatively good understanding in distinguishing and connecting concepts in mathematics. A strong conceptual understanding is the foundation for critical thinking because it allows students to apply mathematical ideas more systematically and flexibly.[48] stated that critical thinking involves the ability to understand concepts in depth before they can be applied in solving more complex problems. In addition, Problem Interpretation also has a fairly high score (7.74), which means that students are quite capable of identifying important information in math problems and understanding the relationship between elements in a problem.

However, the results study This also shows that students have difficulty in Argument Evaluation (4.97) and Logical Conclusion (4.17). Low scores on both indicators indicate that students are not yet accustomed to assessing the validity of the solutions they create or drawing conclusions based on available evidence. This finding is in accordance with research conducted by Facion, which revealed that critical thinking includes the ability to evaluate and make inferences, two aspects that are often challenging for students who are accustomed to a procedural-based learning approach.[49] In mathematics, students tend to memorize formulas and follow steps without really understanding the reasons behind the procedure, so they are less skilled in evaluating the logical arguments underlying a concept or solution.

Indicator with score the lowest score in this study was Metacognitive Reflection (3.50). This result indicates that most students are still unable to consciously control and evaluate their own

[48] Ennis, *The Nature of Critical Thinking: An Outline of Critical Thinking Dispositions and Abilities*.
[49] A Facione, "Critical Thinking : What It Is and Why It Counts."

way of thinking in solving mathematical problems. According to Tilak, metacognitive reflection is an important aspect of critical thinking because it allows individuals to be aware of their thinking processes, identify weaknesses in the strategies used, and make more effective improvements.[50] In the context of education, low metacognitive reflection scores can be caused by learning methods that still do not encourage students to reflect on their thinking. Andrea emphasized that metacognitive strategies, such as reflective journaling and discussing problem-solving strategies, can help students increase awareness of their thinking processes.[51]

Based on findings This requires a learning strategy that places more emphasis on concept exploration and self-reflection. One approach that can possibly be applied is the *Problem-Based Learning* (PBL) approach, which emphasizes solving real problems as a means of developing critical thinking and metacognitive reflection. Cindy stated that PBL helps students in building deeper understanding through independent exploration and reflective discussion.[52] In addition, the *Inquiry-Based Learning* (IBL) approach can also be applied to encourage students to develop skills in evaluating arguments and drawing conclusions based on existing evidence.

Another approach that can be used is Scaffolding, as proposed by Vygotsky.[53] In this strategy, the teacher provides gradual guidance to students, which is then reduced as students' understanding and independence in critical thinking increases. In this way, students can more easily develop high-level thinking skills, including evaluating arguments and drawing logical conclusions independently.

More far, findings in this study also provides implications for curriculum development and pedagogical interventions in elementary schools. To improve students' critical thinking skills in mathematics, teachers need to develop learning activities that not only focus on procedural solutions, but also encourage students to ask questions, assess the validity of solutions, and reflect on their own thinking processes. In line with recommendations Paul, Richard; Elder, effective learning must involve strategies that challenge students to analyze, evaluate, and create solutions based on deep understanding.[54]

In general, research This shows that the critical thinking skills of elementary school students in mathematics learning are still at a low to moderate level, with variations in scores for

[50] Tilak Raj et al., "Importance of Critical Thinking in the Education," *World Journal of English Language*, 2022, https://doi.org/10.5430/wjel.v12n3p126.

[51] Andrea Barta et al., "The Development of Students Critical Thinking Abilities and Dispositions through the Concept Mapping Learning Method – A Meta-Analysis," *Educational Research Review*, 2022, https://doi.org/10.1016/j.edurev.2022.100481.

[52] Cindy E. Hmelo-Silver, "Problem-Based Learning: What and How Do Students Learn?," *Educational Psychology Review*, 2004, https://doi.org/10.1023/B:EDPR.0000034022.16470.f3.

[53] Vygotsky, "Interaction between Learning and Development. From: Mind and Society (Pp. 79-91). Cambridge, MA: Harvard University Press."

[54] Paul, Richard; Elder, "The Miniature Guide to Critical Thinking: Concepts & Tools."

each indicator. The indicator with the highest score is Conceptual Analysis, which shows students' fairly good understanding in connecting mathematical concepts. In contrast, Metacognitive Reflection is the indicator with the lowest score, indicating that students still have difficulty in evaluating their own thinking processes. Therefore, a learning strategy is needed that is more oriented towards concept exploration, self-reflection, and evidence-based problem solving to develop students' critical thinking skills. in a way more optimal.

CONCLUSION

The results of the study showed that students' critical thinking skills in mathematics learning at SDN Pucungkidul 1 Tulungagung still varied. Students performed best in conceptual analysis, showing a good understanding of mathematical concepts, while metacognitive reflection had the lowest score, indicating students' difficulties in evaluating and reflecting on their thinking processes. A tendency for differences in critical thinking skills based on gender was also found, although not all were statistically significant. Cognitive and social factors can influence the development of students' critical thinking, so a more adaptive and reflection-based approach is needed. These findings emphasize the importance of learning strategies such as *Problem-Based Learning* (PBL), scaffolding, and self-regulated learning (SRL) to strengthen critical thinking skills from an early age. These recommendations can support the development of a curriculum that is more oriented towards problem solving and reflection, thereby helping students become more independent and critical learners. Results study This Also give recommendation for development curriculum and policy education, especially in learning mathematics in school base. Implementation a more approach based on breakdown problem and reflection metacognitive can help to form generation students who do not only capable finish question mathematics with Good but Also own ability think more critical ripe for face challenge academic and also life daily.

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