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# Analysis of Mathematical Critical Thinking Ability Reviewed from Student Personality

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## ABSTRACT

This study aims to describe students' mathematical critical thinking skills based on personality types, namely Extrovert and Introvert and to identify personality types that have the highest mathematical critical thinking skills in mathematics learning. This study uses a qualitative descriptive method. The population of the study was grade VIII students of Mts Negeri 6 Cikalongkulon. The subjects of the study consisted of 21 students who filled out a personality questionnaire to determine extrovert and introvert personality types. Data were collected through personality questionnaires, mathematical critical thinking tests in the form of essays, and interviews. Data analysis was carried out using descriptive techniques to classify and explore the level of students' mathematical critical thinking skills. The results showed that students with extrovert personality types had mathematical critical thinking skills in the high category, while students with introvert personality types tended to be in the low category. This study reveals that personality types affect students' mathematical critical thinking skills.

**Keywords**: critical thinking skills; extrovert personality; introvert personality

## INTRODUCTION

Mathematics is an important subject because mathematics can form logical, critical, and analytical ways of thinking. In line with the opinion of Fatmawati, Darmono, and Purwoko (2020) who stated that mathematics not only develops logical and critical thinking skills, but also careful and creative. In line with that, the Ministry of National Education (2006) in the content standards for elementary and secondary education expects students in mathematics learning to be able to demonstrate logical, critical, analytical, careful, thorough, honest, responsible attitudes, and not easily give up in solving problems. From these two views, it can be concluded that critical thinking is one of the most important skills for students.

The importance of critical thinking in mathematics is also emphasized by several studies, including by Angga et al. (2022); Nuryanti, Zubaidah, and Diantoro (2018); and Hidayatullah, Agustiani, and Efrianti (2022) which show that critical thinking skills are used to gain a deeper understanding in learning mathematics. However, although critical thinking is a very important skill, the low level of mathematical literacy of Indonesian students remains a major challenge.

The results of the Program for International Student Assessment (PISA) 2018 showed that Indonesia was ranked 74th out of 79 countries in mathematical literacy (OECD, 2019). One of the reasons for this low ranking is the lack of contextual practice questions that can train students' critical thinking skills (Fatra, Darmono & Purwoko, 2022; Sutama, Sofia, & Novitasari, 2020). In addition, Indonesian students tend to be less trained

 

in solving high-standard questions, such as PISA questions, making it difficult to develop high-level thinking skills (Wardani & Hastari, 2022).

Students' mathematical critical thinking ability, in addition to being influenced by learning factors, is also influenced by individual factors, such as personality. Research conducted by Ningsih and Awalludin (2021); Novianty, 2022; Ngadino, Sukoriyanto and Sudirman (2022); and Rudianti, Aripin, & Muhtadi (2021) shows that students' personalities play an important role in the development of critical thinking skills. Prayitno and Ayu (2018) classify students' personalities into two main types, namely extroverts and introverts. Research shows that students with extroverted personalities tend to be better able to work in situations that require social interaction, while introverted students are more comfortable in calm and reflective situations (Ngadino, Sukoriyanto, & Sudirman, 2022). However, despite the many studies on student personality, studies on how personality affects students' mathematical critical thinking skills, especially in the Indonesian context, are still limited.

The novelty of this study lies in the in-depth analysis of the relationship between personality types and students' mathematical critical thinking skills. Previous studies, such as those conducted by Elmarfia and Yohanes (2020), focused more on general critical thinking skills without considering personality factors. Other studies, such as those by Rudianti, Aripin, and Muhtadi (2021), show differences in the level of critical thinking skills between extroverted and introverted students, but have not examined them specifically in the context of mathematics learning.

The purpose of this study is to describe students' mathematical critical thinking skills based on personality types, namely extrovert and introvert, and to identify the personality type that has the highest mathematical critical thinking skills. This study is expected to provide new contributions in efforts to improve the quality of mathematics learning by considering students' personality factors, both on a national and international scale.

## RESEARCH METHODS

The method used in this study is a qualitative descriptive method, where researchers only describe students' critical mathematical thinking skills without providing special treatment. Data collection techniques include student personality type questionnaires, written tests in the form of essays (SPLDV materials), and interviews.

The subjects of the study were 21 students of class VIII-H MTs Negeri 6 Cianjur. The sample was selected using purposive sampling technique based on the criteria of dominance of extrovert and introvert personality types. The subjects were given a personality questionnaire consisting of 24 statements to determine their personality types. Determination of extrovert and introvert personality types was obtained by adding up the scores. If the score obtained is $\geq 12$ then the student is an extrovert personality type. If the student is $<12$ then the student is an introvert personality type.

After the questionnaire, subjects were asked to work on a mathematical critical thinking test in the form of three essay questions arranged based on indicators of critical thinking skills. Additional data were collected through in-depth interviews to explore students' understanding and explanations of their answers. The results of the questionnaire,

tests, and interviews were analyzed using descriptive techniques. The analysis was carried out by grouping data based on personality type and identifying the level of students' mathematical critical thinking skills according to predetermined indicators.

## RESULTS AND DISCUSSION

Based on the results of data processed using Excel, it was obtained that students with extrovert personalities numbered 12 people, while students with introvert personalities numbered 9 people. Analysis of students' critical mathematical thinking skills was carried out based on certain indicators that reflect critical thinking skills, with an emphasis on the personality of each student. The results of the analysis are presented in Table 1.

Table 1. Analysis Results Based on Critical Thinking Ability Indicators

| Indicator | Percentage (%) | Criteria |
|---|---|---|
| Analyzing questions | 79 % | High |
| Focusing questions | 78% | Medium |
| Identifying assumptions | 72% | Medium |
| Determining solutions to problems in questions | 65% | Medium |
| Writing answers or solutions to problems in questions | 61% | Low |
| Determining conclusions from solutions to problems obtained | 75% | Medium |
| Determining alternative ways to solve problems | 3% | Very Low |

The results in Table 1 show that the indicator of analyzing questions achieved the highest achievement with high criteria (79%). This shows that most students are able to understand the core of the problem given. On the other hand, the indicator of determining alternative ways to solve the problem showed the lowest achievement with only 3%. This indicates that students tend to be fixated on one solution method without exploring other solutions.

### Results Based on Personality

The results of the analysis show that students with extrovert personalities have a higher average score compared to introvert students, as shown in Table 2.

Table 2. Results of Critical Thinking Ability Analysis Based on Student Personality

| Personality | Average Score (%) | Criteria |
|---|---|---|
| Extrovert | 76,67% | High-Medium |
| Introvert | 51 | Very Low |

Based on Table 2, it is obtained that extrovert students are superior in mathematical critical thinking skills. This is shown by their ability to analyze questions and draw conclusions better than introvert students.

The results of the study showed that students with extrovert personalities have better mathematical critical thinking skills compared to introvert students. This is in line with the psychological theory that states that extrovert individuals tend to be more open in interacting, more confident, and more active in facing challenges. Extrovert students may be easier to collaborate or discuss, which can enrich the way they think critically and solve mathematical problems.

Meanwhile, introverted students, who tend to be more reserved and more focused on internal thinking, may find it more difficult to express their ideas in group discussions or explain solutions to problems verbally. This can affect their critical thinking skills in the context of tests that require more open interaction or communication of thoughts.

*Why Do Extrovert Students Excel?*

Several reasons underlie the results showing the superiority of extrovert students in mathematical critical thinking skills:

1. Interactive and Collaborative Nature: Extroverted students tend to be more active in group discussions and dare to express their opinions. This is relevant to the Big Five Personality Traits theory, which states that extroverted traits are correlated with openness to new experiences and good communication skills (John & Srivastava, 1999; Dewi & Handayani, 2013; Ilmadina, et al., 2022). This statement is reinforced by Alvira (2019), who stated that critical thinking requires an open mind, humility, and patience, and these qualities help a person gain a deeper understanding.
2. Confidence in Facing Challenges: A study by Elmarfia & Yohanes (2020) shows that extroverted students are more confident and tend to be results-oriented, which helps them solve problems better.
3. Active Participation: Active participation in learning allows extroverted students to explore more problem-solving approaches (Nussbaum et al., 2002).
4. More careful and long-term memory: extroverted students tend to be careful and remember the material related to the questions given (Elmarfia & Yohanes, 2020).

*Obstacles Faced by Introvert Students*

The results of the study indicate that introvert students face significant difficulties in mathematical critical thinking, especially in the indicators of determining alternative solutions and writing answers or solutions. Several factors that may influence:

1. Tendency to Hesitate: Introverted students often lack confidence in conveying their answers, thus providing incomplete answers (Zhang, 2020; Anwar, et al., 2023).
2. Less thorough and less careful: Introverted students are often less thorough and less careful in solving the problems given so that the calculations made are more often wrong (Elmarfia & Yohanes, 2020; Anwar, et al., 2023).
3. Lack of Exploration of Alternative Solutions: In accordance with Facione's theory (1990), introverted students tend to think linearly and find it difficult to get out of their mindset.
4. Limited Verbal Expression: The closed nature of introverted students makes it difficult for them to communicate openly in discussion-based learning.

This study provides implications for strengthening Facione's theory (1990) which states that critical thinking can be developed through social interactions involving discussion and collaboration. So in practice, teachers can apply a project-based learning approach or individual reflection to support the development of students' critical thinking skills, especially for introvert students.

This study has limitations in terms of the relatively small sample size (12 extrovert students and 9 introvert students), which may affect and limit the generalization of the

results. In addition, other factors such as educational background, learning motivation, and anxiety levels may also affect the results of students' critical thinking ability tests. Therefore, further research can be conducted with a larger sample and control for other factors that have not been studied in this study to provide a more comprehensive understanding.

## CONCLUSION

Based on the results of the discussion, it can be concluded that:

1. Extrovert students have an advantage in mathematical critical thinking skills compared to introvert students, with a higher average score on almost all indicators.
2. The main weakness of both groups is the low exploration of alternative solutions, with only 3% of students being able to do so.
3. Project-based learning strategies or individual approaches can support the development of critical thinking in introvert students.

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