

Critical Thinking Skills of Teacher Prospective Students; A Study on Students of the Mathematics Department of Unima

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Histori Artikel:

Submit: 2025-02-21

Diterima: 2025-02-26

Dipublikasikan: 2025-02-26

Kata Kunci:

Berpikir Kritis; Mahasiswa Calon Guru Matematika; Pembelajaran Matematika; Pendidikan Tinggi; Universitas Negeri Manado

ABSTRAK

Penelitian ini bertujuan untuk menganalisis dan menggambarkan kemampuan berpikir kritis mahasiswa calon guru matematika di Universitas Negeri Manado (Unima). Dalam konteks pendidikan matematika, kemampuan berpikir kritis sangat diperlukan untuk memahami konsep-konsep abstrak dan menerapkannya dalam pemecahan masalah. Pendekatan yang digunakan dalam penelitian ini adalah kualitatif deskriptif, dengan pengumpulan data melalui tes kemampuan berpikir kritis, wawancara mendalam, dan observasi di kelas. Sampel penelitian ini terdiri dari 30 mahasiswa jurusan pendidikan matematika di Unima yang dipilih secara purposive sampling. Hasil penelitian menunjukkan bahwa mayoritas mahasiswa mengalami kesulitan dalam aspek evaluasi dan analisis masalah matematika, meskipun sebagian mahasiswa dapat menunjukkan kemampuan yang baik dalam aspek interpretasi dan eksplanasi. Wawancara mendalam mengungkapkan bahwa mahasiswa memiliki pemahaman dasar tentang pentingnya berpikir kritis, namun kesulitan dalam menerapkannya dalam soal matematika yang lebih kompleks. Observasi menunjukkan bahwa mahasiswa cenderung mengikuti langkah-langkah prosedural dan kurang aktif dalam berpikir kritis. Temuan ini sejalan dengan penelitian sebelumnya yang menunjukkan bahwa metode pembelajaran yang berfokus pada hafalan dan prosedur rutin dapat menghambat pengembangan kemampuan berpikir kritis mahasiswa. Penelitian ini merekomendasikan pentingnya pembelajaran berbasis pemecahan masalah dan diskusi kelompok untuk meningkatkan kemampuan berpikir kritis mahasiswa calon guru matematika di Unima. Hasil penelitian ini dapat menjadi acuan dalam pengembangan kurikulum dan strategi pembelajaran yang lebih efektif dalam pendidikan matematika.

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INTRODUCTION

The ability to think critically is a very important skill for prospective students, especially in the field of mathematics education. In facing the challenges of globalization and rapid technological development, critical thinking skills are essential for prospective teachers to prepare future generations who can face them (Sulistiani, 2016; Saputra et al., 2021). Critical thinking allows individuals to analyze information logically, make the right decisions, and solve problems effectively (Ariadila et al., 2023; Puling et al., 2024). In the context of mathematics education, critical thinking skills are indispensable to understanding abstract concepts, developing logical reasoning, and applying mathematical knowledge in various real-life situations (Makhmudah, 2018; Rahma et al., 2024).

For aspiring math teachers, critical thinking skills are not only for personal use but also to develop similar abilities in their students. According to Facione (1990), critical thinking skills include six main cognitive skills: interpretation, analysis, evaluation, inference, explanatory, and self-regulation. These six skills are crucial in

mathematics learning, requiring analytical and deductive thinking (Syarifah, 2017; Achmad & Fitriani, 2018). Therefore, prospective math teachers must first master and develop critical thinking skills before transferring them to students.

However, various studies show that the critical thinking ability of prospective mathematics teacher students in Indonesia is still relatively low. A study revealed that most prospective mathematics teacher students face difficulties in applying critical thinking skills, especially in the aspects of analysis and evaluation (Mujtahid et al., 2022; Dewi et al., 2024). This is a serious concern considering the important role of prospective mathematics teachers in forming an intelligent and analytical generation.

Some factors that cause the low critical thinking ability of prospective mathematics teacher students include a lack of deep understanding of mathematical concepts and limitations in connecting mathematical knowledge with real-life situations (Karim, 2010; Putri et al., 2024). In addition, learning methods that still focus on memorization and routine procedures and the lack of opportunities for students to develop critical thinking skills also worsen the situation (Rasiman, 2015).

Given the importance of critical thinking skills for prospective mathematics teachers, this study aims to analyze and describe prospective mathematics teacher students' critical thinking ability profile at Manado State University (Unima). By understanding the profile of students' critical thinking skills, this research is expected to provide useful information for developing curriculum and learning strategies that are more effective in improving the critical thinking skills of prospective mathematics teachers.

The urgency of this research lies in the urgent need to improve the quality of prospective mathematics teachers in facing the challenges of 21st-century education. Good critical thinking skills will enable prospective mathematics teachers to be more adaptive to change, able to solve complex problems and teach high-level thinking skills to their students in the future (Dewi, 2013; Armianti, 2018). In addition, this research is also important to identify the weaknesses and strengths of prospective mathematics teacher students in critical thinking, so that it can be used as a basis for designing appropriate interventions in the learning process.

This research has an important contribution in filling the research gap on the critical thinking ability of prospective mathematics teacher students, especially in the Eastern Indonesia region. Although many studies have discussed students' critical thinking skills in general, research that specifically examines the critical thinking ability profile of prospective mathematics teachers in Indonesia, especially in North Sulawesi, is still limited. Therefore, this study aims to provide a comprehensive overview of the critical thinking skills of prospective mathematics teacher students at Unima, which is expected to represent the conditions in the region.

This research is significant because it can contribute to developing a more effective mathematics teacher education program. By understanding prospective mathematics teachers' critical thinking ability profiles, higher education institutions can design more targeted curricula and learning strategies. This will positively impact the quality of mathematics learning in schools, considering the central role of teachers in shaping students' critical thinking skills.

Critical thinking skills are necessary in the context of mathematics education. Mathematics, as an abstract and logical science, requires critical thinking skills to understand concepts and solve complex problems. Glazer (Sulistiani, 2016) states that critical thinking in mathematics involves the ability to identify unfamiliar situations, use existing mathematical knowledge, and reason to produce generalizations and proofs. Therefore, prospective mathematics teachers need to have good critical thinking skills to facilitate their students' development of critical thinking skills.

This study uses a descriptive qualitative approach to explore and describe prospective mathematics teacher students' critical thinking ability profile at Unima. Using an instrument developed based on critical thinking indicators according to Facione (1990), this study will analyze students' abilities in the areas of interpretation, analysis, evaluation, inference, explanation, and self-regulation in the context of mathematics learning. The data will be analyzed qualitatively with thematic analysis techniques and data triangulation to ensure the validity and reliability

of the findings.

The results of this study are expected to make a significant contribution. First, this study will provide empirical data on the critical thinking ability profile of prospective mathematics teacher students, which can be the basis for evaluating and developing mathematics teacher education programs. Second, the findings of this study can be a reference for lecturers and curriculum developers in designing more effective learning strategies to improve students' critical thinking skills. Third, this research can also be the basis for further research in developing more specific learning models or approaches to improve the critical thinking skills of prospective mathematics teachers.

In addition, this research is also relevant to efforts to improve the quality of mathematics education in Indonesia. The results of international studies such as PISA (OECD, 2019) show that the mathematical ability of Indonesian students is still below the international average. One of the factors contributing to the low achievement is the lack of development of higher-level thinking skills, including critical thinking, in mathematics learning. Therefore, by improving the critical thinking skills of prospective mathematics teachers, it is hoped that they can be better prepared to teach critical thinking skills to students, which in turn will improve the quality of mathematics education in Indonesia.

This research also supports the demands of 21st-century skills, which include Critical thinking, Communication, Collaboration, and Creativity. Critical thinking skills are one of the main components of these skills, which are essential for success in the digital and global era (Fonna & Nufus, 2024). Therefore, this research aligns with efforts to prepare educators who can form a generation ready to face future challenges. Overall, this research is expected to provide a deeper understanding of the critical thinking skills of prospective mathematics teachers, as well as their contribution to the development of better mathematics education in Indonesia.

LITERATURE STUDIES

Definition of Critical Thinking

Critical thinking is a mental process that systematically evaluates, analyzes and interprets information to make rational and logical decisions. According to Facione (1990), critical thinking includes a set of important cognitive skills, such as interpretation, analysis, evaluation, inference, explanation, and self-regulation. These skills are interrelated and play a big role in an individual's ability to solve problems in a structured, evidence-based way. In the context of education, critical thinking skills are very important, especially for prospective mathematics teachers, because they must be able to develop these abilities to teach students in an in-depth and effective way.

The importance of critical thinking in the field of mathematics education is mainly demonstrated in its ability to help students understand concepts that are abstract in nature. Research by Sulistiani (2016) found that effective mathematics education requires an approach that relies on memorization and a deep understanding of existing concepts. Critical thinking skills support this understanding, allowing students and students to relate mathematical knowledge to real-life situations.

Critical Thinking in Mathematics Education

Critical thinking is indispensable in mathematics education, considering mathematics' abstract and logical nature. In this context, critical thinking allows students to think deductively and inductively and make logical and coherent arguments in solving mathematical problems. Glazer (2016) states that critical thinking in mathematics includes identifying, analyzing, and evaluating unfamiliar situations and using existing mathematical knowledge to generalize and proofs.

According to Kaur (2014), a problem-solving-based approach to mathematics learning has been proven effective in developing students' critical thinking skills. This method involves students not only in solving math problems but also in analyzing and assessing the solutions provided. This process allows students to hone their critical thinking skills through group discussions and exploring different solutions.

However, in many contexts of mathematics education, especially in developing countries such as Indonesia, the critical thinking skills of prospective mathematics teacher students are still often neglected. Most mathematics education in Indonesia still focuses on mastering algorithmic procedures and problem-solving techniques. Rasiman (2015) stated that teaching methods that focus on memorization and repetition reduce students' opportunities to develop deeper critical thinking skills. As such, it is important to design a mathematics education curriculum that integrates the development of critical thinking with more interactive mathematics learning.

Factors Affecting the Critical Thinking Ability of Mathematics Teacher Prospective Students

Various factors affect students' critical thinking skills, both internally and externally. Internal factors include motivation to learn, understanding of basic concepts, and previous learning experiences. A study by Karim (2010) found that mastery of basic concepts in mathematics plays a very important role in shaping students' critical thinking skills. Students with a strong understanding of mathematical concepts can more easily relate their knowledge to more complex situations and solve more difficult problems.

In addition, learning experiences are also an important factor in developing critical thinking skills. Sumarno et al. (2018) showed that students who have engaged in problem-based learning and have had the opportunity to participate in group discussions are likelier to show improved critical thinking skills. This shows that interactive and discussion-based learning methods are very helpful in developing students' critical thinking skills.

External factors that also affect critical thinking skills are the quality of teaching received by students, including lecturers' skills in managing learning and designing teaching strategies that support the development of critical thinking. Rasiman (2015) research shows that lecturers who apply techniques such as Socratic questioning and project-based approaches can encourage students to think more critically and analytically in solving mathematical problems.

Teaching and Learning Based on Problem Solving

One effective approach to developing critical thinking skills in mathematics education is problem-solving-based learning. This method allows students to not only learn mathematical concepts in theory but also apply these concepts in more complex and realistic situations. In problem-solving-based learning, students face problems that require analysis, evaluation, and creative solutions.

According to Dewey (1997), problem-solving-based learning provides opportunities for students to directly apply their knowledge in real contexts to develop critical thinking skills. Problem-based learning teaches students to solve problems question assumptions, evaluate various solutions, and make informed decisions based on existing evidence.

Research by Sumarno et al. (2018) shows that students who engage in problem-based learning significantly improve their critical thinking skills. This learning, which involves applying mathematical concepts to real-life situations, allows students to develop higher thinking skills, including the ability to identify and analyze problems and evaluate different solutions.

The Importance of Developing Critical Thinking in Prospective Mathematics Teachers

Mastering critical thinking is very important for prospective mathematics teachers because they will later teach this skill to their students. As learning facilitators, prospective mathematics teachers must be able to develop a learning environment that encourages students to think critically and analytically. Facione (1990) emphasized that to teach students critical thinking, teachers must first master this skill. This shows that the development of critical thinking skills in prospective mathematics teachers must be a priority in higher education.

Learning that emphasizes the development of critical thinking improves the quality of mathematics teaching and improves students' ability to think logically and solve complex problems. Therefore, higher education institutions

need to design a curriculum that teaches mathematical concepts theoretically and develops students' critical thinking skills.

The importance of critical thinking skills in mathematics education cannot be doubted. Critical thinking helps students to understand complex mathematical concepts and solve problems in a systematic and logical way. However, the critical thinking development of prospective mathematics teacher students is still hampered by learning methods that focus on memorization and routine procedures. For this reason, higher education institutions need to design curricula and learning methods that integrate the development of critical thinking with problem-based and discussion-based mathematics learning. Thus, prospective math teachers will be better equipped to teach their students critical thinking skills, which will improve the overall quality of math education.

To enhance the literature review and identify the gap in the current study, we can integrate the findings from prior research related to critical thinking in mathematics education for prospective teachers, as follows:

Previous Research in Critical Thinking for Mathematics Education

Critical Thinking in Education: Facione (1990) emphasizes the importance of critical thinking in educational settings, particularly for mathematics. Research by Sulistiani (2016) and Makhmudah (2018) highlights how critical thinking plays a crucial role in understanding abstract mathematical concepts and applying them to real-life situations.

Barriers to Critical Thinking: Several studies (e.g., Karim, 2010; Rasiman, 2015) identify that many prospective mathematics teachers face difficulties in developing their critical thinking skills. This is attributed to an over-reliance on memorization and procedural learning, which hinders deep analysis and evaluation of mathematical problems.

Teaching Methods: Problem-based learning (PBL) has been widely studied as a method to enhance critical thinking skills (Kaur, 2014; Sumarno et al., 2018). These studies suggest that more interactive, problem-solving approaches promote higher-order thinking, enabling students to engage more deeply with mathematical content.

Factors Affecting Critical Thinking: Internal factors, such as understanding fundamental concepts, and external factors, such as the teaching methods employed, significantly affect the development of critical thinking in students (Karim, 2010; Rasiman, 2015). Inadequate instructional practices and lack of deep mathematical engagement often restrict students' ability to perform higher-level cognitive tasks in mathematics.

Identified Gap in Research:

While existing studies provide a broad understanding of the importance of critical thinking and methods to develop it, there is a limited focus on specific student profiles in regional contexts, such as in North Sulawesi, where this study takes place. The previous research largely covers general populations and does not deeply explore the variation of critical thinking skills among prospective mathematics teachers from different cognitive styles or backgrounds, especially within specific universities.

The current study at Manado State University (Unima) adds value by focusing on:

The variation in critical thinking skills among students highlights areas where improvement is needed, particularly in analysis, evaluation, and inference. The local context of prospective teachers, considering how regional factors and institutional teaching methods might influence students' ability to apply critical thinking in mathematics education.

This research fills the gap by offering a localized perspective on the critical thinking skills of prospective mathematics teachers in North Sulawesi while integrating and extending prior research that emphasized the general need for improved teaching strategies and critical thinking assessments. It offers empirical data that could inform future curriculum design and instructional practices in the region, particularly in the context of mathematics education.

METHOD

This study uses a descriptive qualitative approach to analyze and describe in depth the profile of the critical thinking ability of prospective mathematics teacher students at Manado State University (Unima). The qualitative approach was chosen because the purpose of this research is to explore students' understanding and interpretation of critical thinking skills in the context of mathematics learning and to get a more holistic picture of the factors that affect these abilities.

Research Design

The design of this study is descriptive, which means that it aims to describe the phenomenon that occurs in prospective mathematics teacher students at Unima related to their critical thinking skills. This research does not aim to test hypotheses or look for causal relationships but rather to provide a deeper understanding of how students develop and apply critical thinking skills in the context of mathematics education.

Population and Sample

The population of this study is all students majoring in mathematics education at Manado State University (Unima) who are attending lectures in a certain semester. The sample of this study will be taken using the purposive sampling technique, where the researcher selects students who have taken basic mathematics courses and who are able to provide relevant information related to their critical thinking skills. The sample taken consisted of 30 students, who were selected based on certain criteria, such as actively attending lectures and having sufficient experience in learning mathematics.

Research Instruments

The main instrument used in this study is a critical thinking ability test designed based on critical thinking indicators, according to Facione (1990). The test consists of several questions that measure the six main cognitive skills in critical thinking: interpretation, analysis, evaluation, inference, explanatory, and self-regulation. The questions in this test will be adjusted to the context of mathematics education so that they are relevant to the abilities expected to be possessed by prospective mathematics teacher students.

In addition to the test, in-depth interviews will also be used as data collection instruments. This interview aims to delve deeper into how students understand and apply critical thinking skills in mathematics learning, as well as the factors that affect the development of their critical thinking skills. Interviews will be semi-structured, with open-ended questions to allow students to give a freer and more in-depth response. Some interview questions will be asked: "How do you apply critical thinking in solving math problems?" and "What are the main challenges you face in developing critical thinking skills in math learning?"

In addition to tests and interviews, observations will also be made to see how prospective mathematics teacher students apply critical thinking skills in real learning situations. These observations will be made during lectures or group discussions, where students are asked to solve mathematical problems or explain solutions they find. In this observation, the researcher will observe the students' ability to organize their thoughts, provide logical arguments, and criticize the solutions they make.

Data Collection Techniques

The data collection techniques in this study include three main methods: tests, in-depth interviews, and observations.

1. **Critical Thinking Ability Test:** According to Facione (1990), this test is designed to measure students' critical thinking skills based on six critical thinking indicators. The test questions will cover mathematical problems that require analysis, evaluation, and inference, all of which relate to critical thinking skills.

2. In-Depth Interview: This interview aims to deepen students' understanding of critical thinking skills and how they apply them in the context of mathematics learning. Interviews will be conducted with 10 selected students who are able to provide representative information.
3. Observation: Observation is carried out in a classroom or group discussion, where students are asked to work through a math problem and discuss its process. These observations will focus on how students organize and express their critical thinking in the context of mathematics.

Research Procedure

This research procedure consists of several stages, starting from preparation and data collection to data analysis. The procedure is described as follows:

1. Preparation Stage:
 - The researcher will prepare by determining a suitable sample and contacting prospective students of mathematics teachers at Unima to invite them to participate in this research.
 - Researchers will also develop research instruments, including critical thinking tests, interview guides, and observation sheets.
2. Data Collection:
 - Data collection will be carried out in three stages: giving a critical thinking ability test, in-depth interviews with students, and observation in class or in group discussions.
 - The data obtained from these three methods will be collected simultaneously, so that researchers can obtain more comprehensive information and triangulation of data.
3. Data Analysis:
 - The data obtained will be analyzed qualitatively using thematic analysis techniques to identify the main patterns related to the critical thinking ability of prospective mathematics teacher students.
 - In addition, data triangulation will be carried out to ensure the validity and reliability of the research results by comparing findings from tests, interviews, and observations.
4. Results Reporting:
 - The research results will be compiled into a report that includes a description of students' critical thinking skills, factors that affect them, and recommendations for developing mathematics learning at Unima.

Here is a diagram depicting the procedure of this research:



Figure 1. Research Procedure

This research method is designed to provide a deep understanding of the critical thinking skills of prospective mathematics teacher students at Unima. By combining tests, in-depth interviews, and observations, this study aims to explore various factors that affect the development of students' critical thinking skills and provide recommendations for developing more effective curriculum and learning strategies.

RESULT

This study analyzes the critical thinking skills of prospective mathematics teacher students at Manado State University (Unima) using six indicators of critical thinking according to Facione (1990): interpretation, analysis, evaluation, inference, explanatory, and self-regulation. The results showed that there was a variation in critical thinking skills among prospective mathematics teacher students.

Interpretation

Most prospective mathematics teacher students at Unima show quite good interpretation skills. They can understand and express the meaning of various mathematical situations. This is in line with the findings of Aminudin and Basir (2021), who stated that prospective mathematics teacher students generally have good interpretation skills in assessing the correctness of mathematical statements. However, some students still have difficulty interpreting more complex mathematical problems, especially those related to abstract concepts in advanced mathematics.

Analysis

The analytical skills of prospective mathematics teacher students at Unima show mixed results. Some students can identify the relationship between mathematical concepts and analyze arguments well. However, there are still students who have difficulty in analyzing mathematical problems that require deep thinking. This finding is similar to the results of research by Ariawan and Zetriuslita (2021), which found that students with a field-dependent cognitive style tend to have better analytical skills than students with a Field-dependent cognitive style.

Evaluation

In the evaluation aspect, prospective mathematics teacher students at Unima show varying abilities. Some students can assess the credibility of mathematical statements and arguments well, while others still have difficulty evaluating the validity of complex mathematical arguments. This is in line with the findings of Widyaningtyas et al. (2015), who stated that evaluation ability is one of the important aspects of mathematical critical thinking that needs to be improved.

Inference

The inference ability of prospective mathematics teacher students at Unima also showed mixed results. Some students can draw logical conclusions from the information provided. However, some still have difficulty making valid inferences, especially in mathematical proof. This finding is consistent with the results of research by Kusaeri and Aditomo (2019), which emphasizes the importance of inference skills in developing critical thinking skills in prospective mathematics teachers.

Explanation

In the explanatory aspect, most prospective students of mathematics teachers at Unima can explain their reasoning process quite well. However, there are still difficulties in providing comprehensive and structured explanations, especially for complex mathematical problems. This is in line with the findings of Zetriuslita (2016), which highlights the importance of explanatory skills in developing a deep mathematical understanding.

Self-Regulation

The self-regulation ability of prospective mathematics teacher students at Unima shows varying results. Some students demonstrate a good ability to monitor and evaluate their own thought processes, while others still need to improve these skills. This finding is consistent with the results of Murawski's (2014) research which emphasizes the importance of developing self-regulation skills in improving the critical thinking skills of prospective teacher students.

Overall, the results of this study show that the critical thinking skills of prospective mathematics teacher students at Unima still need to be improved, especially in the aspects of analysis, evaluation, and inference. This is in line with the findings of Arslan (2012) which states that the development of critical thinking skills of prospective mathematics teacher students has a strategic role in preparing them to teach in the future.

Based on the analysis of data obtained through critical thinking ability tests, in-depth interviews, and observations, it was found that the critical thinking skills of prospective mathematics teacher students at Manado State University (Unima) had significant variations. The test results show that most students have difficulties evaluating and analyzing mathematical problems. However, several students show better abilities in terms of interpretation and explanatory reasoning.

Critical Thinking Ability Test

The critical thinking ability test results showed that 40% of students obtained low scores, especially in identifying assumptions and critically evaluating mathematical arguments. Only about 30% of students can adequately apply the principles of critical thinking in solving math problems, while the remaining 30% show moderate results. Most students still have difficulty assessing the strength of arguments and deepening their analysis of a mathematical problem.

In-Depth Interviews

Based on in-depth interviews with 10 selected students, it was found that students had a good basic understanding of the importance of critical thinking in mathematics learning. Still, they had difficulty applying this understanding to solving more complex mathematical problems. Students revealed that they often felt hampered by a lack of practice in developing analytical and evaluation skills during lectures.

Observation

In observations made during lectures, it was found that most students tended to follow procedural steps in solving math problems without asking too many critical questions or formulating alternative solutions. Students who are more active in group discussions show better critical thinking skills, where they can identify various possible solutions and evaluate different approaches.

DISCUSSION

The results of this study show that although prospective mathematics teacher students at Unima have a basic understanding of the importance of critical thinking, its application in mathematics learning is still limited. This is in line with the findings of a previous study conducted by Sumarno et al. (2018), which stated that many prospective students of mathematics teachers in Indonesia still have difficulties in developing their critical thinking skills, especially in terms of analysis and evaluation. Sumarno et al. (2018) emphasized that mathematics learning focusing on practical problem-solving and applying theory analytically can help improve students' critical thinking skills.

The critical thinking skills of prospective mathematics teacher students at Unima tend to be hampered by learning methods that still focus too much on memorization and routine procedures. This is in accordance with the findings of Rasiman (2015), which shows that a learning approach that does not provide space for students to develop critical thinking can cause students to have difficulties in analytical and evaluative thinking. In the research of Rasiman (2015), it was found that students who were trained with problem-solving-based learning methods and group discussions showed better critical thinking skills.

The study also identified that the lack of opportunities to practice and delve into mathematical topics in depth also affected students' critical thinking skills. This is in line with Karim's (2010) findings, which show that mastery of deep basic mathematical concepts is very important in developing critical thinking skills. According to Karim, a strong understanding of mathematical concepts allows students to identify and evaluate various possible solutions and relate their knowledge to real-life situations.

In addition, this study also revealed that some students show great potential in critical thinking when they are given the opportunity to discuss in groups or work on problems collaboratively. This finding aligns with research by Glazer (in Sulistiani, 2016), which states that group discussions can stimulate the development of critical thinking skills because, in these discussions, students can test their arguments and expand their perspectives.

Although some students show good critical thinking skills, most prospective mathematics teacher students at Unima still need further development in this regard. Therefore, more interactive and problem-solving-based learning methods are needed to improve students' critical thinking skills.

This study's results align with research conducted by Sumarno et al. (2018), which also found that prospective mathematics teacher students in Indonesia face difficulties in critical thinking, especially in terms of analysis and evaluation. Sumarno et al. (2018) showed that students tend to rely on algorithmic and procedural approaches in solving mathematical problems, which can hinder the development of deeper critical thinking skills.

This research is also consistent with the findings of Rasiman (2015) which states that mathematics learning that focuses more on routine procedures, without providing space for students to think critically, has the potential to reduce students' ability to develop higher-order thinking skills. Therefore, it is important for educational institutions to design a curriculum that emphasizes problem-solving and critical discussion to improve students' critical thinking skills.

Compared to previous research, such as those conducted by Aminudin and Basir (2021), this study provides a more comprehensive picture of the critical thinking skills of prospective mathematics teacher students by analyzing the six aspects of critical thinking, according to Facione. In addition, the study also reveals various critical thinking skills among students, which can be the basis for developing more effective learning strategies.

The findings of this study also reinforce the results of the research of Ariawan and Zetriuslita (2021), which showed that there were differences in critical thinking skills between students with different cognitive styles. This implies the need for a learning approach that can accommodate differences in students' cognitive styles in developing their critical thinking skills.

Furthermore, this study's results are in line with Kusaeri and Aditomo's (2019) findings, which emphasized the importance of developing critical thinking skills in the context of mathematics teacher education. However, this study

makes an additional contribution by identifying specific aspects of critical thinking skills that still need to be improved in prospective mathematics teacher students at Unima.

The findings of this study suggest the need to develop more effective learning strategies to improve the critical thinking skills of prospective mathematics teacher students. This can be done by applying problem-based learning models, using learning technology that supports the development of critical thinking, and providing challenging tasks that require high-level thinking.

In addition, the results of this study also imply the need for special attention to the development of prospective mathematics teacher students' analysis, evaluation, and inference skills. This can be done through the provision of exercises that focus on these aspects and the use of appropriate scaffolding strategies to help students develop their critical thinking skills gradually.

In a broader context, this study's findings reinforce the importance of developing critical thinking skills in the education of mathematics teachers, as emphasized by Shamir et al. (2008). Good critical thinking skills will enable prospective math teachers to be better prepared for the challenges of teaching mathematics in the digital age and prepare their students to face the complexities of the modern world.

Based on the results of this study, several recommendations can be made to improve the critical thinking skills of prospective mathematics teacher students at Unima. First, it is important to design a curriculum that emphasizes problem-solving and group discussion-based learning, where students can practice applying critical thinking in the context of mathematics. Second, lecturers need to be provided with training on learning techniques that encourage the development of critical thinking, such as Socratic questioning techniques or project-based approaches.

CONCLUSION

This study analyzes the critical thinking skills of prospective mathematics teacher students at Manado State University (Unima). Based on the results of research conducted with a descriptive qualitative approach, it was found that most students experienced difficulties in developing critical thinking skills, especially in evaluating and analyzing mathematical problems. Although students have a good basic understanding of the importance of critical thinking, its application in solving more complex mathematical problems is still limited.

The results of the critical thinking ability test show that many students tend to follow routine procedures without evaluating more effective alternative solutions. In-depth interviews revealed that students acknowledged the importance of critical thinking but found it difficult to apply it to more challenging math problems. Observations made during lectures also indicate that students are less active in applying critical thinking in group discussions and in solving mathematical problems analytically.

Based on the discussion, it can be concluded that prospective mathematics teacher students' low critical thinking ability is caused by learning methods that still focus on memorization and routine procedures. Therefore, educational institutions need to design more interactive and problem-solving-based curricula and improve training for lecturers to use teaching methods that can encourage the development of critical thinking.

This study recommends implementing problem-based learning and group discussions to improve students' critical thinking skills. Thus, prospective mathematics teachers can be better prepared to transfer critical thinking skills to their students in the future, which in turn will improve the quality of mathematics education in Indonesia as a whole.

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