



ANALYSIS OF CRITICAL THINKING OF PROSPECTIVE MATHEMATICS TEACHERS IN SOLVING ASSESSMENT PROBLEMS

Dewi Sukriyah*¹, Dwi Juniati²

^{1,2} Universitas Negeri Surabaya, Indonesia

Article Info

Article history:

Received Jun 11, 2023

Revised Sept 11, 2023

Accepted Nov 28, 2023

Keywords:

Critical Thinking
Prospective Teacher
Mathematics

ABSTRACT

Professional teacher candidates must have several competencies, including pedagogical competence. This competency is essential to understand the characteristics of students in various aspects. Simple qualitative descriptive research that describes the critical thinking skills of prospective mathematics teachers based on the percentage of achievement of critical thinking skills test results. We researched 6th-semester students of the Mathematics Education Study Program consisting of 35 students. The research instrument used critical thinking skills test questions consisting of 5 questions prepared based on indicators of critical thinking skills: identifying and interpreting, analyzing, evaluating, connecting, and solving problems. Data analysis used a percentage system. The results showed that the critical thinking skills of prospective mathematics teachers had a total average of 70% in the high category. This result is supported by the percentage of critical thinking skills in each indicator: interpreting and identifying indicators by 85%, analyzing indicators by 70%, connecting indicators by 82.14%, problem-solving indicators by 20%, and evaluating indicators by 92.86%. The results of the percentage classified by gender show that the ability of female prospective mathematics teachers to think critically on each indicator is better than that of male prospective mathematics teachers.

This is an open access article under the [CC BY](https://creativecommons.org/licenses/by/4.0/) license.



Corresponding Author:

Dewi Sukriyah,
Departement of Mathematics Education,
Universitas Negeri Surabaya, Indonesia
Email: dewi.22008@mhs.unesa.ac.id
Phone Number : 081556740951

How to Cite:

Sukriah, D., Juniati, D. (2023). Analysis Of Critical Thinking Of Prospective Mathematics Teachers In Solving Assessment Problems. *JME: Journal of Mathematics Education*, 8(2), 107-113

1. INTRODUCTION

The role of a teacher is one of the components that learning can achieve the goals of national education. Therefore, teachers must have several competencies that must be mastered as stated in the Law on Teachers and Lecturers. These competencies include pedagogical, personality, social, and professional competence. Prospective teachers, including prospective mathematics teacher students, must also possess these competencies. According to Shulman, there is seven basic knowledge in teaching, namely mathematical content knowledge (MCK), pedagogical knowledge, pedagogical content knowledge (PCK), curriculum knowledge, student knowledge, educational context knowledge, and knowledge of educational goals (Shing et al., 2015). Mathematics content knowledge includes a teacher's ability to explain why something is considered true, the relationship between one statement and another, and knowing why something is so can show valid evidence supporting a statement's truth. Low mathematics content knowledge can hinder a teacher's ability to analyze students' mathematical abilities (Gess, 2013). This condition shows that teachers' mathematics content knowledge affects and becomes one of the determinants of success in learning. Therefore, prospective teachers must have good analytical skills and critical thinking.

Critical thinking is effective in helping student teachers understand mathematical concepts. Someone who thinks critically will organize concepts in detail, check information, and evaluate in order to obtain relevant knowledge (Chukwuyenum, 2013). Critical thinking is an essential ability that must be possessed by students both in problem solving and in making decisions so that they will get good results. Students need to practice critical thinking because it will make it easier for students to solve problems. In accordance with the explanation that a person's thinking ability cannot be developed without explicit effort and deliberately trained (Heard et al., n.d.). Critical thinking includes thinking that tests, questions, connects, evaluates all aspects that exist in the situation or problem that arises. This is in line with Facione's opinion (Pratiwi, 2015), which states that critical thinking skills can be measured through the ability to interpret, analyze, evaluate, identify, explain, and self-regulation (Facione, 2020). So in this study, the indicators used to measure critical thinking skills are as follows: 1) Interpretation and identification; 2) Analysis; 3) Evaluation; 4) Connecting; 5) Problem Solving. Critical thinking is considered effective in helping prospective teacher students in mastering mathematical content knowledge, critical thinking will also affect the quality of learning assessment instruments at school. the preparation of the quality of learning assessment instruments at school carried out by student teachers prospective teachers. A good school learning assessment instrument can measure the success of learning objectives appropriately (Pratiwi, 2015). In addition, one of the problems in the mathematics education study program of STKIP PGRI Sidoarjo is the heterogeneous student input in mathematics ability and major background at the secondary school level. Not all students who choose the mathematics education study program come from MIPA majors, even some of them come from vocational schools. Likewise, the results of research conducted by Fikriyati show that the disposition and critical thinking skills of prospective science teachers are still relatively low and underdeveloped (Fikriyati et al., 2022). To find out the critical thinking skills of prospective mathematics teachers, therefore, a study is needed on the analysis of critical thinking of prospective mathematics teachers as a form of effort to prepare students as prospective teachers and know their level of critical thinking.

2. METHOD

The subjects of this study were sixth semester students of Mathematics Education Study Program of STKIP PGRI Sidoarjo. The selection of this subject is with the

consideration that students have taken almost all the compulsory courses in the Mathematics Education Study Program so that the provisions as prospective mathematics teachers have been fulfilled. The instrument used in this research is a critical thinking test question in the form of 5 essay questions. The questions in the critical thinking test questions are compiled based on critical thinking indicators, then the questions are validated by experts. Data collection begins with giving critical thinking test questions to students, and continued data analysis using quantitative descriptive analysis techniques obtained in the form of percentages. The data that has been collected is then scored (each question has a score of 0 - 4). After the scoring is done, it is then analyzed in the form of a percentage with the aim of facilitating the determination of student dominance in critical thinking skills using the following formula:

$$\frac{\text{sum of the scores of each indicator}}{\text{total number of respondents} \times \text{maximum score}} \times 100\%$$

The calculation data in the form of percentages that have been obtained through descriptive analysis is carried out to provide a general description of the critical thinking skills of prospective mathematics teachers. Furthermore, the percentage is used to classify the level of critical thinking ability according to table 1 below (Arikunto, 2008):

Table 1. Critical Thinking Ability Criteria

Percentage Level (%)	Qualification
81 – 100	Very High
61 – 80	High
41 – 60	Medium
21 – 40	Low
0 – 20	Very Low

3. RESULTS AND DISCUSSION

3.1. Results

Based on the research data obtained from the results of tests conducted on 35 students, the following are presented the results of the percentage score as follows:

Table 2. Percentage Results of Critical Thinking Ability

Critical Thinking Indicator	Percentage (%)
Identify & Interpret	85 (very high)
Analyzing	70 (high)
Connecting	82.14 (very high)
Problem Solving	20 (very low)
Evaluating	92.86 (very high)
Overall	70 (high)

Table 3. Percentage students of critical thinking ability based on Gender

Critical Thinking Indicator	Percentage (%)	
	Male	Female
Identify & Interpret	80 (high)	90 (very high)
Analyzing	70 (high)	70 (high)
Connecting	79,27 (high)	85 (very high)

Critical Thinking Indicator	Percentage (%)	
	Male	Female
Problem Solving	10 (very low)	30.2 (low)
Evaluating	90 (very high)	95,6 (very high)
Overall	65 (high)	75 (high)

Based on table 2, it can be seen that the highest percentage of indicators of critical thinking ability of prospective mathematics teachers is evaluating. This shows that the evaluation indicator is the best critical thinking ability indicator possessed by prospective mathematics teachers at STKIP PGRI Sidoarjo. While the indicator with the lowest percentage is the indicator of solving problems. However, when viewed based on table 2, the indicators of identifying, connecting, and analyzing are in the high and very high categories. Overall, the percentage of achievement of critical thinking indicators reached 70% with a high category, which means that overall students' critical thinking skills are good even though they still need an improvement process on problem solving indicators because the percentage of achievement was 20% with a low category.

The percentage of critical thinking skills based on gender as seen in table 3 shows that, male students get the highest percentage on evaluation with a percentage of 90% (very high category). Female students get the highest percentage on the evaluation indicator reaching 95.6% with very high category. From the percentage value of each critical thinking indicator, it shows that female students' scores are higher than male students' scores. Its mean that female students' critical thinking skills are better than male students' critical thinking skills.

3.2. Discussion

Based on the results of the analysis contained in Table 2, it is known that the critical thinking skills of prospective mathematics teachers at STKIP PGRI Sidoarjo are classified in the high category. This can be seen from the results of the answers of students who answered correctly.

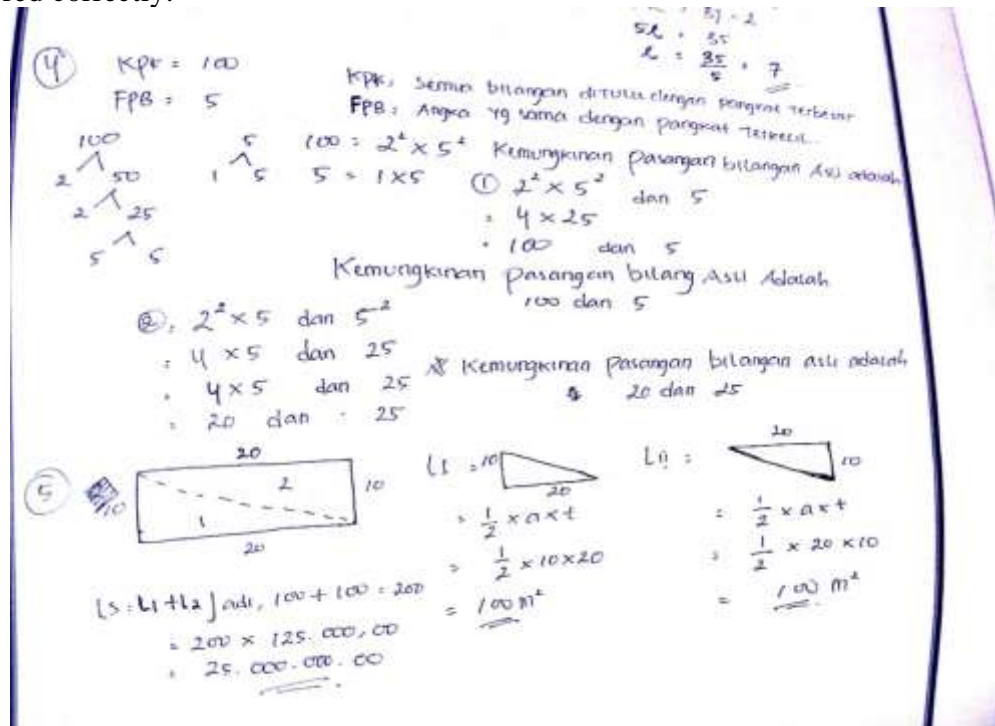


Figure 1. Work student results (a)

From the picture, it can be seen that students wrote their answers in a very detailed, systematic, and clear manner. In Addition, the high critical thinking skills of prospective teachers are due to the fact that the lecture process always involves activities that lead to critical thinking and practice in the learning process. Although there is still a need to improve critical thinking skills on the aspect of solving problems as seen in the results of the following student answer.

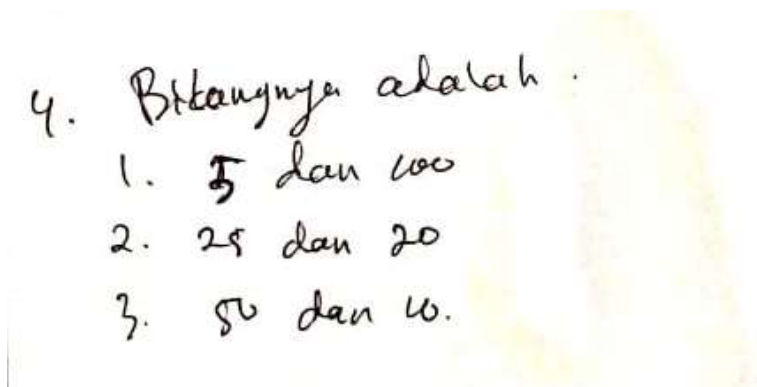


Figure 2. Work student results (b)

From the figure 2, students only write the final result of the answer and do not write the steps of the answer completely and coherently. This is consistent with the research which state that students' lack of basic knowledge results in them not being able to solve the problems posed properly and wrote the answer completely (Sumargiyani et al., 2021)(Noprianda et al., 2019). This can happen because their previous educational background is diverse. They did not only come from high school, but also from vocational schools with non-engineering specializations, for example from tailoring specializations.

The low level of critical thinking skills in the aspect of problem solving is caused by classroom learning carried out by lecturers who also do not train students in solving problems. This can be seen from the learning activities that are carried out are monotonous, do not explore students' critical thinking skills, limited learning resources, and lack of exploring phenomena around the environment and supported by the results of research which states that problem solving skills can be improved through routine practice and a supportive learning atmosphere (Çarkit & Kurnaz, 2022). Critical thinking skills in terms of solving problems can be raised through strengthening concepts and appropriate learning activities. One of them is by using certain active learning models that contain problem solving exercises that can foster critical thinking.

Critical thinking is an activity that is influenced by the learning experience obtained by students (Fahim & Eslamdoost, 2014). If during the learning process students are often given exercises or activities to carry out critical thinking activities, then students will have good development of critical thinking skills in every aspect, including the aspect of problem solving. Critical thinking is a well-organized mental process that plays a role in the decision-making process of solving problems by analyzing and interpreting data in scientific investigation activities(Hafidz et al., 2022). Lecturers need to choose a learning model that can involve students in practicing problem-solving skills.

Critical thinking is reasonable and reflective thinking that is focused on making decisions about what to do or what to believe (Yanti et al., 2019). The statement of reasonable thinking implies thinking based on facts to produce the best decision and reflective thinking means looking consciously and firmly for the best possible solution. In

addition, critical thinking skills are skills that cannot be inherited and are not directly owned by students, so training is needed so that these skills can be owned by students, especially prospective mathematics teachers (Setiawati & Corebima, 2017). For prospective teacher students, critical thinking skills are a must-have skill considering that these students are prepared to educate students in schools. In order for students to be trained in a critical attitude, of course, the prospective teacher must first have the attitude, ability and critical thinking skills in each aspect of critical thinking in line with the results of research (DeWaelche, 2015) which states that the ability to think critically is obtained because it is trained not inherited. Critical thinking skills play a role in processing information, solving problems, and expressing opinions so that each individual can understand the information obtained.

Based on the percentage obtained by male and female students, it can be seen that there is a difference between the percentage criteria on each critical thinking indicator. The highest percentage of female students is on the evaluation indicator and the highest percentage of male students is also on the evaluation indicator. However, the percentage value of female students is higher than male students. Overall, each percentage of the very high category is dominated by female students, while male students dominate the percentage in the high criteria. This shows that female students are overall better than male students. In line with the results of the study which states that the critical thinking skills of female students are better than those of male students (Zetriuslita, 2016).

4. CONCLUSION

The results of the study show that the critical thinking ability of prospective mathematics teachers has an overall average of 70% with a high category, which is supported by the percentage results on each indicator, namely interpreting and identifying indicators of 85%, analyzing indicators of 70%, connecting indicators of 82.14%, problem-solving indicators of 20%, and evaluating indicators of 92.86%. The percentage of each indicator shows that the critical thinking skills of female students are better than those of male students. Problem-solving indicators are low due to a lack of practice and habituation in classroom learning. Critical thinking abilities and skills are acquired due to routine habituation, not genetic inheritance. The results of this study are expected to be used by lecturers or researchers to design and develop learning activities that can facilitate students to practice critical thinking skills so that students can get used to using these skills in everyday life. Further research can be done on this case, one of which is research on developing learning tools based on problem-solving and critical thinking.

REFERENCES

- Çarkit, C., & Kurnaz, H. (2022). The Relationship between Preservice Teachers' Critical Thinking and Epistemological Beliefs. *International Journal of Progressive Education*, 18(1), 114–127. <https://doi.org/10.29329/ijpe.2022.426.7>
- Chukwuyenum, A. N. (2013). *Impact of Critical thinking on Performance in Mathematics among Senior Secondary School Students in Lagos State*. 3(5), 18–25.
- DeWaelche, S. A. (2015). Critical thinking, questioning and student engagement in Korean university English courses. *Linguistics and Education*, 32, 131–147. <https://doi.org/10.1016/j.linged.2015.10.003>
- Facione, P. A. (2020). Critical Thinking: What it is and Why it Counts. Terdapat pada <https://www.insightassessment.com/wp-content/uploads/ia/pdf/whatwhy.pdf>.

- Fahim, M., & Eslamdoost, S. (2014). Critical thinking: Frameworks and models for teaching. *English Language Teaching*, 7(7), 141–151. <https://doi.org/10.5539/elt.v7n7p141>
- Fikriyati, A., Agustini, R., & Suyatno, S. (2022). Pre-service Science Teachers' Critical Thinking Dispositions and Critical Thinking Skills. *Proceedings of the Eighth Southeast Asia Design Research (SEA-DR) & the Second Science, Technology, Education, Arts, Culture, and Humanity (STEACH) International Conference (SEADR-STEACH 2021)*, 627, 176–181. <https://doi.org/10.2991/assehr.k.211229.028>
- Gess, J. (2013). *Pedagogical Content Knowledge: An Introduction and Orientation*. January 2002. <https://doi.org/10.1007/0-306-47217-1>
- Hafidz, Moh., Retnaningdyah, P., Mustofa, A., Setiawan, S., & Purwati, O. (2022). the Students' Mental Process of Critical Thinking Skill Analyzing Literary Work. *JEELL (Journal of English Education, Linguistics and Literature) English Department of STKIP PGRI Jombang*, 8(2), 104. <https://doi.org/10.32682/jeell.v8i2.2175>
- Heard, J., Scoular, C., Duckworth, D., Ramalingam, D., & Teo, I. (n.d.). *Critical Thinking: Skill Development Framework*.
- Noprianda, M., Noor, M. F., & Zulfiani, Z. (2019). Keterampilan berpikir kritis siswa model pembelajaran problem based learning dan sains teknologi masyarakat pada konsep virus. *Edusains*, 8(2). <https://doi.org/10.15408/es.v8i2.3892>
- Pratiwi, D. (2015). *Mahasiswa Calon Guru Biologi Melalui Pembelajaran Kooperatif Pada Mata Kuliah Desain Pembelajaran 2014 / 2015*. 13–25.
- Setiawati, H., & Corebima, A. D. (2017). Empowering Critical Thinking Skills Of The Students Having Different Academic Ability in Biology Learning of Senior High School through PQ4R - TPS Strategy. *The International Journal of Social Sciences and Humanities Invention*, 4(5), 3521–3526. <https://doi.org/10.18535/ijsshi/v4i5.09>
- Shing, C. L., Saat, R. M., & Loke, S. H. (2015). *The Knowledge of Teaching – Pedagogical Content Knowledge (PCK)*. 3(3), 40–55.
- Sumargiyani, S., Istiandaru, A., & Ainurrahman, M. A. (2021). Analisis Kemampuan Berpikir Kritis Matematis Mahasiswa Calon Guru Matematika Menggunakan Soal Limit Fungsi Berbasis Hots. *AdMathEdu : Jurnal Ilmiah Pendidikan Matematika, Ilmu Matematika Dan Matematika Terapan*, 11(1), 19. <https://doi.org/10.12928/admathedu.v11i1.20307>
- Yanti, Y. E., Susilo, H., Amin, M., & Hastuti, U. S. (2019). Analisis Keterampilan Berpikir Kritis Dan Keterampilan Proses Sains Mahasiswa Calon Guru Sekolah Dasar. *Seminar Nasional Biologi “Inovasi Penelitian Dan Pendidikan Biologi III (IP2B III) 2019” Analisis*, 3(Ip2b Iii), 77–86.
- Zetriuslita, H. (2016). *Students' Critical Thinking Ability: Description Based on Academic Level and Gender*. 7(12), 154–164.