



Analysis of Critical Thinking Ability and Understanding of Basic Science Concepts in Primary School Teacher Education Students

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Abstract: Students are not encouraged to develop their thinking skills, and learning in class is only directed at memorizing information. In addition, it is important for Primary School Teacher Education (PGSD) students who will become elementary school teacher candidates to have good critical thinking skills and a good understanding of basic science concepts. This study describes the ability to think critically and understand basic science concepts in PGSD students at PGRI Yogyakarta University. This research is a quantitative descriptive study using survey methods. The population of this study was second-semester PGSD students at PGRI Yogyakarta University. The research sample consisted of 77 second-semester PGSD students. The data analysis technique used in this study was descriptive analysis by measuring and describing the results of critical thinking skills and understanding basic science concepts. The results of this study indicate that the highest percentage of achievement is on the indicator of critical thinking skills, namely providing simple explanations, with a percentage of 75.45% with high criteria, and the indicator of understanding concepts with the highest percentage, namely the indicator of remembering with a percentage of 87.98% with very high criteria.

Keywords: Concepts of Basic Science; Critical Thinking Ability; Understanding Concepts

Introduction

Education is something that every individual needs as a provision for the future and to create the next generation who can advance the nation. It is known that many achievements of Indonesian students have been inscribed in the world of education, including victories in international science Olympiads, scientific work, robotics technology, and even becoming overall champions by beating other competing countries (Mahanal et al., 2019). Through this description, Indonesia already has competitive and highly quality education in the eyes of the world, where the meaning of quality is more towards something good (Lince, 2022). However, in UNESCO data through the Education of All (EFA) Global

Monitoring Report 2011, Indonesia's education is still ranked 69th out of 127 countries below the Southeast Asian region (Prasetyo, 2017).

Education in the 21st century has a big role and responsibility to overcome challenges in the world of education. The US-based Partnership for 21st Century Skills (P21) identifies critical thinking skills (Critical Thinking Skills), Creative Thinking Skills (Creative Thinking Skills), Communication skills (Communication skills), and collaboration skills (Collaboration skills) as competencies needed in the 21st century (Zubaidah, 2018). Critical thinking skills are fundamental skills in solving problems. This skill is important for teacher candidates to have in finding the source of problems and how to find and find the right solution to the problem at hand. Critical thinking is a

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process that enables individuals to acquire new knowledge, synthesize, judge, create and apply new knowledge in real-world situations. Critical thinking is important in learning because it allows students to learn by discovering (Dewi, 2018). When students think critically, they are actively responsible for their learning (Zulkarnain, 2019). Winiari et al. (2019) classifies critical thinking skills into several aspects, namely: 1) Interpretation; 2) conclusion; 3) evaluation, 4) explanation; 5) analysis; and 6) self-regulation. Therefore, a prospective teacher needs to have the ability to think critically to be able to make good decisions in the learning process.

In addition, the thing that needs to be considered by prospective teachers in teaching science is understanding the basic concepts of science in the material to be taught. Mastery of concepts is necessary for successful learning. Understanding the concept is a very important aspect of learning because students can develop their abilities in each subject matter by understanding the concept. Conceptual understanding is an ability that forms the basis for students in understanding science learning (Annajmi, 2016). In this regard, students' mastery of concepts is expected to be able to manage cognitive skills so that improvements can be made in further learning (Lestari et al., 2018). However, even though it is important to understand basic concepts for students, the mastery of understanding concepts for students in Indonesia still needs to improve. This is evidenced by the Trends in International Mathematics and Sciences Study (TIMSS) survey results, where Indonesia is still in the bottom 6th place (Hayati & Asmara, 2021). From the results of TIMSS, students' low ability to connect basic science concepts with real life, because learning is still abstract (Wicaksono et al., 2020).

For this reason, it is important to instill concepts in students. Teachers as educators have an important role in increasing students' understanding of basic science concepts. According to Subayani (2022) students as prospective educators need to understand the basic concepts of science so that later students will be able to develop students' ability to understand science concepts when they become teachers. Because instilling the initial concepts of science is very important so that children have a solid foundation at a later stage. For this reason, Primary School Teacher Education students as prospective teachers must be able to teach science learning effectively to develop students' basic science concept abilities (Sulthon, 2017).

Therefore, this research is useful to measure and understand the ability to think critically and the understanding of concepts in understanding the

concepts taught in a particular subject or discipline. The findings of this research will help in developing curricula, education, and learning more effectively at higher education levels. In addition, the main objective is to identify shortcomings and weaknesses in the peer review process.

The importance of developing critical thinking skills and mastery of concepts is outside the current conditions of science learning. One of the problems faced in Indonesia is the weakness of the learning process; students need to be encouraged to develop their thinking skills, and learning in class is only directed at memorizing information without being required to understand what they remember (Amijaya et al., 2018). Therefore, it is very important for Primary School Teacher Education students who will later become elementary school teacher candidates to have good critical thinking skills and an understanding of basic science concepts. This study describes the ability to think critically and understand basic science concepts in Primary School Teacher Education students at PGRI Yogyakarta University.

Method

This research is a quantitative descriptive study using survey methods. The population of this study was second-semester Primary School Teacher Education students at PGRI Yogyakarta University. The research sample consisted of 77 2nd semester Primary School Teacher Education students. The data analysis technique used in this study was descriptive analysis by measuring and describing the results of critical thinking skills and understanding of basic science concepts in students sampled in this study. Tests for critical thinking skills and understanding basic science concepts use instruments for critical thinking skills and conceptual understanding in the form of essay written tests. Critical thinking skills indicators use indicators developed by Ennis (2013) and Hughes (2014), which consist of giving simple explanations, making further explanations, building basic skills, analyzing data, and providing alternative solutions. The test for understanding basic science concepts refers to indicators, according to Bloom in Sapruddin (2023) which consist of C1 = Remember, C2 = Understand, C3 = Apply, C4 = Analyze, C5 = Evaluate, C6 = Synthesize. In addition, this study's critical thinking criteria used the criteria developed by Utama & Kristin (2020), presented in Table 1. Meanwhile, the criteria for mastering concepts were used by Ramdani (2020), which are presented in Table 2.

Table 1. Criteria for Critical Thinking

Category	Criteria
81.25 < x ≤ 100 %	Very high
71.50 < x ≤ 81.25 %	High
62.50 < x ≤ 71.50 %	Average
43.75 < x ≤ 62.50 %	Low
0 < x ≤ 43.75 %	Very low

Table 2. Concept Understanding Criteria

Category	Criteria
86 - 100 %	Very high
71 - 85 %	High
56 - 70 %	Average
41 - 55%	Low
0 < 40%	Very low

Result and Discussion

Critical Thinking Ability

Based on the results of data analysis according to indicators of critical thinking skills from data collection using test instruments in the form of essay written tests, the overall results are presented in Figure 1.

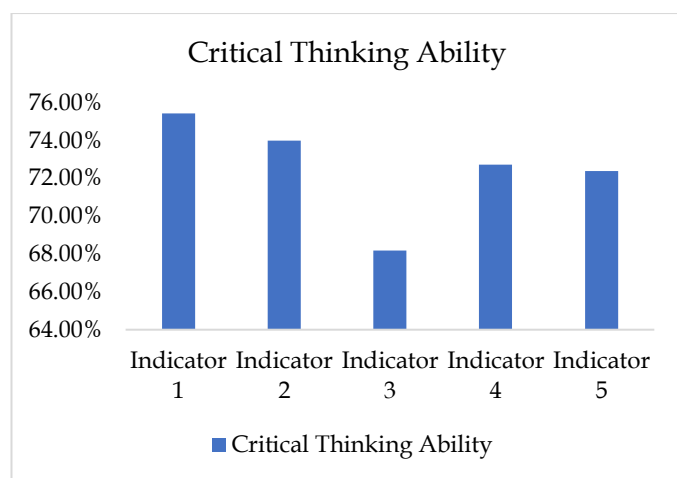


Figure 1. Critical Thinking Ability

Description:

- Indicator 1 = Provides a simple explanation
- Indicator 2 = Making further explanations
- Indicator 3 = Building basic skills
- Indicator 4 = Analyze data
- Indicator 5 = Provide alternative solutions

Figure 1 shows that the highest average value of students' critical thinking skills is found in indicator 1, namely, giving a simple explanation. The indicator explains obtaining the highest percentage of 75.45% with high critical thinking criteria. This indicator is related to the student's ability to provide detailed and clear information about the topic or issue that is currently being discussed. It is very important in critical

thinking skills because it can help students understand a concept or problem better and in depth (Agustine et al., 2020). The elevation of the indicator provides a simple explanation of students' ability to think critically because of the learning process that promotes effective communication, gives feedback, and provides good explanations that help students in the development of thinking skills. This is to the research conducted (Ramdani, 2020), which shows that indicators providing explanations obtain a higher percentage than other indicators of critical thinking skills. This is because, in the learning process, students are used to giving simple opinions in learning activities.

In addition, indicator 2, namely making further explanations, also gets high critical thinking criteria with a percentage of 74%. In the process of making further explanations, students should be able to analyze and evaluate information well and make the right conclusions (Amalia et al., 2021). Indicator 3 of critical thinking skills, namely building basic abilities, obtained the lowest percentage, 68%, with moderate criteria. These indicators relate to students' ability to consider whether sources of information are reliable or not, to observe and consider the results of observations, as well as to build the basic skills needed in solving problems facing them. These basic skills are essential in critical thinking skills as they can help students to develop their ability to think critically better (Miranti, 2016). Based on the analysis of the learning process, the poor ability to build basic critical thinking skills in these students is due to less effective learning processes as well as the lack of opportunities for students to develop their critical thought skills. This is in line with a study conducted by Andriani (2016) that showed that building a student's basic ability to critical thinking is still low with a pre-test score of 60 lower than other critical-thinking ability indicators.

Indicator 4 namely analyzing data, obtains a percentage of 72.73 percent with high criteria. In analyzing data, students should be able to identify relevant information, understand the relationship between information, and draw the right conclusions (Asniar et al., 2022). Indicator 5 provides alternative solutions to obtain 72.40 percent with high criteria. In providing alternative solutions, students must be able to analyze and evaluate information well and make the right decisions (Rachmantika & Wardono, 2019).

Concept Understanding

Based on the results of data analysis according to indicators of critical thinking skills from data collection using test instruments in the form of essay

written tests, the overall results are presented in Figure 2.

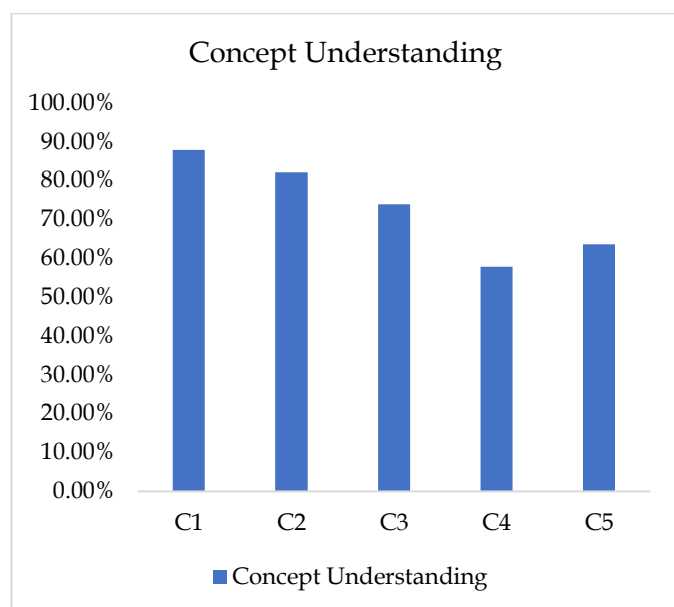


Figure 2. Concept Understanding

Description:

C1 = Remember

C2=Understand

C3 = Apply

C4 =Analyze

C5 =Evaluate

Figure 2 shows that the ability to understand basic science concepts in Primary School Teacher Education students is found in indicator C1, namely considering the percentage of 87.98% in the very high category. The high percentage of indicators is due to the ability to understand concepts due to effective learning methods in developing student concept understanding. In addition, students are given the opportunity to practice in remembering information against a concept. In line with research conducted by Hanifah & Abadi (2018), the average percentage of students' understanding of concepts in remembering is included in the high criteria with a percentage of 79.59%. Students are accustomed to and trained in remembering the subject matter.

The understanding indicator on the ability to understand concepts obtains a percentage of 82.14% in the high category. Indicators of understanding are used to evaluate the extent to which students understand a concept. Through the results of analysis indicators of understanding will help in designing more effective and efficient learning to improve students' ability to understand concepts (Mayasari & Habeahan, 2021).

Indicator 3 is obtaining a percentage of 74% in the high category. Apply to the ability to understand concepts is used to evaluate the extent to which students are able to apply concepts that have been learned in different situations and solve problems using such concepts (Agustina, 2018). The C4 indicator, namely analyzing, obtains the lowest percentage, 57.80, in the medium category. Based on the results of observations and interviews, students feel bored in the learning process, making them pay less attention to the material presented. The poor ability to analyze in this student is due to a lack of understanding of the basic concepts of a subject being studied. This is in line with research Rosyidah (2020) which proves that the poor ability of the student's analysis is because of the lack of ability in understanding the basic principles in the subject. For this reason, more effective and efficient efforts are needed in designing learning that can improve the understanding of concepts in students.

Furthermore, the C5 indicator is evaluating obtaining a percentage of 63.60% in the medium category. According to Ulya et al. (2019) evaluation skills are useful for students to make predictions and evaluate the truthfulness of a statement or argument using the concepts that have been learned. The ability to evaluate students is still in the middle of the classification, this is due to a lack of experience in applying concepts in different situations and the basic concepts are still not strong.

Conclusion

Based on the study results, it was concluded that the analysis of critical thinking skills and conceptual understanding obtained the highest percentage of achievement on the indicator of critical thinking skills, namely providing a simple explanation with a percentage of 75.45% with high criteria. While the indicator of critical thinking skills with the lowest percentage, namely building basic abilities, obtains a percentage of 68% in the medium category. Besides that, the indicator of understanding the concept with the highest percentage is remembering, with a percentage of 87.98% with very high criteria. In comparison, the lowest concept understanding indicator is analyzed with a percentage of 57.80% in the medium category.

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Author Contributions

Yopi Malagola: Conceptualization, methodology, writing – original draft preparation, formal analysis, investigation, and visualization. Supartinah, Setyo Eko Atmojo, Anwar Senen: writing – review and editing, validation, supervision, and resources

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Conflicts of Interest

The authors declare no conflict of interest

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