

Analysis of The Ability to Solve Hots Questions On Measurement Material of PGSD Students Based on Bloom's Taxonomy

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Abstract: A total of 66.7% of Primary Teacher Education (PTE) students demonstrated high-level thinking skills in the high category, while 33.3% were in the moderate category, with none in the low category. Analytical (C4) and creative (C6) skills were relatively strong, though evaluate (C5) varied. This study aimed to analyze students' higher-order thinking skills (HOTS) in the topic of measurement using the revised bloom's Taxonomy (C4-C6) as a framework. Six PTE students from STKIP Al Hikmah based essay items and semi-structured interviews. The data were analyzed qualitatively using triangulation techniques. The findings indicate that, despite most students performing at a high level, inconsistencies in performance across cognitive dimensions suggest uneven mastery of HOTS. This highlights the need to strengthen instructional strategies that foster balanced development of analytical, critical, and creative thinking. The results also imply the importance of embedding HOTS-based assessment and instruction across all fundamental mathematics topics in teacher education curricula, to better prepare prospective teacher for real-world classroom challenges.

Article History

Received: 09-06-2025

Revised: 15-06-2025

Published: 16-07-2025

Key Words :

Analysis, HOTS, Bloom's Taxonomy.

How to Cite: Nabilah Mansur, & Arina Najwa, W. (2025). Analysis of The Ability to Solve Hots Questions On Measurement Material of PGSD Students Based on Bloom's Taxonomy. *IJE : Interdisciplinary Journal of Education*, 3(2), 113–118. <https://doi.org/10.61277/ije.v3i2.207>

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Introduction

Higher-order thinking skills (HOTS), including critical, creative, and problem-solving abilities, are essential for preparing individual to meet the demands of the 21st century. These skills enable students not only to absorb information, but also to process, evaluate, and generate solutions to complex real-world problems (Trillig & Fadel, 2009; Kusumaningtyas et al., 2023).

In the context of teacher education, particularly in Primary Teacher Education (PTE) programs, HOTS serve not only as learning objectives but also as a foundation for preservice teachers to design lessons that foster deep thinking. Teachers who are equipped with analytical and reflective thinking skills are more capable of facilitating contextual and meaningful learning processes (Seftiani & Herman, 2022). However, recent studies reveal that the majority

of PTE students still demonstrate HOTS at low to moderate levels, with mastery concentrated mostly at the basic analysis level (Maspiroh et al., 2023).

One fundamental topic in the PTE curriculum is measurement, which is often taught procedurally, despite its significant potential for developing higher order thinking particularly in connecting concepts to real life contexts (Mat et al., 2025). Skills such as comparing measurement tools, analyzing measurement errors, and evaluating experimental results are key components of HOTS that should be fostered through appropriate learning and assessment methods.

Unfortunately, the application of HOTS based assessments in measurement topics remains limited, both in terms of the number of test items and the depth of outcome analysis (Sudiryo, Hartinah, & Susongko, 2024). Many instructors have not yet conducted systematic analyses of assessment results, resulting in learning processes that fall short of supporting the development of students' higher order thinking. As a result, students do not receive constructive feedback and miss opportunities to enhance their critical, evaluative, and creative thinking skills.

Therefore, this study aims to analyze the HOTS abilities of PTE students in the topic of measurement, based on the revised bloom's taxonomy at levels C4 (analyzing), C5 (evaluating), and C6 (creating). The findings are expected to provide insight into students' levels of higher order thinking and serve as a basis for developing more adaptive teaching strategies, while also promoting the integration of HOTS based assessments throughout the elementary education curriculum in a more systematic and sustainable manner.

Research Method

This research uses a descriptive qualitative approach, which aims to describe and analyze the ability of PTE students to solve HOTS questions in measurement content based on the revised Bloom taxonomy category (Anderson & Krathwohl), namely: analyze, evaluate, and create. The subjects in this study were 6 PTE STKIP Al Hikmah students who were taking Elementary School Mathematics subjects, and had obtained measurement material. The subjects were selected by purposive sampling by considering that they had obtained the appropriate material and were willing to participate in the research process. The main instruments in this study were HOTS test questions and semi-structured interview guidelines. The HOTS test questions contained measurement materials developed based on indicators from Bloom's revised taxonomy at the C4 (analyze), C5 (evaluate), and C6 (create) levels. Then semi-structured interview guidelines were used to dig deeper into the thinking process and strategies used by students in solving the problem. Data collection techniques used in this study were written tests and interviews. Data analysis techniques were carried out qualitatively through data reduction, data presentation and conclusion drawing. To ensure data validity, a triangulation technique was employed by combining test results with interviews. Participants were given essay to assess their problem solving abilities. Subsequently, semi structured interviews were conducted based on their test responses to explore how they approached and

solved the problems. Through the combination of these two data sources, the researcher was able to validate the test answers against the participants' verbal explanations.

Result and Discussion

This research was conducted on 6 PTE STKIP Al Hikmah students who were taking Elementary School Mathematics subjects. This study aims to describe their ability to solve HOTS questions on measurement material based on levels C4 (analyze), C5 (evaluate), and C6 (create) in Bloom's revised taxonomy.

The instruments used were a written test of 3 HOTS questions and in-depth interviews with each subject.

1. A student had 90 minutes to complete the math test which consisted of 3 parts: multiple choice, essay questions, and application questions. The student spent 25 minutes on multiple choice questions, 35 minutes on essay questions, and 18 minutes on application questions. Based on this data, analyze what percentage of time was spent on each part of the exam and determine which part of the exam took the most time? (Score 15)
2. A teacher assigns students to read 3 chapters in a book for 4 days. On the first day, students read 40 pages, the second day 50 pages, the third day 60 pages, and on the fourth day, students read 70 pages. If the student has to read a total of 200 pages, analyze whether the student can complete the task on time. If not, how many more pages need to be read on the fourth day to complete the assignment on time? (Score 15)
3. A student measures the weight of a watermelon and writes the weight as 2.5 kg. His friend says the watermelon weighs 250 grams. Is his friend's conversion correct? Explain. Then describe the mistakes that may be made when converting units! (Score 15)
4. The following are the results of weighing rice by four students: 1.95 kg, 2.00 kg, 2.05 kg, and 1.90 kg. Calculate the average of the rice. Then explain whether the measurement results are consistent and what are the possible causes of the difference. (Score 15)
5. You are asked to make a simple prop from cardboard to teach cm and mm length units to grade 3 students. Design the prop with a total size of 30 cm. Divide it into cm units and also display the mm scale. How many mm lines should you draw? Explain how this tool will help students understand the relationship between cm and mm! (Score 20)
6. You are going to make a simple teaching aid to help elementary school students understand weight comparisons (e.g. 1 kg vs 500 g). What kind of props will you make? Explain. (Score 20)

The following table is a recapitulation of student test results based on HOTS categories:

Table 1. Recapitulation Of Student Test Results

Student Code	Problem 1	Problem 2	Problem 3	Problem 4	Problem 5	Problem 6	Total Score	Kategori
M1	10	15	12	15	15	15	82	High
M2	15	15	12	10	10	15	77	High
M3	0	15	15	15	15	15	75	Medium
M4	10	15	10	15	10	15	80	High
M5	12	12	5	10	10	15	64	Medium

M6	15	15	12	10	12	13	77	High
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Categories:

Low: $0 < \text{Score} \leq 50$

Medium: $51 \leq \text{Score} \leq 75$

High: $76 \leq \text{Score} \leq 100$

Hani M1 Amel M2 Nia M3 Dian M4 Ela M5 Hilda M6

Based on the results of the tests given to six PTE students on measurement material based on HOTS questions, a recapitulation of the scores is obtained as shown in Table 1. Of the total six respondents, four students were in the high ability category (Hani, Amel, Dian, Hilda), while two students were in the medium category (Nia and Ela). The category distribution shows that the majority of students (66.7%) have high ability in solving HOTS questions on measurement material, while the rest (33.3%) are in the medium category. There were no students in the low category.

The results of this study illustrate that in general PTE students are able to work on HOTS questions with sufficient ability. Further analysis can be done by looking at the pattern of score achievement on each item that represents the dimensions of HOTS in the revised Bloom's Taxonomy.

1. Analytical Ability (C4)

Questions that require the ability to analyze require students to identify components, separate information, and find relationships between parts. Students such as M2, M4 and M6 showed good mastery in analyzing questions with relatively stable scores between 12-15. However, M5 only scored 5 on question 3, indicating a weak ability to distinguish important information in the context of measurement. This is in line with information processing theory, which states that effective learners are able to organize and manage complex information to produce solutions (Gagné, 1985). From a constructivistic perspective (Vygotsky, 1978), this analytical ability is most likely formed through social interaction and meaningful learning experiences, such as class discussions and laboratory experiments. This finding is also reinforced by the research of Sabir et al (2024), which shows that strengthening analytical skills through open questions and critical reflection in the learning process can improve students' higher order thinking skills. In addition, Trisnawaty et al (2024) emphasized that students who are successful in the analysis aspect generally have collaborative and contextual learning experiences, in accordance with the HOTS-based approach.

2. Evaluation Ability (C5)

The ability to evaluate is seen in questions that ask students to assess procedures or conclusions in the context of measurement. Students' scores are quite varied. M1 and M4 showed consistency in evaluating information with high scores, while M3 who scored 0 on question 1 may not have been able to provide a critical assessment of the measurement procedure or experienced initial misconceptions that affected his overall solution strategy. This variation reflects the uneven mastery of critical thinking, as stated by Ennis (1993) that critical

thinking involves judgment based on relevant reasons and accountable criteria. According to Sabir et al (2024) the evaluation dimension (C5) is the least used part in learning practices, although this is precisely what encourages students' reflective thinking and logical reasoning abilities. In addition, the evaluation skills of PTE students tend to be in the low to medium category, especially when students are faced with situations that require open reasoning and procedural justification. This indicates the need for explicit learning that trains evidence-based reasoning and scientific data-based decision making (Trisnawaty et al, 2024).

3. Creation Ability (C6)

The ability to create is the highest level in Bloom's Taxonomy and highly demands integrative abilities. In question number 6, most students achieved high scores between 13-15, indicating that they were relatively able to design or develop new solutions based on their understanding of measurement concepts. This indicates that students have the potential for creative thinking, but it still needs to be stimulated more purposefully in the learning process. According to Bruner's constructivism theory (1960), the process of creating occurs when learners are able to form new mental schemes through exploration, meaning and reflection of learning experiences. Learning environments that provide space for open-ended problem solving, collaborative projects and critical reflection are essential in building this C6 ability.

The results of the study indicate that 66.7% of students achieved scores in the high category, with most students performing well on C4 (analyzing) and C6 (creating) questions. However, there were notable variations in responses to C5 (evaluating) questions, as some students struggled to critically assess measurement procedures. This inconsistency suggests that although many students demonstrate strong analytical and creative skills, evaluative thinking remains a challenging aspect.

Conclusion

Based on the results of the analysis of the ability of PTE students in solving HOTS questions on measurement material based on Bloom's Taxonomy, it can be concluded that the majority of students (66.7%) showed high-level thinking skills in the high category, while the rest (33.3%) were in the medium category. There were no students in the low category. Students' ability to analyze (C4) and create (C6) tended to be good, marked by high scores on related questions. However, the ability to evaluate (C5) still shows significant variation between students, indicating the need for strengthening in this dimension. The inconsistency of scores between students on HOTS questions indicates that mastery of higher order thinking skills is not fully equitable, and in some cases, depends on the context or form of the question.

This findings have important implications in the broader context of higher education. HOTS are not only indicators of students' academic readiness but also serve as a critical foundation for shaping graduates who capable of critical thinking, creative problem-solving, and analytical decision-making. Therefore, efforts to enhance the quality of learning in higher education should emphasize not only knowledge transfer but also the equitable development of higher order thinking skills. This is essential in preparing future educators who are adaptive, innovative, and ready to face the challenges of today's and tomorrow's educational landscape.

Recommendation

Based on the results and conclusions of the study, the following suggestions can be given. Lecturers need to design lessons that explicitly train students' HOTS skills through methods such as problem-based learning (PjBL), project-based learning (PjBL), reflective discussion, and contextual learning. These approaches can also contribute to the development of prospective educators who are adaptive and innovative. For further researchers, further research needs to be conducted with a larger number of respondents and a more in-depth analysis per HOTS dimension (C4, C5, C6), and can even be developed with a qualitative approach to explore students' thinking strategies in solving problems. It is recommended that the evaluation of student learning does not only focus on low-level cognitive aspects (C1-C3), but also includes systematic HOTS assessment so that students' higher-level thinking skills can be developed in a sustainable manner.

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