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Readiness of Pre-Service Elementary School Teacher to Implement PBL and HOTS in Learning Geometry

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Abstract: Readiness of Pre-Service Elementary School Teacher to Implement PBL and HOTS in Learning Geometry. This survey research aims to assess the comprehension of elementary school teacher education students regarding PBL and HOTS and elucidate the application of PBL and HOTS in elementary geometry education. The study engaged 18 elementary school teacher education students at UPI Cibiru Campus. Findings reveal that these students possess a solid understanding of PBL and a very high level of comprehension of HOTS. The proposed implementations of PBL in geometry education exhibit variations, while others have yet to integrate PBL into their Lesson Implementation Plans. The application of HOTS also varies, with some encompassing all its components, while others fall short. In conclusion, prospective teachers exhibit a robust initial grasp of PBL and HOTS, but a consistent application is essential to foster confidence in practical teaching at elementary schools.

Keywords: PBL, HOTS, geometry learning, elementary school.

Abstrak: Kesiapan Calon Guru Sekolah Dasar untuk Menerapkan PBL dan HOTS dalam Pembelajaran Geometri. *Penelitian survei ini bertujuan untuk menguji pemahaman mahasiswa Pendidikan Guru Sekolah Dasar tentang Pembelajaran Berbasis Masalah (PBL) dan Keterampilan Berpikir Tingkat Tinggi (HOTS) serta menggambarkan penerapan PBL dan HOTS dalam pembelajaran geometri di sekolah dasar. Penelitian ini melibatkan 18 mahasiswa Pendidikan Guru Sekolah Dasar di UPI Kampus Cibiru. Hasil penelitian menujukkan bahwa mahasiswa Pendidikan Guru Sekolah Dasar memiliki pemahaman baik tentang PBL dan pemahaman sangat tinggi tentang HOTS. Rencana penerapan PBL dalam pembelajaran geometri bervariasi, dengan beberapa sesuai sintaknya, sementara yang lain belum mengintegrasikan PBL dalam Rencana Pelaksanaan Pembelajaran. Penerapan HOTS juga bervariasi, dengan beberapa mencakup semua komponennya, namun beberapa belum. Kesimpulannya, Mahasiswa calon guru memiliki pemahaman awal yang kuat tentang PBL dan HOTS, namun perlu konsistensi dalam penerapannya untuk mengembangkan keyakinan diri dalam praktik pembelajaran di sekolah dasar.*

Kata kunci: *PBL, HOTS, pembelajaran geometri, sekolah dasar.*

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INTRODUCTION

One of the phenomena of the 21st century is a shift in the need for Human Resources (HR), namely replacing low-skilled human resources with high-level creative human resources (Chan, Looi, & Sumintono, 2021). Creativity is the only possibility for developing countries to grow, so 21st century learning teachers need to orient learning to produce students who have high creativity (Asriadi & Hadi, 2021; Asriadi & Istiyono, 2020). This can be achieved more quickly if students become active subjects in constructing learning experiences, practicing higher order thinking (HOTS), and developing habit creation.

Currently, schools need teaching staff who have knowledge of effective teaching strategies to meet the needs of each student. One step to create students who have high creative abilities is through teachers who have a deep love for the field or subject they teach and love for their students. Teachers must also have the ability to choose and develop various methods, approaches or learning models that suit students' needs (AM, Hadi, & Istiyono, 2023). Educators must develop students' learning and innovation skills, which include critical thinking and problem solving, communication, collaboration, as well as creativity and innovation (AM & Hadi, 2023). One tendency that is often overlooked is forgetting that the essence of learning is student learning and not teacher teaching (Maulana, Smale-Jacobse, Helms-Lorenz, Chun, & Lee, 2020). In this condition, educators are no longer just transforming knowledge, but are more concerned with adapting learning experiences to students' needs.

Teacher competence includes pedagogical competence, personality competence, social competence and professional competence (Aryani, Purnamawati, & Kurniawan, 2022; Milinga, Amani, & Lyakurwa, 2022). In one of the indicators of pedagogical competence, teachers must facilitate the development of students' potential to actualize the various potentials they have, by; (a) providing various learning activities to encourage students to achieve optimal learning achievements, (b) providing various learning activities to actualize students' potential, including their creativity (Trinter, Brighton, & Moon, 2015). Teachers must be able to manage learning activities, starting from planning, implementing and evaluating learning activities.

One learning approach that allows students to develop various potentials, become active subjects in constructing learning experiences, practice higher order thinking (HOTS), and develop habits in solving problems is problem-based learning (Suprapto, Saryanto, Sumiharsono, & Ramadhan, 2020). Problem Based Learning (PBL) has several characteristics, including starting with the presentation of a problem that is generally related to the real world (McLeod et al., 2017). Next, students work in groups to formulate the problem and identify gaps in their knowledge (Klanèar, Starèiè, Cotiè, & Žakelj, 2021). They are active in searching for and studying material relevant to the problem. Next, students examine themselves and formulate solutions to overcome the problem (Huang & Watson, 2015). The results of research conducted by Haladyna (2012) and Munfaridah, Avraamidou, & Goedhart (2021) show that students who learn through problem solving methods achieve better than students who learn using traditional methods.

However, in reality, not all teachers understand the PBL concept. This may be caused by a lack of desire and motivation to improve the quality of knowledge, or due to a lack of system support to improve the quality of teacher knowledge. Especially in mathematics learning (Krumphals & Haagen-Schutzenhofer, 2021). Apart from teachers having to understand learning approaches, they also have to understand

mathematical concepts (Hadi, Retnawati, Munadi, Apino, & Wulandari, 2018). Mathematics is the foundation that equips students to be able to survive in changing conditions (Tama, Rinaldi, & Andriani, 2018). One of the concepts studied in mathematics is the concept of geometry.

Learning the concepts of geometry and measurement includes contextual spatial concepts, so it is hoped that students can connect these concepts with problems in everyday life. Learning that occurs in the classroom tends to still use learning that is dominated by the teacher's explanation of concepts or knowledge, thus providing less opportunity for students to develop the various potentials they have in solving a problem. The results of research conducted by Dalila, Rahmah, Liliawati, & Kaniawati (2022), show that the obstacles experienced by teachers in implementing the problem-based learning model occur at the planning and implementation stages of each stage of the learning model. At the planning stage, the obstacle that occurs is that the teacher requires thorough preparation in making it.

Based on these considerations, teachers must have high motivation to study and understand the theory of the problem-based learning approach as an appropriate method for teaching mathematics, especially geometry. Apart from that, teachers must also have the ability to develop students' high level skills (HOTS). Therefore, through a planned research, the researcher intends to describe the understanding of prospective Elementary School Teacher Education students regarding the Problem-Based Learning (PBL) and Higher-Order Thinking Skills (HOTS) approaches in the context of geometry learning in elementary schools.

METHODS

Population and Sample

This research was conducted on a population of all Elementary School Teacher Education students at UPI Cibiru Campus, Bandung Regency. The research sample consisted of 18 students in class 4F Elementary School Teacher Education at UPI Cibiru Campus. The sampling technique is purposive sampling. Class 4F students were chosen as the sample because they are at a learning stage that is in accordance with the focus of this research. This class can also be considered a representation of the Elementary School Teacher Education student population.

Research Design and Procedures

This research uses a survey method with a cross-sectional research design (Fraenkel, Wallen, & Hyun, 2012). The research was conducted within the Elementary School Teacher Education program at the Indonesian University of Education. The choice of survey method was based on the need to collect data from a large number of respondents, in this case, Primary School Teacher Education students, in an efficient manner. In addition, a cross-sectional design was chosen because this research emphasizes collecting data at one specific point in time, which is in accordance with the research objective of measuring students' understanding and thinking at the time the research was conducted. In addition, this research took place for one semester in the even semester of the 2022/2023 academic year.

The research procedure began with the data collection stage regarding Elementary School Teacher Education students' understanding of PBL and HOTS. The first step is to test their understanding of the concepts through relevant tests or questionnaires. After that, they were asked to prepare a Learning Implementation Plan (RPP) which included the application of PBL and HOTS in Geometry learning in elementary schools. Next, after students complete their lesson plan, the research will enter the evaluation stage. At this stage, researchers will assess the work they have created, checking the extent to which

their lesson plans reflect the understanding and application of PBL and HOTS in the context of Geometry learning in elementary schools. This evaluation can include an assessment of aspects such as the formulation of learning objectives, preparation of student worksheets, as well as the development of cognitive, affective and psychomotor evaluations in the lesson plan. After the evaluation stage, the research will continue with a re-measurement stage regarding students' understanding of PBL and HOTS in Geometry material in elementary schools. The aim is to assess whether participation in preparing lesson plans that include PBL and HOTS has increased their understanding of these concepts. This procedure provides complete and relevant data to understand Elementary School Teacher Education students' understanding of PBL and HOTS and the extent to which they can apply them. in Geometry learning in Elementary School.

Instrument

The data collection instrument that has been prepared for this research includes three main components. First, to measure students' initial understanding, a 10-number multiple choice test is used which covers the concepts of PBL and HOTS. Students are asked to choose the most appropriate answer from the options provided. Second, to assess the lesson plan created by students, a lesson plan assessment sheet is used which is in accordance with a format that includes the formulation of learning objectives, preparation of student worksheets, as well as the development of cognitive, affective and psychomotor evaluations. Assessment is carried out based on the lesson plan format that has been filled in by students, with each aspect assessed based on predetermined criteria. Third, to measure students' final understanding regarding PBL and HOTS in the context of Geometry learning in elementary schools, a questionnaire was used. This questionnaire contains questions that assess students' understanding of definitions, concepts and evaluations related to PBL and HOTS. Students are asked to provide responses in response to these questions. These instruments have been carefully designed to ensure the collection of relevant data according to the planned stages of the research. The validity and reliability of these instruments have been tested previously to ensure that they can provide accurate and reliable data in evaluating students' understanding and application of PBL and HOTS in Geometry learning in elementary schools.

Data Analysis

Data analysis in this study uses descriptive statistics to calculate the Mean and Standard Deviation. Furthermore, the categorization of student understanding is classified based on the level of achievement of student learning outcomes, Urbina (2014) guidelines are used which categorize student understanding as presented in table 1. This analysis will help identify the level of student understanding of the concepts of PBL and HOTS according to the test score data obtained in this research.

Table 1. Criteria for assessing of students' understanding

Interval	Category
80 - 100	Very good
66 - 79	Good
56 - 65	Moderate
40 - 55	Not good
30 - 39	Gagal

■ RESULTS AND DISCUSSION

Students' Understanding towards PBL

Table 2 illustrates pre-service elementary school teacher understanding toward PBL approach. Based on the results of the understanding test regarding the PBL approach in table 2, it shows mixed results. Based on the tests carried out, the average student comprehension score was 70.83, which is in the "Good" category based on Arikunto (2007) guidelines. This indicates that in general, the majority of students have a good understanding of PBL. However, it should be noted that there was variation in scores, with some students achieving high scores of up to 84 (Very Good), while others had poorer understanding with scores as low as 40 (Poorly Good). These results illustrate differences in the level of students' understanding of PBL in the classroom. This can be influenced by various factors, including previous educational background, interests and individual abilities.

Table 2. Students' responses toward PBL

Respondent	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	Skor	Category
R1	7	5	6	6	4	6	5	6	7	7	59	Moderate
R2	7	10	9	6	6	6	8	6	7	8	73	Good
R3	6	5	5	4	4	4	4	4	4	4	40	Not Good
R4	9	3	4	4	6	5	3	3	5	6	48	Not Good
R5	9	5	9	6	5	5	8	9	10	10	77	Good
R6	7	10	10	7	7	7	7	4	7	9	75	Good
R7	8	10	10	6	6	6	6	6	8	8	74	Good
R8	7	10	10	9	9	9	8	7	7	8	84	Very Good
R9	7	8	10	7	6	7	7	8	10	6	78	Good
R10	7	8	8	7	6	8	7	8	9	8	76	Good
R11	7	8	7	6	7	7	10	6	10	8	76	Good
R12	9	6	9	6	5	6	10	8	10	10	79	Good
R13	8	8	7	8	9	9	9	8	7	0	73	Good
R14	7	10	9	6	7	7	10	5	10	8	79	Good
R15	8	9	9	8	7	7	6	7	8	8	77	Good
R16	7	6	6	6	5	6	6	6	6	7	58	Moderate
R17	7	6	6	6	8	8	8	7	10	6	72	Good
R18	7	10	10	6	7	7	6	5	7	8	73	Good
Mean:			70.83									Good
Deviation standard:			10.77									

The problem-based learning (PBL) educational model focuses on problem-solving activities. This means that students are actively involved in finding solutions to the problems presented by their teacher. In this scenario, educators function more as mediators and facilitators, helping students to actively build knowledge (Felder & Silvermen, 1988; Hasanah et al., 2022). According to (Citra, District, & Herlina, 2020), PBL functions as a learning approach that challenges students to "learn by doing", collaborating in groups to design solutions to real-world problems. This method aims to utilize students' curiosity, analytical skills and motivation in exploring learning material (Mogaji, Soetan, & Kieu, 2021). PBL equips students with critical and analytical thinking skills while encouraging them to seek and utilize appropriate learning resources. The importance of understanding differences in student understanding is to provide

more attention to those who need additional help in mastering the PBL approach. Student-focused learning efforts, such as providing additional assignments, group discussions, or individual tutoring, can help improve their understanding. In this way, the overall quality of PBL learning among Primary School Teacher Education students can be improved, preparing them to better apply this in future teaching practice.

Students' Understanding towards HOTS

The next stage is to collect data about students' understanding of HOTS. The test results can be seen in table 3. Based on the results of the understanding test regarding the Higher Order Thinking Skills (HOTS) approach in table 3, the results of Elementary School Teacher Education students' understanding of Higher Order Thinking Skills (HOTS) show very good achievements. Based on the table above, students' understanding scores for HOTS reached the highest score of 100, and the average understanding score was 95, which is in the "Very Good" category based on the assessment guidelines. This shows that the majority of students have a very good understanding of HOTS.

Table 3. Students' responses toward HOTS

Responden	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	Score	Category
R1	10	9	10	9	8	9	10	10	6	10	91	Very Good
R2	10	9	10	10	10	10	10	10	8	10	97	Very Good
R3	10	7	7	7	5	8	10	8	5	6	73	Good
R4	10	10	10	10	10	10	10	10	10	10	100	Very Good
R5	10	10	10	8	10	10	10	10	10	10	98	Very Good
R6	10	8	10	10	10	10	10	10	10	10	98	Very Good
R7	10	7	10	10	10	10	10	10	9	10	95	Very Good
R8	10	9	10	7	10	10	10	10	10	10	96	Very Good
R9	10	9	10	10	10	10	10	10	10	9	98	Very Good
R10	10	10	10	10	10	10	10	10	10	10	100	Very Good
R11	10	9	10	10	10	10	10	10	8	10	97	Very Good
R12	10	10	10	10	10	10	10	10	10	10	100	Very Good
R13	10	10	8	10	10	8	10	10	10	10	96	Very Good
R14	10	10	10	10	10	10	10	10	10	10	100	Very Good
R15	10	10	10	10	10	10	10	10	9	10	99	Very Good
R16	10	9	10	8	8	10	10	9	8	10	92	Very Good
R17	10	9	10	6	5	10	7	7	8	9	81	Very Good
R18	10	10	10	10	10	10	10	10	9	10	99	Very Good
Mean:		95										Very Good
Deviation standard:		7.17										

HOTS refers to students' ability to think critically, analytically, creatively, and reflectively. These results indicate that Elementary School Teacher Education students have a strong ability to develop these high-level thinking abilities. They are able to analyze information, connect concepts, and generate new ideas well. HOTS capabilities are very important in the learning and teaching process. Teachers who have a strong understanding of HOTS can more effectively develop higher-order thinking skills in their students, thereby preparing students to face challenges in learning and everyday life.

Even though the results show excellent achievements in understanding HOTS, it is still important for educators to continue to develop and encourage students to think critically, creatively, and analytically (Corti, Raimundi, Celsi, Alvarez, & Castillo, 2023). Increasing HOTS abilities can help students become more independent learners and more critical thinkers in facing the complexity of today's world. Therefore, these results show the positive potential that Elementary School Teacher Education students have in forming a strong understanding of HOTS in their students in the future.

Implementation plan of PBL dan HOTS on learning geometry in elementary school

The results of the analysis of the Geometry Learning Implementation Plan (RPP) in Elementary Schools with the implementation of HOTS carried out by 18 students revealed a number of interesting findings. In the ten lesson plans analyzed, there is the use of PBL and HOTS elements which permeate various aspects of learning. This includes formulating learning objectives, preparing Student Worksheets (LKPD), as well as developing cognitive, affective and psychomotor evaluations. Elementary School Teacher Education students as respondents succeeded in developing various HOTS elements, which include: First, the "Analyzing" element (C4) is reflected in their ability to accurately attribute relevant elements in geometric problems and organize geometric material appropriately to solve problems. They also succeeded in integrating the use of geometry into students' daily lives and presenting geometry material clearly and accurately. Second, the element of "Assessing" (C5) is reflected in students' skills in checking student work correctly and providing constructive criticism for student improvement. They are also able to formulate hypotheses related to geometry material and carry out experiments to test the results of students' work to find relevant material. Third, the "Creating" element (C6) is reflected in their ability to generalize the criteria needed to create geometry and be able to design, produce and re-plan the geometric shapes to be created.

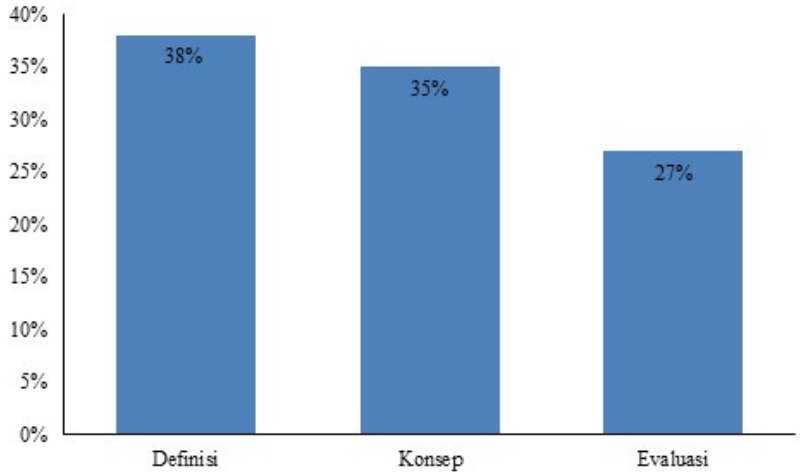
The results of the analysis of Learning Implementation Plans carried out by a sample of students revealed that there were 10 Learning Implementation Plans which included plans for teacher activities and student activities in accordance with the syntax or steps of the PBL approach in learning geometry in elementary schools with the application of HOTS. However, the other 8 RPPs already include HOTS content, although the steps are not yet fully visible. There were 4 learning implementation plans that contained PBL approach activity plans, but these activities were still focused on the teacher. In addition, there are five Learning Implementation Plans that do not include PBL activity plans because they do not include PBL syntax/steps. One of the Elementary School Teacher Education students did not make a Learning Implementation Plan.

The results of the analysis show that Elementary School Teacher Education students have succeeded in integrating HOTS elements well in their learning plans. This creates a learning environment that allows students to develop higher order thinking skills in geometry learning in elementary school. Thus, this analysis provides a positive picture of their efforts in implementing the PBL and HOTS approaches in geometry learning in elementary schools.

Students' understanding toward PBL on geometry content in elementary school

Students' understanding of PBL (Problem Based Learning) in Geometry material in elementary schools is measured based on three aspects. The first aspect is "Definition", students are measured based on their ability to explain the

concept of Problem Based Learning (PBL) and understand the roles of students and teachers in PBL. This reflects the extent to which students understand the basics of PBL and its role in the learning process. The second aspect is "Concept" which includes several indicators. Students are measured based on their ability to understand the "student-centered" concept in PBL, analyze how to stimulate students in a PBL context, and explain the basic points of the PBL concept itself. This illustrates the extent to which students understand and can apply important concepts in problem-based learning. The final aspect is "Evaluation" which measures students' ability to explain and analyze evaluations in PBL. This reflects students' understanding of how assessment and evaluation is carried out in the context of PBL learning. The results of an overview of the achievements of each measurement aspect can be seen in Figure 1.



Figuer 1. Students' understanding toward PBL on geometry content in elementary school

This understanding can be analyzed further based on the question components in the survey instrument. In the "Definition" aspect, all students were able to explain what is meant by Problem Based Learning (PBL) with a score of 38%. They are also able to understand the roles of students and teachers in PBL. In the "Concept" aspect, 35% of students were able to understand student-centered concepts in PBL. However, there are still some who need to improve their ability to analyze how to stimulate students in PBL and explain the basic principles of the PBL concept. Finally, in the "Evaluation" aspect, as many as 27% of students were able to explain and analyze evaluation in the PBL context. Although this level of understanding is good, there is still room for improvement. Overall, the survey results show that students' understanding of PBL and HOTS aspects in the context of geometry in elementary schools is Moderate, especially in understanding and understanding concepts. However, evaluation can still be improved to ensure students can plan and implement PBL-based learning more effectively.

In addition, students were found to have difficulty answering questions related to how to stimulate students and understand the basic principles of PBL concepts (Beck & Perkins, 2016). The results of interviews to complete the test data show that students who give inaccurate answers tend to lack understanding of how to approach problems in the PBL learning context (Eisenwort et al., 2021). As prospective teachers, students must be able to explore and organize

contextual and conceptual problems to present to students. PBL has more goals than just understanding the material; also aims to understand why something happens, provide an understanding of what happened and how, and encourage critical thinking in solving problems (Mumthas & Abdulla, 2019). One weakness that is often seen is that students who get high scores on exams often have difficulty solving problems in everyday life. There are also those who can explain concepts well but have difficulty providing solutions when problems arise.

In the evaluation aspect, the test results show an understanding level of 70%. Problem-based learning has certain characteristics, such as starting learning with a problem, connecting the problem with the real world of students, organizing problem-centered learning, large student responsibility in the learning process, the use of small groups, and teachers. as a facilitator. There are three main characteristics of problem-based learning, namely student-centered, solving interesting and important problems, and using a scientific thinking approach. Teachers need to choose learning materials that have problems that can be solved and facilitate students' understanding through interaction and reinforcement (Sudirman & AM, 2018). Thus, evaluation of theoretical understanding must be accompanied by educators' efforts to ensure that students can apply their understanding in solving everyday problems.

Students' understanding toward HOTS on geometry content in elementary school

To find out the extent to which students understand and are able to apply the HOTS concept in an educational context, and their ability to design and evaluate HOTS-based learning is measured based on three aspects. First, in the "Understanding" aspect, students are measured in two main indicators. First, do they know what HOTS means? This reflects their basic understanding of the HOTS concept. Second, students are measured based on their ability to explain why HOTS is important in learning. This shows their understanding of the relevance and benefits of implementing HOTS in the educational process. Second, the "Concept" aspect includes several additional indicators. Students are measured regarding their understanding of the origins of HOTS, their ability to analyze the development of HOTS-based learning, their understanding of the cognitive domain of HOTS, and their ability to propose learning models that are appropriate to HOTS. This assesses their understanding of the basic and in-depth concepts related to HOTS. Finally, in the "Evaluation" aspect, students are measured based on their ability to explain learning evaluations that focus on HOTS. This includes their understanding of how to evaluate learning that enhances higher order thinking skills.

The results of the understanding test on Geometry showed that the average score obtained by students was 63.61. Of the total students tested, only 6 people (33.33%) managed to get a score above the average, while 12 people (66.67%) got a score below the average. These results indicate that students' understanding in the elementary school teacher education study program regarding elementary school geometry material can be categorized as good. For a more detailed analysis of each aspect, see Figure 2.

Figure 2 shows that as many as 36% of students know what HOTS means and are able to explain why HOTS is important in learning. The HOTS concept is also understood by 30% of students who understand the origins of HOTS, are able to analyze the development of HOTS-based learning, understand the cognitive domain in HOTS, and can put forward learning models that are appropriate to HOTS. The HOTS evaluation was also successfully understood by 34% of students in the context of HOTS-based learning. These results show that students have a

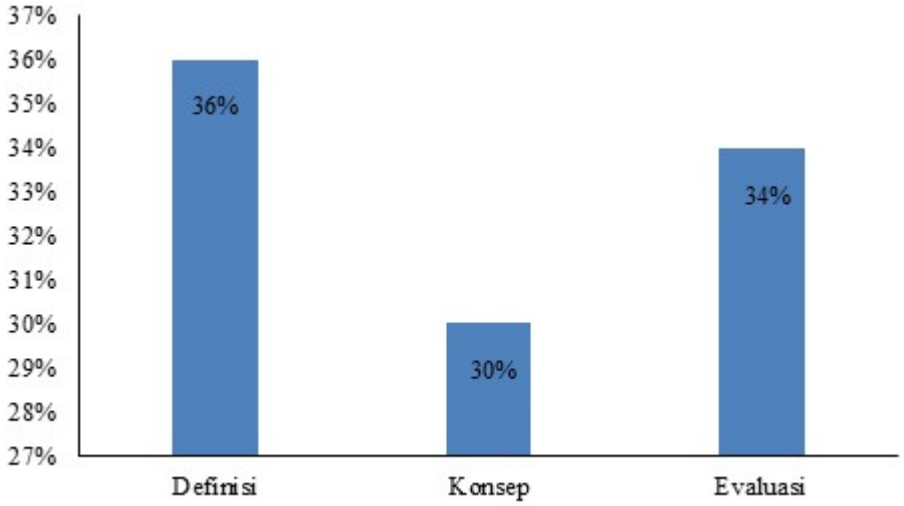


Figure 2. Students' understanding toward HOTS on geometry content in elementary school

good understanding of the concept and importance of HOTS in learning. Although students demonstrated good understanding of HOTS, poor understanding of Geometry suggests there is potential for improvement in understanding this particular material. Strong evaluations on the HOTS aspect also show students' ability to plan and implement learning that encourages higher level thinking.

This research has a significant contribution both theoretically and practically. From a theoretical perspective, this research deepens understanding of the relationship between the Problem Based Learning Approach (PBL) and Higher Order Thinking Skills (HOTS) in the context of basic education. It also provides insight into gaps in understanding and implementation of PBL and HOTS among primary school teacher education students, thereby contributing to the documentation and understanding of educational gaps. From a practical point of view, these findings can be used to improve the development of primary school teacher education curricula by integrating PBL and HOTS as important components of their education. Understanding the barriers students face in understanding PBL and HOTS can also help improve the quality of teaching at the elementary school level through more targeted training and support. The findings of this research can also help in formulating more effective education policies, especially in integrating PBL and HOTS into the elementary school curriculum. Ultimately, by improving the quality of basic education, this research has the potential to have a positive impact on student learning outcomes and contribute to the creation of a higher quality educational environment at the primary level.

■ CONCLUSIONS

Based on data analysis, it can be concluded that students generally have a good understanding of the HOTS and PBL concepts. However, they face challenges in planning effective learning, as seen from confusion in teaching steps, evaluation processes, and the perception that HOTS questions are very challenging. Specifically, the average score of elementary school teacher education students' understanding of Problem Based Learning (PBL) was 70.83. Of them, thirteen students (72.22%) got scores above average, with scores ranging from 72 to 84, while five students (27.78%) got scores below average, with scores ranging between 40 to 68. This indicates a good understanding of PBL among primary school teacher education students.

Furthermore, the average score for elementary school teacher education students' understanding of Higher Order Thinking Skills (HOTS) was 95.06. Thirteen students (72.22%) got scores above the average, while five students (27.78%) got scores below the average. This indicates a high level of understanding of HOTS among primary school teacher education students.

In terms of implementing PBL in elementary school geometry learning, eight lesson plans were identified that were in accordance with the syntax and steps of the PBL approach. However, four of them only partially integrated PBL elements and still relied heavily on teacher-guided activities. In addition, five lesson plans did not include PBL elements because they lacked syntax or steps, and one elementary school teacher education student did not submit a lesson plan. In connection with the application of HOTS in elementary school geometry learning, ten lesson plans were identified that comprehensively cover HOTS elements, including formulating learning objectives, creating Student Activity Sheets (LKPD), and developing assessments in various cognitive, affective and psychomotor domains. However, the other eight RPPs have included HOTS elements, but are incomplete in certain components. In conclusion, effective implementation of the PBL and HOTS approaches does not only rely on a strong understanding, but also a continuous commitment in seeking additional knowledge that can increase teacher self-efficacy in implementing these two methods.

To respond to these findings, it is recommended that prospective teachers remain open to change and follow curriculum developments, especially regarding the PBL and HOTS concepts contained in the 2013 curriculum. This will facilitate more effective understanding and implementation in accordance with the steps that have been determined. In addition, it is important for prospective teachers to not only have knowledge about PBL and HOTS but also collaborate to maximize their application in teaching, increasing their self-efficacy in adopting these two methods. While designing a learning plan that integrates PBL and HOTS methodologies, prospective teachers must ensure that student activities are in line with the steps that have been determined, so as to achieve learning objectives optimally.

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