



The Influence of Self-Confidence on Higher-Order Thinking Skills through Project Learning with Minecraft Education Support

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Abstract

This study analyzes the quality of learning through PjBL assisted by Minecraft Education on HOTS and examines HOTS of grade IX students based on self-confidence. The method used is a mix method with a sequential explanatory model, involving quantitative at the beginning, followed by qualitative. The population of the study was grade IX students of SMP Islam Sultan Agung 1 Semarang, with class IX B as the experiment and IX C as the control. Subjects were selected using purposive sampling, with two students per self-confidence category. Quantitative data analysis used statistical tests through IBM SPSS 26, while qualitative data were analyzed through reduction, presentation, and drawing conclusions. The results showed that the learning devices and instruments were categorized as good to very good, with teacher suitability reaching 92.8% and positive student responses of 80.23%. PjBL-based learning with Minecraft Education was effective in increasing HOTS, with significant statistical test results. The increase in high-order thinking skills and self-confidence were both in the moderate category ($g = 0.51$). HOTS patterns vary: students with high self-confidence do not always meet all HOTS indicators, while students with medium or low self-confidence are able to meet the same indicators as students with high self-confidence.

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INTRODUCTION

The development of the learning process in the world of education continues to experience rapid progress along with the development of information and technology. Innovations in learning, models, and increasingly creative learning media are present to support the progress of education, especially in efforts to improve human resources in Indonesia. In the context of mathematics education, the development of learning systems is very important to increase students' interest, motivation, and ease in learning mathematics. This subject is often considered difficult and complicated by many students, so teachers are required to create innovations in mathematics learning to change negative mindsets towards the subject. Education includes several main elements, namely educating, guiding, teaching, and training, as expressed by Serevina (2020). Educating aims to form an integrated personality towards self-maturity, which is carried out through the delivery of science, technology, and art using strategies and learning models that are in accordance with student characteristics. Guidance includes motivation and coaching, while teaching focuses on providing knowledge and training students' skills. In this process, teachers are expected to be able to shape students' intelligence and skills. Training life skills is also an important part of education, such as through work practices, simulations, and internships (Darmadi, 2019).

As one of the compulsory subjects at all levels of education in Indonesia, mathematics plays an important role in developing students' ability to think logically, analytically, reasoningly, systematically, critically, and creatively, as well as learning to work together. Mathematics taught from elementary school to university level is able to encourage the ability to think, discuss, give opinions, and solve problems in life and the world of work. The Ministry of Education, Culture, Research, and Technology (Kemdikbudristek, 2022a) states that mathematics is a conceptual tool for constructing and reconstructing learning materials through mental activities that can form systematic thought

processes and deep understanding. In this case, skills such as reasoning, proposing conjectures, decision-making, and creativity are very important to develop (Wahyudi & Walid, 2020). Higher Order Thinking Skills (HOTS) are a crucial aspect that students need to master because they can help them think critically, creatively, logically, and objectively in solving problems. However, the results of the Programme for International Student Assessment (PISA) test show that Indonesian students' achievement has not improved significantly since 2009 (OECD 2019). In 2016, the weaknesses of Indonesian students mainly lay in their inability to solve problems that require critical, creative, and Higher Order Thinking Skill (OECD, 2016). Amalia (2021) explained that PISA questions generally contain HOTS, while mathematics questions in Indonesia are often below these standards, making it difficult for students to achieve average scores. The mathematics learning process in Indonesia tends to be abstract, rote, and oriented solely to learning outcomes, without providing space for students to think critically according to PISA question indicators (Badjeber & Purwaningrum, 2018; Hamidah et al., 2021). The absence of questions specifically designed to train HOTS and the lack of training of students in solving contextual questions are the causes of this low ability (Noor & Abadi, 2022). The revision of Bloom's taxonomy by Krathwohl (2002) shows that higher-order thinking skills include analysis, evaluation, and creation, which allow students to develop creativity and generate new ideas.

However, teachers in Indonesia still face obstacles in determining the right methods, strategies, and learning media. Limited student books, teaching materials that are too broad, and teachers' lack of ability to use technology also affect the learning process (Zulaiha et al., 2022). This causes mathematics learning to often only focus on delivering material through lectures without paying attention to the development of students' higher-order thinking skills.

A similar condition occurred in class IX of SMP Islam Sultan Agung 1 Semarang. Based on interviews with mathematics teachers, students tended to be passive in asking questions, expressing opinions, and solving problems. They

had difficulty solving problems that were different from the examples given by the teacher, especially due to the impact of learning during the Covid-19 pandemic, which also weakened students' higher-order thinking skills.

The results of Mohammed Saido et al (2015) study showed that most students still needed to improve their HOTS. In addition, research by Mulyani & Muhtadi (2019) found student errors at the Comprehension, Transformation, Process Skill, and Encoding stages in solving HOTS problems. Therefore, efforts to improve students' Higher Order Thinking Skill are urgently needed.

Self-confidence also plays an important role in supporting students' motivation and success in learning mathematics. Self-confidence allows students to be more confident, responsible, and optimistic in completing tasks (Andayani & Amir, 2019). Several studies, such as those conducted by Syam & Amri (2017) and Pratiwi et al (2022), show that self-confidence has a significant relationship with students' Higher Order Thinking Skill, learning achievement, and motivation in learning mathematics. To support quality learning, choosing the right learning model is very important. One relevant model is Project-Based Learning (PjBL), which encourages students to be actively involved in problem solving and developing their creativity (Irman & Waskito, 2020). PjBL is considered effective in improving the quality of learning and students' HOTS. This effort can be a solution to improve Higher Order Thinking Skill while preparing students to face more complex learning challenges.

METHOD

This study uses a mixed methods method that combines quantitative and qualitative approaches to obtain more comprehensive data. The quantitative approach is an experiment with a Pretest-Posttest Control Group design to test the effect of Project Based Learning assisted by Minecraft Education on students' Higher Order Thinking Skill and self-confidence. The experimental group used this model, while the control group used Discovery

Learning. Quantitative data were obtained through questionnaires, Higher Order Thinking Skill tests, and observations, while qualitative data were obtained through interviews to dig deeper into students' self-confidence.

This study was conducted at SMP Islam Sultan Agung 1 Semarang with data collection including observations, initial and final tests, and interviews with students and teachers. The research instruments were validated by experts, including Higher Order Thinking Skill tests that were compiled with validity tests, reliability tests, and analysis of the discriminating power and difficulty of the questions. The self-confidence scale was measured twice, before and after treatment, using a validated Likert scale questionnaire. Instrument testing aims to ensure that the data obtained is reliable and valid.

Data analysis was carried out using quantitative, qualitative, and a combination of both approaches. The analysis of learning quality includes three stages: planning, implementation, and assessment. This study also conducted a data normality test using the Kolmogorov-Smirnov test to ensure normal distribution. The classical completeness test was used to determine the proportion of students who completed the experimental class. The mean difference test and the proportion difference test were used to test the differences in Higher Order Thinking Skill and the proportion of students who achieved completion in the experimental class compared to the control class.

RESULTS AND DISCUSSIONS

The results of this study focus on measuring students' Higher Order Thinking Skill, which are reviewed from their level of self-confidence. The measurement of thinking skills was carried out through pre-test and post-test questions with flat-sided spatial geometry material. The trial of the questions was applied to class IX A on November 4-6, 2024. The research sample consisted of two groups: class IX B as the experimental group using Project Based Learning assisted by Minecraft Education, and class IX C as the control group using other learning methods. Both classes have the same average test

scores on the previous material, namely the two-variable linear equation system. The pre-test was conducted on November 11, 2024 for class IX C and on November 12, 2024 for class IX B. The post-test was conducted on November 27-28, 2024. Learning with Project Based Learning assisted by Minecraft Education was conducted for 6 meetings, between November 12 and 27, 2024. After learning, a high-level thinking ability test was conducted, followed by filling out a self-confidence questionnaire on November 27, 2024.

Student grouping was carried out after the thinking ability test and filling out the self-confidence questionnaire, based on the level of thinking ability and self-confidence. The six subjects interviewed were selected according to the criteria: two subjects with high self-confidence, two subjects with moderate self-confidence, and two subjects with low self-confidence. The interview was conducted on November 29, 2024, according to the agreed time so as not to interfere with teaching and learning activities.

The quality of learning through Project Based Learning assisted by Minecraft Education on students' high-level thinking abilities was assessed based on three stages: planning, implementation, and evaluation. At the planning stage, learning instruments, such as ATP/CP, teaching modules, LKS, and pre-test and post-test questions, were validated by three validators consisting of lecturers and mathematics teachers. The validation results showed that the instruments met good criteria, with a high percentage of validity on all instruments used. Furthermore, the pre-test and post-test questions were tested for validity, reliability, difficulty level, and discriminatory power. The results showed that all questions were valid and had high reliability, with variations in difficulty levels from easy to moderate. The discriminatory power of the pre-test and post-test questions also varied, but most had good or sufficient criteria, meaning that these questions were able to measure student competence well. At the implementation stage, this study implemented the Project Based Learning (PjBL) learning model assisted by Minecraft Education in class IX B. Learning took place over six meetings, covering the material of flat-sided spatial structures. During each meeting,

learning activities consisted of analyzing and applying the surface area formula for prisms and pyramids, as well as applying the formula in the context of real problems. Observations were conducted by mathematics teachers to assess the implementation of learning through teacher activities during four meetings.

Table 1. Observation Results of Learning Implementation Observations

Meetings	Average Percentage	Criteria
1	88.8 %	Very good
2	92.3 %	Very good
3	95.8 %	Very good
4	94.4 %	Very good
Average	92.8 %	Very good

The implementation of learning with the Project Based Learning (PBL) model assisted by Minecraft Education in class IX B went very well during four meetings. The average score for learning implementation reached 92.8%. In the first meeting, students started with analyzing house design images/videos, forming groups, and using Minecraft Education to design a house that utilizes flat-sided spatial structures. Although the implementation was not perfect (88.9%), students began to adapt to this learning model. In the second meeting, students continued with the design of a dream house related to a pyramid, and the implementation reached 92.2%. Students still had difficulties in designing the project, so researchers needed to provide further guidance. In the third and fourth meetings, students were increasingly structured in completing projects related to the application of the surface area formula for prisms and pyramids, with implementation scores of 95.6% and 94.4%, respectively. Although in the last meeting there was a slight decrease in effectiveness because students were more focused on their projects, learning continued smoothly. Students' responses to learning were very positive, with the results of the questionnaire showing a score of 80.23%. Students felt happy, comfortable, and interested in using Minecraft Education in learning. They also felt that the learning components such as LKPD, media, and high-level thinking ability test questions were very interesting and clear. Overall, students responded very well to

Minecraft Education-assisted learning with the PjBL model.

The assessment stage in this study began with a prerequisite test that included a normality test and a homogeneity test to ensure that the final test data from the Minecraft Education-assisted PBL and Discovery Learning groups could be analyzed statistically. The results of the normality test using Kolmogorov-Smirnov showed that the data from both groups were normally distributed with a Sig. value greater than 0.05. Furthermore, the homogeneity test was carried out using the Levene Statistic test, which showed that both groups had homogeneous variances because the Sig. value was greater than 0.05.

Hypothesis testing was then carried out to test the success and differences between groups. The classical completeness test showed that more than 75% of students in Minecraft Education-assisted PjBL learning met the completeness limit, as evidenced by the Z test and the One-Sample T-Test, both of which rejected H_0 . The mean difference test with Independent Sample t-Test shows that the average of students' high-order thinking skills in the experimental group (PjBL assisted by Minecraft Education) is better than the control group (Discovery Learning), with a Sig. value <0.05 . In addition, the proportion difference test shows that the proportion of students who achieve high-order thinking skills completion in the PjBL group assisted by Minecraft Education is higher than the Discovery Learning group. Finally, the improvement test with Paired Sample T-Test shows an increase in students' high-order thinking skills after using Project Based Learning assisted by Minecraft Education, which means there is a significant average difference between the pretest and posttest.

This study was conducted by giving self-confidence questionnaires to students before and after PBL learning assisted by Minecraft Education. The first questionnaire was given on November 12, 2024, before learning to measure students' self-confidence levels. The second questionnaire was given on November 27, 2024, after learning to evaluate changes in self-confidence levels and select interview subjects based on the results of grouping students' self-

confidence levels. The results of the questionnaire showed that 5 students had a high self-confidence category, 21 students were in the medium category, and 6 students were in the low category. Interview subjects were selected from each category to explore their Higher Order Thinking Skill, with subject grouping based on self-confidence scores obtained from the questionnaire. Data reduction was carried out by analyzing the results of the questionnaire and interviews to provide a clearer picture of the effect of learning on students' self-confidence levels and Higher Order Thinking Skill.

Project Based Learning (PjBL) learning assisted by Minecraft Education has proven to be of high quality in improving students' Higher Order Thinking Skill. The quality of this learning is reflected through three main criteria, namely planning, implementation, and assessment. At the planning stage, learning instruments, including learning devices and research instruments, have been well validated through reliability, validity tests, and analysis of the level of difficulty and differentiating power. The learning devices used, such as ATP, CP, teaching modules, and LKPD, are designed based on the PjBL model that focuses on students' Higher Order Thinking Skill. Research instruments, including observation sheets, student response questionnaires, self-confidence questionnaires, and Higher Order Thinking Skill tests, also show very good quality. At the implementation stage, learning was carried out in four meetings by filling out observation sheets and student response questionnaires. The results showed that the implementation of learning achieved very good quality with an average teacher observation of 92.8% and student responses of 80.23%. The use of Minecraft Education in the PjBL model gives students the freedom to construct knowledge and encourage critical thinking skills, with scaffolding support if needed. At the assessment stage, Higher Order Thinking Skill tests are conducted before and after learning. The post-test results showed a significant increase in the experimental class using Minecraft Education, with an average score increasing from 67.34 in the pre-test to 80.57 in the post-test, and a normalized gain between 0.3 and 0.7, indicating an increase in students' Higher Order Thinking

Skill in the moderate category. Overall, these results indicate that the use of PjBL assisted by Minecraft Education contributes positively to improving the quality of learning and students' Higher Order Thinking Skill. Students' Higher Order Thinking Skill, which are measured based on three indicators, namely analyzing (C4), evaluating (C5), and creating (C6) are obtained by considering the student's self-confidence category consisting of high, medium, and low. Grouping of students based on self-confidence levels was carried out after the high-level thinking ability test with the results that there were 5 subjects with a high category, 21 subjects with a medium category, and 6 subjects with a low category. Interviews were conducted with two students from each category. Subjects with high self-confidence (SC-T1 and SC-T2) showed good Higher Order Thinking Skill, meeting most of the indicators of analyzing, evaluating, and creating. In contrast, subjects with moderate self-confidence (SC-S1 and SC-S2) showed varying achievements, with SC-S1 being more dominant in the creating indicator, while SC-S2 was better able to fulfill the analyzing and evaluating indicators. In subjects with low self-confidence (SC-R1 and SC-R2), their Higher Order Thinking Skill were inadequate in fulfilling the analyzing indicator and only partially fulfilled the evaluating and creating indicators. Therefore, quantitative and qualitative analysis showed that self-confidence had a significant effect on students' Higher Order Thinking Skill, where the higher the students' self-confidence, the higher the Higher Order Thinking Skill shown, with observation and interview results consistently supporting this finding.

CONCLUSION

Based on the results of the study, it can be concluded that the implementation of the Project Based Learning model assisted by Minecraft Education media in class IX B students of SMP Islam Sultan Agung 1 Semarang has proven to be of high quality in improving students' Higher Order Thinking Skill. This learning has good quality devices and instruments, as well as very good implementation

based on validation and observation results. This learning process also shows a positive influence on students' self-confidence, where students with high self-confidence tend to have better Higher Order Thinking Skill. Overall, the implementation of this model increases students' self-confidence in understanding the material, completing assignments, and collaborating with their friends, and has a positive impact on learning both in mathematics and other fields of study. Based on the results of the study, some suggestions that can be given are as follows: Teachers can use Minecraft Education to increase students' self-confidence, especially in project-based assignments that involve creativity and problem solving. Teachers should also provide opportunities for students to work independently or in groups to increase their self-confidence, as well as provide constructive guidance and feedback during learning. Students are also expected to be more active in participating and utilizing technology-based media such as Minecraft to learn while playing. Schools should support the use of Minecraft by providing adequate facilities and training teachers to be able to use it effectively. Further research is expected to develop this model at other levels of education or different fields of study, as well as explore more deeply the relationship between self-confidence and learning outcomes through the use of project-based learning technology.

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