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The effect of Genially Assisted PBL toward Internet accesbility on Elementary School Science HOTS Skills

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Abstract

This research aimed to investigate the impact of the Genially-integrated Problem-Based Learning (PBL) model and levels of internet accessibility on the Higher-Order Thinking Skills (HOTS) of fourth-grade students, specifically regarding the topic of energy transformation. Utilizing a quasi-experimental method with a 2 x 2 factorial design, the study analyzed the interaction between the PBL model, students' internet access (categorized as high or low), and their cognitive outcomes. Data were collected via a 40-item multiple-choice HOTS test, which was validated using the Point Biserial Correlation formula. The hypothesis testing yielded an F-value of 4.76, surpassing the F-table threshold of 4.113; consequently, the null hypothesis was rejected in favor of the alternative, confirming that Genially-assisted PBL significantly influenced students' HOTS. The second hypothesis test resulted in an F-value of 0.01, which is smaller than the F-table value of 4.113 (0.01 < 4.113). Thus, the null hypothesis (Ho) was accepted and the alternative hypothesis (H1) was rejected, meaning that students' internet accessibility did not significantly affect their HOTS. The third hypothesis test yielded an F-value of 1.95, which is smaller than the F-table value of 4.113 (1.95 < 4.113). Therefore, the null hypothesis (H_0) was accepted, while the alternative hypothesis (H_1) was rejected, demonstrating that there was no significant interaction between the Genially-integrated Problem-Based Learning model and the students' Higher-Order Thinking Skills.

Keywords: Problem-Based Learning Model Assisted by Genially Media, Internet Accessibility, HOTS Thinking

1. Introduction

21st-century learning, known as the digital era, introduces and guides students to become proficient in the use of Information and Communication Technology. This aims to facilitate students' search for learning resources and broaden their knowledge horizons, thereby fostering higher-order thinking skills (HOTS) (Hanifah, et al, 2025). HOTS refers to the sophisticated ability to analyze and synthesize information creatively and critically in order to resolve various challenges. This is also known as the 4C skills (Critical Thinking, Creativity, Collaborative, and Communicative), which include HOTS (Higher Order Thinking Skills) learning (Said et

al., 2023). Furthermore, critical thinking skills are fundamental to decision-making and problem-solving (Kania, A, 2025).

Research on genially-based media was conducted by Fatma & Ichsan (2022), entitled " implementation of genially-based learning media to enhance science learning outcomes." The results showed that genially-based media can help students improve their average science learning scores. However, this study only examined the final process, focusing on average student scores, without using a learning method that teaches students to analyze and evaluate questions using HOTS thinking skills.

Furthermore, similar research was conducted by Lutfi (2024), which showed that genially-based media can improve student learning outcomes because students are more enthusiastic in listening to teacher explanations and find it easier to understand. understanding concepts and developing skills. However, the study only measured learning outcomes at the end of the study, without incorporating in-depth teacher learning methods that should have guided students to think more deeply through analyzing and evaluating questions.

The relevant model for achieving HOTS skills in this study is Problem-Based Learning (PBL). This model positions students as the central focus of the learning process by solving contextual problems independently or in groups. In the process, students are encouraged to analyze problems, evaluate information, and generate solutions, which aligns with the HOTS indicators of analyzing (C4), evaluating (C5), and creating (C6) (Irdalisa, dkk, 2024). In implementing learning, media plays a crucial role as a supporting factor for success, with its ability to facilitate communication and information delivery between teachers and students (Cahyaning Sekar Pangesti et al., 2025). Furthermore, to make PBL implementation more effective and engaging, interactive media such as Genially is needed as an aid. Genially supports interactive and dynamic visualization of material, thereby increasing learning motivation and helping students understand science concepts more deeply.

By integrating the PBL model and Genially media in science learning, it is expected that students will be more capable of developing higher-order thinking skills (HOTS), as they are trained to understand problems, analyze data, evaluate solutions, and generate new ideas based on conceptual understanding. The novelty of this research is that this research not only tests the effectiveness of Problem-Based Learning (PBL) on elementary school students' HOTS science skills, but also integrates the Genially platform as an interactive learning medium and internet accessibility as a variable that influences the success of learning implementation. Most previous studies only discuss the relationship between PBL and HOTS or the use of digital media separately, while this research combines these three aspects in one complete research model. The problem-based learning model, supported by Genially media, is expected to create learning breakthroughs that elementary school students enjoy, with concepts that are not boring.Presentations and the snakes and ladders game used to present HOTS questions are effective media for interactive learning because they facilitate learning in a fun and engaging environment (Wahyuni, 2024). In addition, the use of snakes and ladders games as an interactive

medium in learning can increase students' interest and motivation in learning (Alya Nurzahira & Waliyul Maulana S, 2024).

2. Methods

This study used an experimental method with a post-test-only design with nonequivalent groups. The reason is that this design involved two unequal groups, meaning one experimental group received a treatment and the other control group received no treatment.This study employed an experimental design with a 2x2 factorial design. This method is validatory, testing the effect of one or more variables on other variables. There were three variables in this study: two independent variables and one dependent variable. The independent variables included the Genially interactive media-assisted PBL model and internet accessibility. While the dependent variable was students' higher-order thinking skills (HOTS).

The independent variable, internet accessibility, was categorized into low and high levels, measured using a questionnaire. Meanwhile, higher-order thinking skills were categorized into low and high levels. Students' higher-order thinking skills (HOTS) were measured using a HOTS test administered to both the experimental and control groups. The research design and methodology are described below. The population in this study was all fourth-grade students at SDN Kebayoran Lama Selatan 11 registered in Dapodik (Distribution Data Collection) for the odd/even semester of the 2024/2025 academic year. The sample consisted of 40 fourth-grade students of SDN Kebayoran Lama Selatan 11 in the 2024/2025 academic year. The sampling technique used purposive sampling for factorial analysis. From the total population, 40 students were selected who met the criteria for high (n=20) and low (n=20) internet accessibility based on the results of the initial questionnaire, which was distributed to the experimental and control classes.

Data collection in this study involved administering a questionnaire to obtain information about students' internet accessibility as a learning resource. This questionnaire was distributed and analyzed before treatment was administered to classify students with low and high internet accessibility. The measurement scale used in this questionnaire was a Likert scale (Lestari, 2021).

In this study, the internet accessibility questionnaire will measure three main indicators. According to Bucy and Newhagen, three main indicators are: Availability,Referring to the existence of internet infrastructure, such as telecommunications networks, computers, or other devices that support internet access, connection quality relating to the speed, stability, and affordability of internet services for users (Rahardjo, dkk., 2016). Validity is a measure that indicates the level of appropriateness of an instrument. An instrument is considered valid if it has high validity. An instrument is regarded as valid if it is capable accurately measure what is desired and reveal data from the variables being studied. In this study, the formula used to find the validity coefficient is the Correlation Product Moment formula as follows (Lestari, 2021). Reliability refers to the extent to which an instrument is consistent and dependable, making it suitable for use as a data collection tool (Lestari, H.A. 2021). A reliable instrument is one that,

when used repeatedly to refer to the same object, will produce the same data. In calculating questionnaire reliability, the formula used is Cronbach's Alpha Correlation, as follows (Arikunto, 2016). Hypothesis testing was performed using a two-way Analysis of Variance (ANOVA) using Excel. After the experiment was completed, the data from the experimental class was compared with the data from the control class. The next step was statistical analysis, interpretation, and conclusions. The research method used was an experimental method with a 2x2 factorial design. Afterward, statistical hypothesis testing was conducted.

3. Result and Discussion

The data obtained from the test results in measuring the High-Order Thinking Skills (HOTS) of students in the experimental class using Genially learning media for 20 students presented results including an average value of 74.25. This means that overall, the posttest scores of students in the experimental class were in the range of 74.25. This indicates a fairly good level of learning achievement after being given the PBL model treatment assisted by Genially media. Then, the standard deviation of 19.9 means high. This shows the level of variation or distribution of students' scores from the average score is very diverse, some are very high and some are low. , the maximum posttest score in the experimental class is 100, meaning he has mastered the material very well, and the minimum score of the High-Order Thinking Skills (HOTS) of students in the posttest in the experimental class is 32.5, indicating that there are still students who have not understood the material optimally even though they have participated in the learning.

Table 1. Descriptive Statistics

Descriptive Statistics	Value	Interpretation
Number of Students (N)	20	Total number of students in the experimental class.
Mean Score	74.25	Indicates the average HOTS test score of students after participating in Problem-Based Learning (PBL) supported by Genially media. This result reflects a fairly good level of learning achievement.
Standard Deviation	19.90	Indicates a high variation in students' scores, suggesting considerable differences in HOTS performance among students.
Maximum Score	100.00	Indicates that some students achieved optimal mastery of the learning material.
Minimum Score	32.50	Indicates that some students had not yet achieved optimal mastery of the learning material despite participating in the learning process.

In the control class that uses conventional media in learning, the test results obtained with an average value of 61.75. This indicates that the level of learning achievement is classified as moderate or sufficient, not yet optimal., a standard deviation of 16.2 indicates that there is a

large variation or spread of student scores. With a standard deviation of 16.2, it means that student scores are spread quite far from the average, some are high and some are low. The maximum student score of 82.5 means that there are students who have mastered the material well, although not achieving a perfect score. and the minimum student score of 35.0 indicates that there are still students whose understanding of the material is still very low or not yet complete. So these results can be used as a benchmark for improving the learning model in the classroom.

The data obtained shows that students who have high internet accessibility from both experimental and control classes produced an average value of 68.25, a standard deviation of 20.7, and a maximum value of 100, and a minimum value of 32.5. The data obtained shows that the average value of High-Order Thinking Skills of students in both classes with low internet accessibility was 67.75, a standard deviation of 17.6, a maximum value of 92.5, and a minimum value of 35. The High Order Thinking Skills (HOTS) data of students in the experimental class with the PBL model assisted by Genially media and high internet accessibility of students obtained results with an average value of 70.5, a standard deviation of 25.1, a maximum value of 100, and a minimum value of 32.5. The results of the High Order Thinking Skills (HOTS) test of students with low internet accessibility in the experimental class using the PBL model assisted by Genially media obtained results with an average value of 78.00, a standard deviation of 13.1, a maximum value of 92.5, and a minimum value of 55. The posttest data from the experimental and control classes served as the research data analyzed to formulate hypotheses. Before conducting hypothesis testing, the data must be normally distributed and have homogeneous variance. Therefore, prerequisite data analysis tests were conducted, consisting of normality and homogeneity tests.
The normality test was used to determine whether the research data were normally distributed. The Liliefors test for data normality in the four treatment groups was used with a significance level of 5% (α=0.05).

Table 2. Summary of ANOVA Results

Hypothesis	Independent Variable	F Calculated (Fcount)	F Table (α = 0.05)	Decision
H1	Effect of the PBL Model Assisted by Genially Media	4.76	4.113	Reject H_0, Accept H_1
H2	Effect of Internet Accessibility	0.01	4.113	Accept H_0, Reject H_1
H3	Interaction between the PBL Model Assisted by Genially Media and Internet Accessibility	1.95	4.113	Accept H_0, Reject H_1

Based on the results of the analysis using a two-way ANOVA, the calculated F value was 4.76, which is greater than the F table value of 4.113. Therefore, it can be concluded that hypothesis (Ho) is rejected and hypothesis (H1) is accepted. This indicates that there is a significant effect of the use of the PBL model assisted by Genially Media on the Higher-Order Thinking Skills of fourth-grade students at SDN Kebayoran Lama Selatan 11 Pagi.
Based on the results of the analysis using a two-way ANOVA, the calculated F value was 0.01, which is smaller than the F table value of 4.113 (0.01 < 4.113). Thus, hypothesis (Ho) is accepted and hypothesis (H1) is rejected. This indicates that students' internet accessibility does not significantly influence the Higher-Order Thinking Skills of fourth-grade students at SDN Kebayoran Lama Selatan 11 Pagi.

Based on the results of the two-way ANOVA analysis, the F count value was 1.95, which was smaller than the F table of 4.113 (1.95 < 4.113). Therefore, it can be concluded that the hypothesis (Ho) is accepted and the hypothesis (H1) is rejected. Thus, there was no interaction between the PBL model assisted by Genially media and the Higher Order Thinking Skills of fourth-grade students at SDN Kebayoran Lama Selatan 11 Pagi.

The results of hypothesis testing in the experimental class and the control class indicate that genially interactive media has an effect on Higher-Order Thinking Skills (HOTS). This finding is reinforced by a study conducted by Febriani and Casnan (2024), which revealed that Genially interactive media based on the snakes-and-ladders game has a significant effect on increasing learning interest and motivating students to answer HOTS questions in learning, as well as enhancing students' direct engagement in the learning process through high levels of visualization and interactivity. Consequently, this strengthens students' understanding and creates a more positive learning atmosphere. When learning materials on energy and its transformations were presented through Genially presentations, students appeared active in asking questions about the images and text displayed. In addition, within the material slides, there were questions that required problem-solving, and students showed enthusiasm in responding to these questions.

Furthermore, students were observed paying close attention to the teacher's explanations and actively responding by asking questions, answering, and arguing about the presented material. Interestingly, the process of responding—asking questions, answering, and arguing—was not dominated solely by students who were usually active in class, but also involved students who had previously tended to be passive before the implementation of Genially media. This finding is further supported by another study conducted by Wahyuni, (2024), which found that Genially media not only increases students' learning motivation but is also effective in enhancing their learning interest and critical thinking skills. During the learning process in the experimental class, students were seen to be motivated to ask questions while and after the researcher explained the material. In addition, students who were typically passive became motivated and demonstrated a high level of learning interest when learning used Genially, particularly in responding to questions presented by the teacher through Genially features.
The enhancement of Higher-Order Thinking Skills (HOTS) in the experimental class was not only driven by the visual attractiveness and interactivity of the Genially media, but was also

strengthened by the application of a problem-based learning modelThis model requires students to actively analyze the problems presented in the media, engage in discussions, and formulate solutions, which directly trains their analytical and evaluative skills. In contrast, conventional learning media tend to be more limited in terms of interactivity and flexibility in presenting information to students (Ramadhani, N et al., 2023). As a result, students are less challenged to gain a clear understanding of the material, and only a few students are observed asking questions about the material presented and explained by the teacher. In the PowerPoint media used, students were seen merely observing and directing their attention toward the screen on the whiteboard.

Genially was selected as the instructional media because its interactive and multimedia features align well with the development of students' Higher Order Thinking Skills (HOTS) in science learning. Unlike conventional presentation tools, Genially allows students to actively interact with learning materials through animations, clickable objects, simulations, embedded videos, quizzes, and branching scenarios. These features create an inquiry-oriented learning environment that encourages students to construct knowledge rather than passively receive information. Genially supports analytical thinking by presenting scientific phenomena through interactive diagrams, animations, and simulations. Students can examine relationships among variables, identify patterns, distinguish causes and effects, and compare different scientific concepts. Interactive visualizations enable learners to break complex problems into smaller components, making it easier to recognize evidence and determine logical relationships. Consequently, students develop stronger analytical reasoning when investigating authentic science problems. Genially provides opportunities for students to design solutions, develop concept maps, organize scientific information, and present original ideas creatively. During Problem-Based Learning activities, students can synthesize knowledge from multiple sources to produce innovative solutions for real-world science problems (Wahyuni, 2024). The multimedia environment encourages learners to communicate their understanding through visual presentations, interactive projects, and digital storytelling, thereby fostering creativity alongside scientific thinking.

In this context, students during both the learning process and the presentation of HOTS questions were not motivated to answer questions that required deep thinking. This condition is caused by the absence of interactive features, either in the form of images or interactive symbols, that could attract students to explore the material more deeply, thereby reducing their motivation to respond to HOTS questions. Ideally, competent teachers should be able to utilize a variety of learning media, both modern and traditional, to guide students' thinking toward analysis and problem-solving (Saputra, H.A. 2023).

4. Conclusion

This research concludes that the Genially-integrated Problem-Based Learning (PBL) model significantly impacts the Higher Order Thinking Skills (HOTS) of fourth-grade students. Conversely, internet accessibility was found to have no significant effect on HOTS, with students in both high and low accessibility categories demonstrating comparable results.

Furthermore, there was no observed interaction effect between the PBL model and internet access levels. Based on these findings, it is recommended that educators more frequently implement Genially-supported PBL, particularly when developing HOTS-oriented exercises. Additionally, teachers should offer technological guidance to ensure students utilize the internet for educational purposes rather than purely for entertainment.

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