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The Correlation Between Interactive PowerPoint as a Learning Medium and Science Learning Outcomes of Fourth-Grade Elementary School Students in Pinang Subdistrict, Tangerang City

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Abstract

This study aims to examine the relationship between interactive PowerPoint learning media and science learning outcomes of grade IV elementary school students. A quantitative approach with a correlational method is used in this study. The research population consisted of 61 grade IV students of SDN Pinang 1, Pinang District, Tangerang City. The total sampling technique is used, where the entire population is used as a research sample considering the relatively small number so that comprehensive research is possible. Data was collected using questionnaires to measure the use of interactive PowerPoint and documentation of science learning scores. Data analysis was carried out using the Pearson Product Moment correlation technique. The results showed that there was a positive and significant relationship between the use of interactive PowerPoint and students' science learning outcomes, with a correlation coefficient of 0.582 which was included in the medium category. This shows that the more effective interactive PowerPoint is used in the learning process, the better the student learning outcomes tend to be. These findings confirm that the use of technology-based interactive media can be an effective alternative to support the improvement of science learning outcomes at the elementary school level.

Keywords: *Interactive PowerPoint, Learning Outcomes, Learning Media, Science, Elementary School*

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INTRODUCTION

Education is a fundamental foundation for character development, potential enhancement, and improvement of human resources. In the era of rapid technological and scientific advancement, education not only functions as a medium for knowledge transfer but also as a forum to foster attitudes, skills, and critical and creative thinking skills in students (Alpian et al., 2019). Law Number 20 of 2003 concerning the National Education System states that the purpose of national education is to develop the potential of students to become human beings who have faith, piety, noble character, capable, creative, and responsible (Republic of Indonesia, 2003).

To achieve this goal, a quality learning process is needed. One of the important aspects of the learning process is the use of appropriate and varied learning media (Magdalena et al., 2021). Learning media serves as a bridge between abstract material and students' concrete experiences. In addition, learning media can increase student motivation, attention, and involvement in learning (Audie, 2019). However, the optimization of learning media in many elementary schools still faces challenges due to the limited facilities and ability of teachers to operate these media effectively (Nurrita, 2018).

Observations conducted in eight elementary schools in Pinang District, Tangerang City, show that although most schools have learning media such as projectors, laptops, or visual aids, their use is still not optimal. Many teachers still rely on a conventional teacher-centered approach, and the media used is often in the form of static visuals with minimal interaction (Djamarah, 2023). This results in low student participation and the achievement of the Completeness Criteria for Learning Objectives (KKTP) which is not optimal. The science learning outcomes of grade IV students vary significantly between schools. Schools that use diverse and integrative media tend to have higher average learning outcomes compared to schools that are limited in media use. This indicates a potential relationship between the level of optimization of learning media and student achievement (Ariyani, 2021).

Science learning in elementary school requires an approach that can concretize abstract concepts so that they are easy for students to understand. Samatowa (2020) stated that science learning must be designed in such a way that students can experience a meaningful learning process through direct and indirect experiences. In this context, technology-based learning media such as interactive PowerPoint can be a solution because it is able to present dynamic visualizations, animations, videos, and interactive elements that support the understanding of science concepts (Munir, 2018).

Previous research has shown that different types of learning media—concrete, audiovisual, and digital—can positively affect student learning outcomes. Wahyuni (2018) found that the use of image media has a positive effect on science learning outcomes. Ladda (2020) shows the relationship between audiovisual media and learning outcomes. Margareta et al. (2024) also found a positive association between interactive PowerPoint media and science learning outcomes in grade V. However, most studies focused on specific types of media or specific subjects, and comprehensive studies exploring the relationship between media use and science learning outcomes at the elementary school level are still limited.

The multimedia learning theory from Mayer (2015) explains that students learn better from a combination of words and pictures than from words alone. This multimedia principle affirms that presentations that integrate text, images, animations, and sound can improve information understanding and retention. Interactive PowerPoint as a learning medium has characteristics that correspond to this principle because it can integrate various multimedia elements in one easily accessible platform. In addition, the constructivist theories of Piaget (1970) and Dewey (1938) emphasized

the importance of active experience in learning. Interactive media allows students to actively engage in the learning process through features such as clicks, controllable animations, interactive quizzes, and flexible navigation (Heinich et al., 2018). This is in line with the characteristics of elementary school students who are at the concrete operational stage and require a concrete and interesting learning experience (Budiningsih, 2017).

Based on this background, this study aims to explore the relationship between the use of interactive PowerPoint as a learning medium and the science learning outcomes of grade IV students in elementary schools in Pinang District. Interactive PowerPoint was chosen for its high accessibility, ability to present dynamic visuals, and the ability to integrate diverse multimedia features (Vaughan, 2016). This research is expected to contribute both theoretically and practically. Theoretically, this study enriches the discussion on the effectiveness of digital learning media in the context of basic education. Practically, this study offers a reference for teachers and schools in designing effective learning strategies using interactive media to improve the quality of education and student learning outcomes (Sadiman et al., 2018).

METHODS

Reseacrh Design

This study uses a quantitative approach with a correlational survey method to test the relationship between two variables: interactive PowerPoint as an independent variable (X) and science learning outcomes as a dependent variable (Y) (Sugiyono, 2022). The bivariate correlational design was chosen to measure the strength of the relationship between the two variables without manipulating the research subjects (Bungin, 2023). Correlation research aims to find out whether there is a relationship between two or more variables, and if there is a relationship, how closely the relationship is and how much one variable contributes to another variable (Arikunto, 2023).

Place and Time of Research

The research was carried out at SDN Pinang 1, Pinang District, Tangerang City, involving students from grades IV B and IV C. The selection of this location was based on the results of cluster random sampling from eight elementary schools in the Pinang District area. The research took place in June 2025, with the consideration that in this period students had experienced learning using interactive PowerPoint for a full semester, so that the data obtained could reflect the actual conditions (Nasution, 2019).

Population and Sample

The population in this study consisted of 417 grade IV students from eight elementary schools in the Pinang District area. The cluster random sampling method was applied using a spin wheel application to randomly select schools, which resulted in the selection of SDN Pinang 1 as the research location (Satriadi et al., 2023).

Furthermore, all 61 students from classes IV B and IV C were included as research samples using the total sampling technique. The total sampling technique was chosen because of the relatively small population (less than 100), so that all members of the population were sampled to obtain more accurate and representative results (Hidayat, 2021).

Research Instruments

Two instruments were used for data collection: questionnaires and written tests. The questionnaire is designed to measure students' perceptions of the use of interactive PowerPoint in science learning. The questionnaire was compiled based on the Likert scale with five main indicators adapted from the learning media theory of Heinich et al. (2018) and Arsyad (2023), namely:

1. Visualization: Media capabilities display attractive and clear images, diagrams, animations, and videos
2. Interactivity: The level of student engagement in interacting with the media through clicks, navigation, and other interactive features
3. Ease of use: A level of ease of use for students in operating and understanding media navigation
4. Availability: Media accessibility both at school and at home
5. Benefits: Students' perception of the benefits of media in helping to understand science material

Each indicator is described in 5-6 statements, so that there is a total of 28 statements. The questionnaire uses a 4-point Likert scale: Strongly Agree (SS) = 4, Agree (S) = 3, Disagree (TS) = 2, and Strongly Disagree (STS) = 1. Before use, the questionnaire was validated by media experts and linguists and tested on 30 students outside the research sample to test its validity and reliability using the Alpha Cronbach formula (Sudjana, 2024).

Written tests are designed to measure students' science learning outcomes based on the material that has been studied. The test questions are arranged based on the Revised Bloom Taxonomy (Kocakaya & Kotluk, 2016; Nafiati, 2021), starting from remembering (C1) to creating (C6), in the form of multiple choice (20 questions), short content (10 questions), and essays (5 questions). The questions are designed based on the Learning Outcomes and Learning Objectives of the Merdeka curriculum for grade IV science subjects (Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia, 2023). This test also goes through a validation process by science subject matter experts and is tested to ensure the validity of the content and its reliability (Suwono, 2018).

Data Analysis Techniques

In this study, a descriptive analysis method was used. Descriptive analysis is a form of data analysis used to examine the generalization of research results based on a single sample (Iqbal Hasan, 2004). This analysis evaluates the feasibility of the product based on questionnaire results obtained from subject matter experts, language experts, and media experts, as well as student responses after using the product. For data calculation, a four-point Likert scale is used, consisting of: scale 4 for Strongly Agree (SA), scale 3 for Agree (A), scale 2 for Disagree (D), and scale 1 for Strongly Disagree (SD). Once the data has been collected, a calculation will be carried out to determine the quality of the product. The formula used is as follows:

$$\frac{\text{Total score from data collection}}{\text{Number of items} \times \text{highest scale point}} x\ 100\%$$

In interpreting quantitative data into qualitative descriptions based on the obtained score criteria, a reference scale is required. The score range is determined by dividing the highest percentage score by the number of answer choice criteria. Thus, the resulting score interval is as follows:

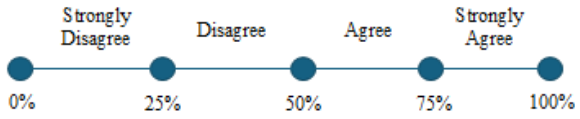

Figure 2. Score Range Interval

Based on the descriptive table above, if the final score falls within the range of 0 to 50%, the product is considered to be of poor or very poor quality. Therefore, product revision is necessary to improve its quality. However, if the score falls within the range of 51% to 100%, the product is deemed feasible and valid, and no further revision is required. This is because the product is considered suitable and ready to be disseminated to the students.

RESULTS & DISCUSSION

Result

Description of Science Learning Outcomes Data

Based on the analysis of science learning data from 61 grade IV students of SDN Pinang 1, the following picture was obtained. The average score (mean) of

science learning outcomes was 85.52 with a standard deviation of 6.24. The highest score achieved by students is 96, while the lowest score is 70. A median score of 86 and a mode of 88 indicate that most students obtained grades above the class average. The frequency distribution of science learning outcomes showed that most students were concentrated in the interval of 88-91, with a total of 16 students or 26.23% of the total sample. This distribution shows that most students achieve high grades with a distribution that tends towards the top-middle, and very few students achieve low grades. This indicates that science learning in the classroom is relatively effective and most students have achieved the expected competencies (Sudjana, 2017). If analyzed based on the Criteria for Completeness of Learning Objectives (KKTP) set by the school, which is 75, as many as 58 students (95.08%) have completed, while 3 students (4.92%) have not achieved completeness. This high percentage of completeness shows that the learning process, including the use of interactive PowerPoint media, has had a positive impact on the achievement of student learning outcomes (Ministry of Education, Culture, Research, and Technology, 2023).

Description of Perception Data on Interactive PowerPoint

Students' perceptions of the use of interactive PowerPoint also showed positive results. From the questionnaire given, an average score of 79 was obtained from a maximum score range of 112 (28 items × 4 points). The standard deviation of 8.12 indicates a relatively small variation in perception between students. The highest score obtained is 98, while the lowest score is 58. The frequency distribution showed that the highest frequency was at intervals of 77-80, with 20 students or 32.79% of the total sample. This indicates that most students consider the interactive PowerPoint media used in science learning to be of good to very good quality in terms of visualization, interactivity, ease of use, availability, and usefulness (Arsyad, 2023). If converted into an eligibility percentage using the formula:

Percentage = (Total Score / Maximum Score) × 100%

So, an average percentage of 70.54% was obtained, which according to the interpretation criteria is in the "Good" category. This shows that the interactive PowerPoint media used has met the eligibility standards and can be well received by students as an effective learning medium (Sadiman et al., 2018). Analysis of perceptions based on indicators. A more detailed analysis of the five indicators of the questionnaire showed the following results:

1. Visualization: An average score of 3.15 out of 4.00 (78.75%), indicating that students highly appreciate the attractive, clear, and colorful visual display of interactive PowerPoint
2. Interactivity: An average score of 2.98 out of 4.00 (74.50%), indicating students feel quite engaged with interactive features such as navigation buttons and clickable animations
3. Ease of Use: An average score of 3.08 out of 4.00 (77.00%), indicating that students do not experience significant difficulties in operating the media
4. Availability: An average score of 2.65 out of 4.00 (66.25%), the lowest score among the five indicators, indicating that there is still limited media access outside of school hours
5. Benefits: Average score of 3.22 out of 4.00 (80.50%), the highest score, shows that students feel the real benefits of the media in understanding science material

This data provides important information for teachers and schools to continue to improve aspects of media availability, for example by providing digital access that students can download or online learning platforms (Munir, 2018).

Analysis Prerequisites Test

Before conducting the correlation test, a prerequisite test was carried out which included normality and linearity tests. The normality test using Kolmogorov-Smirnov showed the following results:

1. Interactive PowerPoint variable: significance value 0.187 ($p > 0.05$)
2. Science Learning Outcome Variable: significance value 0.154 ($p > 0.05$)

Both significance values are greater than 0.05, which means that the data of both variables are normally distributed and are eligible for the Pearson Product Moment correlation test (Sukmadinata, 2022).

The linearity test using the Test for Linearity produced a linearity significance value of 0.000 ($p < 0.05$) and a significance value of deviation from linearity of 0.312 ($p > 0.05$). These results show that the relationship between interactive PowerPoint variables and science learning outcomes is linear and is eligible for correlation analysis (Bungin, 2023).

Uji Korelasi Pearson Product Moment

The Pearson Product Moment correlation analysis showed a correlation coefficient (r) of 0.582 with a significant value of 0.000 ($p < 0.05$). The correlation coefficient value of 0.582 according to Sugiyono's (2022) criteria is in the "medium"

category (0.40 - 0.599), which shows a positive and significant relationship between the use of interactive PowerPoint and students' science learning outcomes. This positive relationship means that the more effective the use of interactive PowerPoint in learning (characterized by a high perception score), the higher the science learning outcomes of students tend to be. On the other hand, if the use of media is less than optimal, learning outcomes tend to be lower (Margareta et al., 2024).

Uji Signifikansi Korelasi

To test the significance of the correlation, a t-test is performed with the formula:

$t = r\sqrt{(n-2)} / \sqrt{(1-r^2)}$ $t = 0.582\sqrt{(61-2)} / \sqrt{(1-0.582^2)}$ $t = 0.582 \times 7.681 / \sqrt{(1-0.339)}$ $t = 4.470 / 0.813$ $t = 5.499$

The t-calculated value of 5.499 was then compared with the t-table value at a significant level of 5% with df = n-2 = 59, which was 2.001. Since t-count (5.499) > t-table (2.001), H_0 is rejected and H_1 is accepted. This confirms that the relationship between interactive PowerPoint and science learning outcomes is statistically significant and can be generalized to the population (Arikunto, 2023).

Coefficient of Determination

To find out the amount of contribution of interactive PowerPoint variables to science learning outcomes, the determination coefficient was calculated:

$KD = r^2 \times 100\%$ $KD = (0.582)^2 \times 100\%$ $KD = 0.339 \times 100\%$ $KD = 33.9\%$

These results show that interactive PowerPoint contributes 33.9% to students' science learning outcomes, while the remaining 66.1% is influenced by other factors such as learning motivation, family environment, teacher teaching methods, students' learning readiness, and other internal and external factors (Dimyati & Mudjiono, 2015; Suardi, 2018).

Although the contribution does not reach 50%, the value of 33.9% still shows that interactive PowerPoint media has a significant influence in supporting the achievement of science learning outcomes. These findings are in line with the research of Margareta et al. (2024) which found a contribution of 36.2% of interactive PowerPoint media to the learning outcomes of science class V.

DISCUSSION

The results of this study show that there is a positive and significant relationship between the use of interactive PowerPoint learning media and the science learning outcomes of grade IV students of SDN Pinang 1, Pinang District, Tangerang City. Based on the analysis using the Pearson Product Moment correlation test through the SPSS program, a correlation coefficient of r = 0.582 was obtained with a significance value (p-value) of 0.000 which is smaller than the significance level of 0.05. This value indicates that the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_1) is accepted, which means that there is a significant relationship between the two variables. According to the correlation interpretation criteria, the coefficient of 0.582 was in the medium category, which shows a clear relationship between the use of interactive PowerPoint media and students' science learning outcomes. Thus, the better the use of interactive PowerPoint media in science learning, the more student learning outcomes tend to increase (Sugiyono, 2022).

These findings reinforce the idea that technology-based visual media continue to contribute to supporting the learning process, although learning outcomes are also influenced by various other factors such as motivation, learning interests, student involvement, and teaching strategies implemented by teachers (Audie, 2019; Nurrita, 2018).

Relevance to Multimedia Learning Theory

The findings of this study are in line with the multimedia learning theory from Mayer (2015) which states that media that combines visual and verbal elements can help students understand information more deeply and quickly. Interactive PowerPoint as a learning medium integrates text, images, animations, and sounds, so that it can attract students' attention and facilitate their understanding of abstract science concepts (Vaughan, 2016). The principle of modality in Mayer's theory states that people learn better from a combination of graphs and narratives than graphs and written text alone. In this study, the interactive PowerPoint used integrated process animation (e.g. water cycle, butterfly metamorphosis, and photosynthesis process) with narrative and supporting text, allowing students to process information through two cognitive pathways: visual and auditory (Munir, 2018). This reduces cognitive load and improves information retention, which ultimately contributes to improved learning outcomes.

In addition, the principle of interactivity in multimedia learning is also proven in this study. Interactive features such as navigation buttons, interactive quizzes, and animations that students can control provide opportunities for them to learn at their own pace and repeat ununderstood passages (Heinich et al., 2018). This is in line with the principle of student-centered learning, where students have more control over their own learning process.

Observation of the Learning Process

During the research process, the researcher made observations on learning using interactive PowerPoint. Some of the key findings from these observations are:

1. Increased Student Engagement and Motivation

The use of interactive PowerPoint noticeably increases student engagement in learning. Students appear more enthusiastic and focused when the material is presented through animations and videos compared to verbal explanations alone. This is in accordance with the characteristics of elementary school students who are in the concrete operational stage according to Piaget (1970), where they can more easily understand concepts through visualization and concrete representation (Budiningsih, 2017). For example, when learning material about plant parts and their functions, animations that show the process of photosynthesis and water absorption from roots to leaves make it easier for students to understand previously abstract concepts. Students are also more active in asking questions and discussing interesting visualizations when they see interesting visualizations, which shows that the media has succeeded in sparking their curiosity (Samatowa, 2020).

2. Learning Differentiation

Interactive PowerPoint allows for differentiation of learning, where students with different abilities can learn at a suitable pace. Students who need additional explanations can repeat certain parts of the presentation, while students who grasp the material faster can move on to the next section or work on interactive practice questions (Sumantri, 2016).

The researchers observed that some students who initially showed low learning outcomes, especially in materials that require an understanding of basic concepts, experienced an improvement after interactive PowerPoint media was used regularly in the learning process. This indicates that media helps students to stay focused, become more interested in the material, and more easily remember the information conveyed (Djamarah, 2023).

3. Home Learning Support

One of the interesting findings in the study is that some students get learning support from parents at home, especially by re-accessing PowerPoint materials used in class through digital devices such as laptops or mobile phones. This access to learning at home has significantly improved their academic performance, showing that interactive PowerPoint learning media can be used flexibly outside of school hours (Kurniawan, 2020).

This is in line with the concept of continuous learning, where students not only learn at school but also continue the learning process at home with the support of technology. Parents who are involved in children's learning by facilitating access to

digital materials contribute to improving learning outcomes (Sumantri & Syaodih, 2020).

Comparison with Previous Research

The findings of this study are consistent with several previous studies that examined the relationship or influence of learning media on learning outcomes. Margareta et al. (2024) found a positive relationship between interactive PowerPoint media and science learning outcomes in class V with a correlation coefficient of 0.641 (strong category). Differences in correlation levels can be caused by differences in sample characteristics, learning contexts, and variations in the PowerPoint design used. Saputra and Yustina (2022) in their experimental study found that the use of interactive PowerPoint had a significant effect on science learning outcomes with an average increase in scores of 12.5 points compared to conventional learning. This strengthens the argument that interactive media has advantages over traditional lecture methods.

Wahyuni's (2018) research on the use of image media showed a positive influence on science learning outcomes with a contribution of 28.4%. Although drawing media is simpler than interactive PowerPoint, its contribution to learning outcomes remains significant. This shows that the principle of visualization in learning is indeed fundamental to help students understand (Arsyad, 2023). Ladda (2020) found a relationship between audiovisual media and Islamic Religious Education learning outcomes with a coefficient of 0.524. These findings suggest that media that integrate audio and visuals, such as interactive PowerPoint, have relatively similar effectiveness across a wide range of subjects, not just limited to science.

Factors Affecting Learning Outcomes

Although the results show a significant relationship, it should be noted that student learning outcomes are not solely influenced by learning media. The determination coefficient of 33.9% shows that there are still 66.1% of other factors that also affect students' science learning outcomes. Some of these factors include:

1. Learning Motivation

Students' intrinsic and extrinsic motivation greatly affect their learning outcomes Students who have high motivation tend to be more active in learning, more diligent in doing assignments, and more persistent in dealing with learning difficulties (Hamalik, 2019). Interactive PowerPoint media can increase extrinsic motivation through an engaging display, but intrinsic motivation remains an important factor that needs to be developed.

2. Family Environment

Parental support, family economic conditions, and the learning environment at home also affect student learning outcomes. Students who receive full support from their families, both in the form of learning facilities and attention to academic development, tend to have better achievements (Sumantri & Syaodih, 2020).

3. Teacher's Teaching Methods

Teachers' skills in integrating media with effective teaching methods are also very decisive. Good media will not be optimal if it is not accompanied by the right learning strategy. Teachers need to be able to facilitate discussions, provide scaffolding, and create a conducive learning environment (Onuebunwa, 2012; Sumantri, 2016).

4. Students' Initial Readiness and Ability

The students' initial ability to understand prerequisite concepts also affects learning outcomes. Students with a strong foundation of knowledge will have an easier time understanding new material, while students with low initial abilities will need additional intervention (Dimyati & Mudjiono, 2015).

5. Other Internal Factors

Internal factors such as physical health, psychological condition, interest in subjects, and students' learning styles also contribute to learning outcomes (Esti, 2017).

Theoretical Implications

Theoretically, this study enriches the literature on the effectiveness of digital learning media, especially interactive PowerPoint, in the context of basic education in Indonesia. These findings support the multimedia learning theory of Mayer (2015) and the theory of constructivism which emphasizes the importance of active and meaningful learning experiences (Dewey, 1938; Piaget, 1970). This research also shows that the principles of multimedia learning design developed in the Western context can be applied well in the Indonesian educational context, with adjustments to cultural characteristics and local needs. This opens opportunities for further development of technology-based learning media that is appropriate to the Indonesian context (Seels & Richey, 1994).

CONCLUSION

Based on the results of research, data analysis, and discussion, it can be concluded that there is a positive and significant relationship between the use of interactive PowerPoint learning media and the science learning outcomes of grade IV elementary school students in Pinang District, Tangerang City. A correlation coefficient of 0.582 indicates a relationship in the medium category, which means that interactive PowerPoint has a beneficial contribution to the student's academic performance. The null hypothesis (H_0) is rejected, and the alternative hypothesis (H_1) is accepted, which confirms the statistical significance of the relationship. The determination coefficient of 33.9% shows that interactive PowerPoint media makes a significant contribution, although there are still other factors that also affect learning outcomes such as motivation, family environment, teaching methods, and student readiness. The findings of this study reaffirm that engaging, visual, and interactive media continue to play an important role in improving the learning process, despite various other influencing factors. The use of technology in learning, especially interactive PowerPoint, can be an effective alternative to support the achievement of science learning goals in elementary schools.

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