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Development and Validation of PowerPoint-Based Interactive Game Media for Science Learning in Islamic Elementary Schools

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ABSTRACT

The rapid development of technology and information has inevitably influenced the field of education. This development presents significant challenges for teachers and educational practitioners, who must develop innovative approaches to effectively integrate technology into the teaching and learning process. This development research aims to determine the specifications, validity, teacher and student responses, and effectiveness of an interactive learning media based on a PowerPoint game on the topic of characteristics of living things for third-grade students at MI Miftahul Ulum Gondang. The research employed the ADDIE development model, which consists of five stages: analysis, design, development, implementation, and evaluation. Data were collected through observations, interviews, validation sheets, and questionnaires. The data analysis techniques included validation sheet analysis, questionnaire analysis, descriptive statistical analysis, normality testing, paired-samples t-tests, and N-gain analysis to assess the effectiveness of the developed media. Based on the validation results, the material expert evaluation reached 85%, the media expert evaluation reached 90%, and the language expert evaluation reached 88.8%. These results indicate that the interactive PowerPoint-based game is valid and feasible for instructional use. Furthermore, student responses showed a very positive result at 90.9%, while teacher responses reached 97.5%, indicating strong acceptance and usability of the media in classroom learning. Quantitative data analysis revealed an average effectiveness score of 59.27%, demonstrating a meaningful improvement in students' understanding after using the developed media.

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INTRODUCTION

The quality of education is very important in a country because it will affect the direction of the country's success and progress (Amirudin et al., 2024; Darwanto et al., 2024). This is because education is a pillar of human resource development, ensuring that the quality of education keeps pace with the increasingly advanced times (Albert et al., 2025; Amalia, 2022; Rosdiana et al., 2024; Waldan et al., 2025). The development of technology and information is increasingly rapid, and its influence on the world of education is inevitable. Digital technology has become a necessity in education today (Ahmad Kusaini et al., 2024; Dearman et al., 2018; Landa et al., 2021; Muhith et al., 2023). It has been adapted by the Ministry of Education and Culture to develop a new curriculum and advance education towards a creative Indonesia in 2045 (Alvadina et al., 2024). Therefore, the use of technology and information is considered important for the success of students and educational personnel. Regardless, the role of a teacher cannot be overlooked. There needs to be educational interaction, namely the teaching and learning process, between a teacher and students. Teachers play an important role in the learning process, which requires them to be innovative in selecting appropriate learning methods and media to create an effective and enjoyable learning experience (Cahyanto et al., 2025; Nurdin et al., 2024; Sholihah et al., 2022).

However, the majority of teachers still use conventional methods in the learning process because they are easy to apply and do not require complex organization (Prameswara & Pius X, 2023). The facts on the ground also show that many teachers still do not understand the proper steps for selecting media (Anggraeni et al., 2025; Ilham & Ramadani, 2024; Martanti et al., 2025). This causes students to quickly become bored and lose focus in learning, making it difficult for them to accept the material being presented (Habibah et al., 2025; Mahrus et al., 2025). The use of learning media is one of the components that is very necessary in the school learning process. This is because it can help in achieving learning objectives (Anderson et al., 2009). Therefore, preparing learning media is one of the responsibilities of teachers/educators.

Communication cannot take place without an intermediary to convey messages. Learning media serve as a means of conveying messages or communicating between students, teachers, and teaching materials (Kohout-Diaz, 2026; Mahmudah et al., 2025). Thus, it can be said that human relationships or interactions, reality, images, moving images, and audio recordings are forms of stimuli that can be used as media. These forms of stimuli will help students learn the material being taught (Elihami et al., 2025; Johari et al., 2024). Technology is used as an innovative learning medium, believed to keep up with the times. Isma states that learning using technological media has a significant influence on learning (Badawi, 2025; Lee et al., 2023; Tan & Sen, 2026). One interactive learning media option is Microsoft PowerPoint. Microsoft PowerPoint offers several benefits, including the ability to serve as an interactive learning medium. In addition to displaying presentation material, Microsoft PowerPoint can also display sounds that can be adjusted to the user's needs.

The use of learning media greatly determines the course of a learning activity (Avcı & Ergün, 2019; Setyaningsih & Atmaja, 2021). This is evident in science subjects at the elementary school level, where science is a fixed subject that cannot be understood solely through reasoning. Therefore, this study will develop interactive, game-based media in the form of audiovisual games featuring engaging animation elements to increase students' enthusiasm for learning. Interactive games can also eliminate student boredom in learning. Natural Sciences (IPA) is one of the subjects closely related to learning media. These subject guides help students measure, observe, predict, classify objects, conclude, and then communicate what they have

learned. In reality, not everything can be conveyed through experiments in the process of learning science. In certain cases, the concept of science learning arises from human reflection on all events in nature (Desmiati et al., 2023; Hisbullah & Firman, 2019; Pertiwi et al., 2025). The material on the characteristics of living things requires media in the learning process. Without learning media, students will find it difficult to understand the material being conveyed. Using learning media such as images, videos, and multimedia presentations helps visualize difficult concepts, making them easier for students to comprehend.

Based on observations at MI Miftahul Ulum Gondang, the school's facilities and infrastructure are adequate to support teaching and learning. The school already has a computer lab available for learning. In addition, based on interviews with third-grade teachers at MI Miftahul Ulum Gondang, it was found that in addition to using conventional learning methods, teachers also often use simple learning media such as pictures, human skeleton models, and other concrete objects. Occasionally, teachers also conduct fun games or learning activities outside the classroom to prevent students from getting bored during the learning process. However, the use of these media is still considered insufficient. The use of technology in the science learning process has not yet been implemented.

Limitations in using interactive learning media can affect the effectiveness of the teaching and learning process, leading to lower student learning outcomes. In addition, teachers have not fully utilized the school's facilities, such as computer laboratories, for learning. Based on the above problems, this study developed PowerPoint as an interactive medium to improve the quality of student learning outcomes. This study provides solutions to the problems faced through the research and development of interactive learning media titled "Development of Interactive Learning Media Based on PowerPoint Games for Material on the Characteristics of Living Things for Grade III at MI Miftahul Ulum Gondang".

METHODS

This study uses a Research and Development approach. According to Sugiyono, the research and development method is a scientific approach to researching, planning, designing, producing, and testing the validity of the resulting product. The development design and procedure used in this study is the ADDIE model, which consists of five stages: analysis, design, development, implementation, and evaluation. Data was collected through observation, interviews, validation sheets, and questionnaires. Data collection techniques included validation sheet analysis, questionnaire analysis, descriptive questionnaire analysis, normality testing, paired-samples T-test, and N-gain testing.

Initially, interviews were conducted with third-grade teachers to analyze the factors influencing the problem. This activity was carried out to determine the selected problem variables and obtain preliminary data on the teaching materials in the third grade at MI Miftahul Ulum Gondang. Then, questionnaires and test instruments were prepared, followed by their review and validation by experts. Next, the research process involved testing the PowerPoint-based game-learning media product. This activity was carried out to identify any shortcomings. In the next stage, the researcher developed a PowerPoint game-based learning media product and evaluated it through field testing with third-grade students at MI Miftahul Ulum Gondang in the science subject on the characteristics of living things. In the final stage, the researcher tested the PowerPoint game-based learning media as a learning resource for the science subject of the characteristics of living things, evaluating its feasibility and effectiveness.

FINDINGS AND DISCUSSION

Result

The development of interactive PowerPoint game learning media on the characteristics of living things for third-grade students has gone through several stages, including identifying potential and problems, data collection, product design, design validation, product testing, product revision, usage testing, and product revision to produce learning media that contains material on the characteristics of living things for third-grade students. The steps in the ADDIE model research and development are as follows:

Analyze

This research stage was conducted to analyze the need for information on needs in the teaching and learning process in the thematic subject one in the field of science. In addition, this study analyzed learning media suitable for students' needs in the thematic subject one in the field of science. This was done as a preliminary step before developing products that help students learn more effectively and better understand the lessons being taught.

The needs analysis was conducted by observing third-grade students at MI Miftahul Ulum Gondang and by interviewing teachers who teach thematic subject one in the field of science at the school. The information obtained showed that the use of learning media in the teaching and learning process of science subjects was still not fully effective, and that teachers were not fully utilizing school facilities, such as electronic media, as learning media in thematic science subjects. Given the existing problems, this study aims to develop media on thematic science subjects, specifically interactive, game-based PowerPoint media on the characteristics of living things.

Design

This design stage involves creating a draft of the interactive PowerPoint game learning media product. During this design stage, material is gathered from various sources. Next, prepare the material to be delivered, including the KI and KD, learning objectives, opening activities, core activities, closing activities, and conclusions. The creation of this product requires PowerPoint 2016 as the main application and Wordwall as a supporting application or additional web-based application.

Development

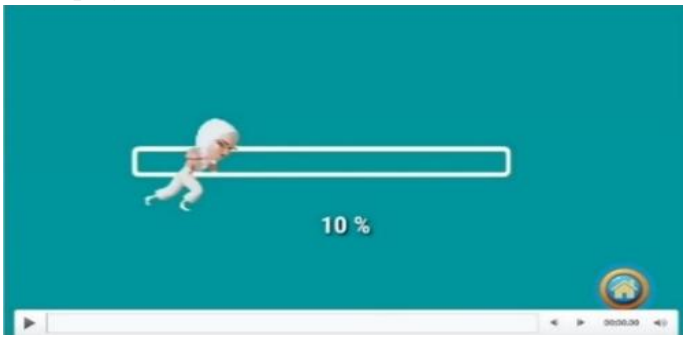
At this stage, the media are compiled and developed in this study according to the predetermined design. After that, this study can validate and develop this interactive PowerPoint game learning media in accordance with the design. At this stage, it is necessary to include important elements that must be present in the product, including the following: (1) Designing the background of the slides and adjusting it to the theme of the material. (2) Inserting and arranging the layout of images or animations in the PowerPoint application in accordance with the material being presented. (3) Adjusting the font used, including the size, type of font, and layout of the text. (4) Insert audio into certain slides according to the design. (5) Arrange the slide sequence to match the lesson plan and so on. (6) Set up hyperlinks so that all slides can be operated according to the design stage. (7) Create a quiz in the Wordwall application and set up hyperlinks to connect to the Wordwall website that has been created.

Table 1. **Analyze–Design–Development**

Stage	Main Activity	Description
Analyze	Needs analysis	Observation of third-grade students and interviews with teachers showed that science learning media were not used optimally. The study therefore aims to develop interactive PowerPoint game media on the characteristics of living things.
Design	Media design	Preparing learning materials (KI, KD, objectives, activities) and designing interactive PowerPoint media using PowerPoint 2016 supported by Wordwall.
Development	Media development	Developing the media by designing slides, inserting images, audio, and animations, arranging navigation with hyperlinks, and creating quizzes in Wordwall connected to PowerPoint.

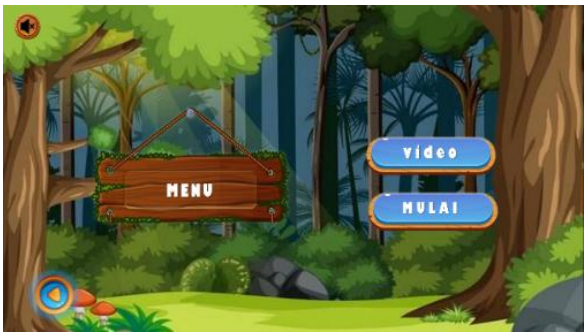
The specifications of the product components contained in this interactive PowerPoint game learning media are as follows:

Learning video display



Product start screen

Main menu display



Instructions for use display

Basic competencies and game objectives

Level display in the product

Quiz link display in the game

After the interactive PowerPoint game learning media has been created and developed, the next step is to validate it with experts to obtain comments and suggestions on the product, ensuring it is valid before testing. At this stage, several experts validate the interactive PowerPoint game learning media, namely subject matter experts, media experts, and language experts. The validity testing by these experts is conducted through a validation sheet. Please note that the results and discussion are separated.

Subject matter validation

Based on the results of subject matter expert validation, it is known that the content of the interactive PowerPoint game learning media developed is in accordance with several aspects, namely the relevance of the material to the KD, the suitability of the material to the learning objectives, the material presented systematically, the consistency of sentence structure and language that is easy to understand, the suitability of the material to the level of student ability, the clarity of the material description, the images used in accordance with the material, and the examples given in accordance with the material.

The results of the subject matter expert validation show good and very good ratings. The total score was 43, with an average of 4.3. Then, comparing the average score with the ideal assessment criteria indicators, using a scale conversion of 5, yields a very good category. The developed product's percentage is 86% after comparing the validation sheet percentage with the expert validation criteria, indicating that the criteria are very valid. Based on the results from the subject matter experts, it was concluded that the interactive PowerPoint game learning media can be used in the learning process with a few improvements and suggestions, namely at levels 4 and 2, namely the understanding of breathing and language growth, which should be simplified so that it is easier for children to understand.

Media validation

Based on the results of media expert validation, the content of the interactive PowerPoint game learning media developed is in accordance with several aspects, namely presentation, visuals, colors, audio, and text. These aspects include product appeal, ease of use, clarity of instructions, visual appeal, illustration quality, image suitability, color

selection, audio settings, and the suitability of the font type and size used in the interactive PowerPoint game learning media.

The results of media expert validation show good and excellent ratings. The total score is 45, with an average of 4.5. Furthermore, by comparing the average score with the ideal assessment criteria indicators using a 5-point conversion scale, the category is excellent. The percentage of products developed is 90%. After comparing the validation sheet's percentage results with the expert validation criteria, the criteria are found to be very valid. Based on the results from the media expert, it can be concluded that interactive PowerPoint game learning media can be used in the learning process. Still, it needs to be revised because the text in the video is not clearly visible, and at level 2, there is no connection with the material. Hence, it needs improvement to create appropriate puzzles. There is no exit or exit minute. Level 4 should have the cat in the same position so that there is no comparison of increasing size. Finally, a quiz based on evaluation needs to be added so that the child's score or ability can be determined.

Language Validation

Based on the results of linguistic validation, the content of the interactive PowerPoint game learning media developed is appropriate in several aspects, namely readability. In this aspect, there are several indicators, namely the correctness of language use, the appropriateness of the terms used, language that is easy to understand, the use of communicative language, accuracy in language selection, sentences that can represent the information to be conveyed, simplicity in sentences, accuracy in spelling, and consistency in the use of terms in the interactive learning media developed.

The results of linguistic validation show good and excellent ratings. The total score is 40, with an average of 4.4. Then, a comparison of the average score with the ideal assessment criteria indicator,, with a scale conversion of 5,, indicates the category of excellent. After comparing the validation sheet percentage with the expert validation percentage criteria, the criteria are found to be very valid. Therefore, based on the linguists' results, it can be concluded that interactive PowerPoint game learning media can be used in learning with a few improvements and suggestions, namely, improvements in spelling.

Based on the research results and suggestions from subject matter experts, media experts, and linguists, the researcher will make several improvements to the product.

Data Analysis

Validation sheet

All data collected in this study are qualitative and will be converted to quantitative data. Therefore, the data analysis used in this study uses descriptive data analysis through the following steps: a). Qualitative data obtained by the validator is converted into quantitative values. b). Calculate the average value or score of all interactive PowerPoint game learning media indicators using the formula: $\bar{X} = (\sum x)/n$. c). The average values of previously quantitative indicators were converted to qualitative categories by comparing them with the ideal assessment criteria for each indicator using a 5-point scale. d). Determine the percentage of interactive PowerPoint game learning media. e). Compare the results of the expert validation

sheet percentage with the expert validation sheet percentage criteria.

Questionnaire analysis

During the questionnaire analysis process, the results of the student response sheets were compared with the predetermined response criteria. The classification of the response scores is presented in **Table 1**:

Table 2. Interpretation Criteria of Questionnaire Response Scores

Percentage	C**ategory**
0-10%	Very Poor
11-40%	Poor
41-60%	Fair
61-90%	Good
91-100%	Very Good

Similar steps were also applied to analyze the teachers' response questionnaires to the interactive PowerPoint game learning media developed by this study.

Quantitative data analysis

The pretest and posttest results for grade III at MI Miftahul Ulum Gondang were then analyzed quantitatively to determine the effectiveness of the interactive PowerPoint game as a learning medium in science. This was done in the following ways:

Descriptive Analysis: Descriptive analysis was conducted to determine the mean, maximum, minimum, and other values. This was a step toward obtaining an overview of the research data.

Normality Test: Parametric statistics require that the data for each analyzed variable be normally distributed. Therefore, a normality test was necessary. The normality test in this study used the Shapiro-Wilk test, as follows:

$$T_3 = [\sum_{i=1}^{k} ai\ (X_{n\text{-}i\text{-}1} - X_i)]^2$$

$$D = [\sum_{i=1}^{k} \quad (Xi - \bar{X})^2$$

Valid data is normally distributed. The significance level is 5%, and the rule is that if the significance value is less than 0.05, the data are not normally distributed. If the p-value is greater than or equal to 0.05, the data are normally distributed.

Paired Sample T-Test: The paired sample T-test was used to determine the effect of the interactive PowerPoint Game learning media on student learning outcomes before and after being given treatment in science lessons on the characteristics of living things for third-grade students at MI Miftahul Ulum Gondang. To test the data, the researcher used SPSS version 23 and the paired sample t-test formula as follows.

$$T_{hit} = \frac{\frac{\bar{D}}{SD}}{\sqrt{var}}$$

$$SD = \sqrt{var}$$

So, it can be formulated that var (s2) = 1/(n-1) ∑_(i-1)^n (xi −x̄)2

The conclusion of the paired-samples t-test must first determine the significance level (α) and the degree of freedom (DF) = n-1. Then compare the values: if thit > ttab, they are different (Ho is rejected); if thit > ttab, they are not different (Ho is accepted).

N-Gain Test: The N-Gain test measures the improvement in students' abilities and learning outcomes before and after treatment in the teaching and learning process. To find this out, the following formula is used.

$$g = \frac{\text{x post test} - \text{x pretest}}{\text{x max} - \text{x pretes}}$$

After obtaining the normalized N-gain value, the learning improvement category can be determined using the criteria presented in **Table 2**.

Table 3. Normalized N-Gain Interpretation Criteria

Normalized N-gain Value	Criteria
0.70 ≤ g ≤ 1.00	High
0.30 ≤ g < 0.70	Moderate
0.00 < g < 0.30	Low
g = 0.00	No Increase
-1.00 ≤ g < 0.00	Decrease

To determine the effectiveness level of the learning media, the percentage score is interpreted based on the effectiveness criteria shown in **Table 3**.:

Table 4. Effectiveness Category Based on Percentage Score

Percentage (%)	Category
< 40	Ineffective
40 – 55	Less Effective
56 – 75	Moderately Effective
> 76	Effective

Discussion

This study aims to produce interactive learning media that are suitable and engaging for learning and effective in improving student learning outcomes. To achieve this goal, interactive learning media were developed using the ADDIE model: analysis, design, development, implementation, and evaluation (Allen, 2006).

During the analysis stage, problems were identified through observation and interviews with third-grade teachers at MI Miftahul Ulum Gondang. Based on the results of the observation and interviews, the researcher found that the school's facilities were adequate but not being utilized to their full potential, so learning relied solely on textbooks. Teachers also

often used manual media such as pictures or videos during lessons. However, the use of such simple learning media did not make students focus on understanding the material. In fact, when studying, many students did not pay attention and were busy talking to their friends. This makes the learning process not conducive. Therefore, interactive, game-based PowerPoint learning media is very suitable for addressing all existing problems.

Product design serves as the primary reference for developing interactive learning media. The design contains an overview of product development and the parts that will be included in the product. At this stage, several applications are needed to develop interactive learning media in PowerPoint. PowerPoint 2016 is the primary application used to compile learning materials and all components of learning media. The researcher also used an additional web-based application, Wordwall, to compile quizzes before linking them to the PowerPoint application.

During the development stage, the researcher created the product that had been designed previously. All parts of the product and its materials were compiled in PowerPoint. Transition effects, animations, and audio were then added to make the compiled parts resemble a game. Next, the researchers created quizzes using Wordwall by adding questions, setting themes and templates, and ensuring that the Wordwall quizzes could be accessed via the URL listed on the PowerPoint hyperlink. The developed media was then validated by subject matter experts, media experts, and language experts to obtain criticism and suggestions. Subject matter experts assessed the material contained in the learning media.

The validation results obtained were then analyzed. Validation by subject matter experts yielded an average score of 4.3, which is very good and highly valid, but accompanied by several suggestions for improvement. Furthermore, validation by media experts on the appearance and use of interactive, game-based PowerPoint learning media yielded an average score of 4.5, which is very good and highly valid, but revisions accompanied it. The final validation was conducted by language experts, who gave an average score of 4.4 with criteria of very good and very valid, but accompanied by suggestions. Based on the results of the expert/specialist validation, this interactive PowerPoint game learning media is very good and highly valid, making it suitable for use.

During the implementation stage, the product was tested on third-grade students and science teachers at MI Miftahul Ulum Gondang. The trial was conducted to determine student and teacher responses and to assess learning outcomes before and after using the interactive PowerPoint game learning media. The questionnaire used to collect student and teacher responses used a 5-point rating scale. In the small-group trial, the students' responses averaged 4.8, with a 96% success rate. Meanwhile, the teachers' responses in the small-group trial averaged 4.75 (95% confidence interval). Furthermore, the students' responses in the field trial averaged 4.54, with a 90.9% response rate. Teachers' responses had an average score of 4.87, with a response rate of 7.5% (p-value). Based on responses from third-grade students and thematic subject teachers at MI Miftahul Ulum Gondang, it can be concluded that the interactive PowerPoint game learning media on the characteristics of living things is suitable for use and can assist students and teachers in the learning process.

The effectiveness of the product can be determined through pre- and posttests administered to students in class IIIA at MI Miftahul Ulum Gondang. In a small group trial, descriptive analysis of the pretest results showed an average of 61.00, while the posttest showed an average of 82.00. The pretest normality test result was 0.421, which is within normal limits, and the posttest result was 0.814, which is also within normal limits. The results of the paired-samples t-test in the small-group trial showed a significant (2-tailed) of 0.000, indicating a difference in the average learning outcomes of the students. The results of the gain test in the small-group trial showed an average gain of 55.51%, indicating that the product is quite effective. In the field trial, the descriptive analysis of the pretest results showed an average of 57.94, while the posttest showed an average of 82.65. The pretest normality test results were 0.125, within normal limits, while the posttest results were 0.278, also within normal limits. The results of the paired-samples t-test in the field trial showed a significant (2-tailed) p-value of 0.000, indicating a difference in students' average learning outcomes. The results of the N-Gain test in the field trial showed an average of 59.27%, indicating that interactive, game-based PowerPoint learning media is highly effective in improving student learning outcomes. Based on the quantitative data analysis, it can be concluded that interactive PowerPoint game learning media on the characteristics of living things is effective in the learning process.

The product's evaluation by validators yielded average scores of 4.3, 4.5, and 4.4, respectively. Based on student responses, the product was categorized as excellent, while based on teacher responses, it was also categorized as excellent. This shows that the researcher's product is suitable for use. Furthermore, based on quantitative analysis of the pretest-posttest results, there was an increase in third-grade students' learning outcomes at MI Miftahul Ulum Gondang. Therefore, it can be concluded that the interactive PowerPoint game learning media on the characteristics of living things is effective in the learning process.

The development and use of interactive PowerPoint game learning media yielded excellent results on average, as indicated by expert, student, and teacher responses. Based on these results, it can be concluded that interactive PowerPoint-based learning media can help teachers and students in the learning process. This is evidenced by students' and teachers' responses and by the increase in student learning outcomes.

To enhance usability, the slides were systematically organized to include an opening title, specific instructional guides for button functionality, and clear sections for learning objectives and core competencies (Ahmad Faudzi et al., 2023; Cook & Dupras, 2004). Furthermore, the visual interface was designed with vibrant, engaging layouts to capture student interest and facilitate intuitive interaction between slides (Chauhan, 2023) . Following these design phases, the product underwent rigorous validation by material and media experts to ensure that the content and pedagogical structure aligned with the learning objectives (Kao et al., 2023; Shakeel et al., 2023). Expert validation provided critical feedback in the form of scores and suggestions, which served as the basis for necessary revisions to finalize the media's quality and educational relevance.

Once the media was refined based on these expert recommendations, the implementation phase was conducted in the classroom to observe student engagement and interaction with the interactive tools. During this stage, data regarding student responses were systematically

collected to measure the effectiveness of the media in a real-world learning environment (Hsu, 2022).

This empirical observation revealed significant improvements in student concentration and participation compared to previous instructional methods (Tzafilkou et al., 2022). Finally, the evaluation phase confirmed that the media met the established quality standards, as evidenced by positive feedback from both students and educators (Lai et al., 2022). The final validation results indicated that the media achieved high scores across pedagogical and technical dimensions, confirming its status as a feasible and highly effective tool for classroom instruction. These outcomes demonstrate that integrating interactive multimedia into traditional classroom settings significantly enhances both the quality of instruction and student academic achievement (Budiartini et al., 2025; Mariam et al., 2026).

These results are consistent with broader research indicating that game-based multimedia serves as a viable solution for countering declining student interest often associated with traditional, non-interactive lecture methods (Ivanović, 2024). By fostering a more dynamic classroom environment, such tools effectively bridge the gap between abstract instructional materials and student comprehension. Furthermore, the high validation scores obtained from experts confirm that the integration of diverse multimedia elements is essential for ensuring both technical quality and instructional effectiveness (Tang et al., 2023). The rigorous application of the ADDIE model at each development stage ensures that the resulting digital media is both pedagogically robust and sustainable for long-term classroom use (Crompton et al., 2023). Ultimately, this study underscores the necessity of systematic instructional design in transforming passive learning environments into active, student-centered experiences. Such interactive media not only elevates student engagement and enthusiasm but also contributes to significantly higher test scores compared to conventional teaching approaches (Pandita & Kiran, 2023).

Consequently, the structured implementation of these game-based strategies provides educators with a reliable pedagogical framework that increases instructional accessibility and overall learner satisfaction (Bado, 2022; Lester et al., 2023). Future research could further explore the longitudinal effects of these interactive tools on retention rates to determine if the observed gains in academic performance are sustained over longer instructional periods. Additionally, investigating the scalability of these digital solutions across various academic subjects could provide further evidence for the versatility of the ADDIE model in enhancing educational outcomes (Sousa et al., 2025). Moreover, the integration of such instructional designs proves essential for adapting to the evolving demands of contemporary digital classrooms.

Prioritizing collaboration between instructional designers and subject experts remains vital to ensure that these evolving tools maintain both pedagogical integrity and content accuracy as curriculum standards shift (Hummel et al., 2024). By aligning teaching strategies with the cognitive habits and expectations of students, these interactive models effectively bridge the gap between traditional instruction and the requirements of a modern digital society. Ultimately, this framework provides a robust foundation for educators seeking to leverage technology to create equitable and meaningful learning experiences for all students. The successful synthesis of technology within this framework highlights the remarkable

adaptability of the ADDIE model in addressing current educational challenges (Abuhassna & Alnawajha, 2023). Furthermore, this systematic approach serves as a scalable blueprint for practitioners aiming to integrate high-impact practices into diverse disciplines, ensuring that technological interventions remain both instructionally sound and highly engaging.

This study aimed to develop and evaluate interactive game-based PowerPoint learning media using the ADDIE model (analysis, design, development, implementation, and evaluation) to enhance student engagement and learning outcomes (Branch, 2009). The analysis phase revealed that although school facilities were adequate, instructional practices relied heavily on textbooks and conventional media, resulting in low student attention and participation. To address this issue, an interactive multimedia approach integrating PowerPoint and Wordwall was designed to create engaging, game-like learning experiences.

The developed media incorporated structured instructional components, including learning objectives, navigation guides, and visually appealing interfaces to support intuitive interaction. Validation by subject matter, media, and language experts indicated high validity (mean scores of 4.3, 4.5, and 4.4, respectively), confirming the product's feasibility with minor revisions. Implementation results demonstrated highly positive responses from both students and teachers, indicating strong acceptance and usability.

Effectiveness testing through pretest-posttest analysis revealed significant improvements in student learning outcomes, supported by statistically significant results ($p < 0.001$) and moderate-to-high N-gain scores (55.51% in small-group trials and 59.27% in field trials). These findings confirm that the developed media is effective in improving students' understanding of the characteristics of living things.

Overall, the study demonstrates that integrating interactive, game-based multimedia within a structured instructional design framework significantly enhances student engagement, participation, and academic achievement. The findings align with existing literature emphasizing the importance of multimedia integration and systematic design models in creating student-centered learning environments. Furthermore, this study highlights the ADDIE model's adaptability as a robust framework for developing sustainable and scalable digital learning solutions. Future research is recommended to examine long-term learning retention and the applicability of such media across different subjects and educational contexts.

CONCLUSION

This study aimed to develop and validate interactive learning media in the form of a PowerPoint-based game for the science topic "characteristics of living things" for third-grade students at MI Miftahul Ulum Gondang using the ADDIE development model. The findings show that the developed interactive PowerPoint game media has a high level of validity based on expert evaluations, including material experts (86%), media experts (90%), and language experts (88.8%), indicating that the product is feasible for use in the learning process. In addition, the responses from students (90.9%) and teachers (97.5%) demonstrate that the media is highly accepted and considered engaging and helpful in classroom learning.

The results of quantitative analysis also reveal that the use of interactive PowerPoint game media significantly improves students' learning outcomes, as evidenced by the difference between pretest and posttest scores and the N-Gain result of 59.27%, which falls into the

moderately effective category. These results indicate that integrating interactive and game-based learning media can enhance student motivation, engagement, and understanding of science concepts.

However, this study has several limitations, including the limited research sample and its implementation in a single school context, which may restrict the generalization of the findings. Future research is recommended to involve larger and more diverse samples and to explore the application of similar interactive media in other subjects and educational levels to obtain more comprehensive results.

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