Jurnal Reviu Pendidikan Dasar:
Jurnal Kajian Pendidikan dan Hasil Penelitian
Vol 11(1), Februari 2025

e-ISSN: 2460-8475
http://journal.unesa.ac.id/index.php/PD
https://doi.org/10.26740/jrpd.v11n1.p51-61

Transforming Learning with Web-based Interactive Digital Books to Improve Student Learning Outcomes

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Abstract: Environmental awareness is a crucial aspect of education, particularly at the elementary level, where students begin to develop an understanding of their surroundings. This research aims to assess the feasibility and effectiveness of the interactive book Lihat Sekitar as a thematic learning medium based on environmental education for elementary school students. The study employs the Research and Development (R&D) method to develop and evaluate the teaching material. Various data collection techniques are utilized, including observations, interviews within the school environment, and questionnaires to assess student responses. The findings indicate that Lihat Sekitar is a feasible and engaging learning medium that effectively enhances students' understanding of environmental themes. The interactive features of the book encourage active participation and improve learning outcomes. The student responses, collected through questionnaires, show high levels of interest and motivation in using the book as a learning resource. These results suggest that integrating interactive and thematic approaches in elementary education can foster a deeper connection between students and their environment. This study highlights the importance of innovative teaching materials in promoting environmental literacy and suggests that Lihat Sekitar has strong potential for broader implementation in elementary education settings.

Keywords: Digital Books, Learning Outcomes, Transforming Learning

How to Cite: Hairil, M., Syabrina, M., Rahmat, & Pratama, A. D. (2025). Transforming Learning with Web-based Interactive Digital Books to Improve Student Learning Outcomes. *Jurnal Reviu Pendidikan Dasar: Jurnal Kajian Pendidikan dan Hasil Penelitian, 11*(1), 51-61. https://doi.org/10.26740/jrpd.v11n1.p51-61

Article Info:
Received: 6 January 2025; Accepted: 9 February 2025; Published Online: 28 February 2025

Published by:
Pendidikan Dasar Universitas Negeri Surabaya

INTRODUCTION

The rapid development of information and communication technology (ICT) has significantly transformed the way people access, process, and disseminate information. In the field of education, digital technology offers vast opportunities to enhance learning experiences, making them more interactive, engaging, and relevant to the needs of 21st-century students. Today's learners, often referred to as digital natives, exhibit different learning patterns compared to previous generations (Tran et al., 2020). They prefer learning environments that are dynamic, visually engaging, and interactive, where information is easily accessible anytime and anywhere (Cheung et al., 2021). As a response to these evolving learning preferences, web-based interactive digital books have emerged as an innovative solution that extends beyond the traditional role of printed textbooks.

Web-based digital books integrate multimedia elements such as videos, animations, and simulations, which have been shown to enhance students' engagement and comprehension of complex concepts (Yohannes et al., 2023). The Cognitive Theory of Multimedia Learning (CTML) posits that combining verbal and visual information improves cognitive processing and retention (Immanuel & A., 2023). Additionally, interactive features such as quizzes and immediate feedback mechanisms support formative assessment, allowing students to independently evaluate their understanding and reinforce their learning (Zainuddin et al., 2020). Students using multimedia-based learning materials exhibited higher levels of engagement and knowledge retention compared to those using conventional textbooks (Laksana, 2021).

Several studies have demonstrated the positive impact of web-based digital books on students' motivation, engagement, and academic performance. Students who used interactive digital books showed a 30% increase in learning evaluation scores compared to those using printed materials (Setyaningsih et al., 2020). Digital books encourage students to become more autonomous and active learners, particularly in the context of post-pandemic distance learning (Lubis et al., 2023). The Self-Determination Theory suggests that autonomy, competence, and relatedness are key drivers of intrinsic motivation, which digital books can support through interactive and personalized learning pathways (Alamri et al., 2020).

Despite these advantages, the implementation of web-based interactive digital books in Indonesia faces several challenges. Limited access to technological devices, disparities in internet connectivity, and a lack of teacher training in managing digital learning materials remain significant obstacles (Na'im, 2019). However, government initiatives and institutional efforts, such as digital literacy programs and infrastructure development, aim to bridge these gaps and promote equitable access to digital learning resources (Wang & Si, 2024).

Although previous studies have examined the benefits of digital books, research that focuses on the integration of web-based interactive features tailored to the needs of Indonesian students remains limited. Most existing studies have centered on general multimedia-based learning without a specific emphasis on interactive digital books designed for a web-based platform. Therefore, this research seeks to develop a web-based interactive digital book with responsive design and integrated multimedia elements to enhance students' learning outcomes. By addressing the limitations of conventional media and leveraging the advantages of digital interactivity, this study aims to contribute to the growing body of research on educational technology while providing a practical solution for modern learning needs.

METHODS

This study employed a Research and Development (R&D) approach using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) to develop and evaluate an interactive digital book as a thematic learning medium. The ADDIE model was selected because of its systematic and iterative process, ensuring the alignment of instructional materials with learning needs (Branch & Varank, 2009). The research was conducted from October 11 to 19, 2024, at MIN 2 Palangka Raya City, focusing on IPAS (Ilmu Pengetahuan Alam dan Sosial) material for fourth-grade students.

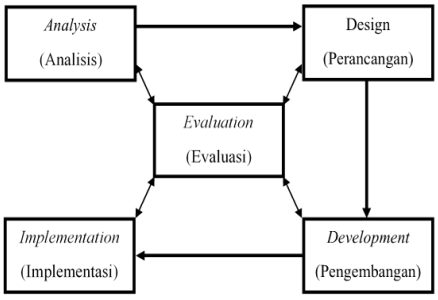

Figure 1. ADDIE Model

In the Analysis phase, a needs assessment was conducted through interviews, classroom observations, and an analysis of students' midterm test (UTS) results to identify learning difficulties and gaps (Habibie & Turmudi, 2021). The design phase involved structuring content and integrating multimedia elements such as videos, animations, and interactive quizzes, ensuring alignment with constructivist learning principles (Song et al., 2023). During the development phase, the teaching materials underwent validation by material experts, design experts, and teachers to assess content feasibility and instructional effectiveness (Tolentino et al., 2023). The research instruments included a critical thinking test (10 items) and a questionnaire (20 items), both of which underwent expert and empirical validation to ensure reliability (Farhana et al., 2021).

The Implementation phase used a purposive sampling technique, selecting fourth-grade students to test the digital book in a classroom setting (Fauziyah & Mulyani, 2024). The Evaluation phase involved analyzing student responses, expert feedback, and test results, following a triangulated approach with qualitative (interviews and observations) and quantitative (questionnaires and test scores) data (Ardiansyah et al., 2023). Continuous revisions were made based on expert suggestions and student feedback to enhance usability and instructional quality (Johnson et al., 2021). By following the ADDIE framework, this research ensures that the final digital book is pedagogically sound, engaging, and effective in supporting student learning outcomes in the digital era (Mella et al., 2022).

RESULTS

Expert Validation

The validation process involved subject matter experts and design experts to ensure that the interactive digital learning material met the required pedagogical and usability standards before implementation. Expert validation focused on four key aspects: content feasibility, presentation feasibility, language feasibility, and contextual feasibility. Content feasibility ensured that the material aligned with the curriculum and effectively conveyed the intended learning objectives. Presentation feasibility assessed the clarity and coherence of the structure, while language feasibility evaluated accessibility and appropriateness for fourth-grade students. Contextual feasibility examined the integration of real-life contexts into the learning process to enhance engagement and comprehension.

Figure 2. Suggestions for Improvement from Material Experts

Results from the subject matter expert validation showed that the interactive digital learning material for Bahasa Indonesia (Lihat Sekitar) achieved an overall high rating. The content feasibility score was 92.00%, indicating that the material accurately covered the required learning objectives. The presentation feasibility score of 94.00% suggested that the instructional design was structured effectively. The language feasibility score was 94.00%, confirming that the material was clear and age-appropriate. Finally, the contextual feasibility score was 97.00%, reflecting the material's strong connection to real-life scenarios. These results indicate that the teaching material is highly suitable for classroom use. Based on expert recommendations, improvements were made, such as adding a more comprehensive glossary to enhance students' understanding of key vocabulary.

Figure 2. Suggestions for Improvement from Media Experts

Meanwhile, design expert validation assessed aspects such as layout, cover design, and content presentation. The results indicated a 100% approval rating for the overall model, showing that the interactive elements were appropriately structured. The cover design received a 93.00% rating, while the content presentation scored 94.00%, highlighting its visual appeal and ease of navigation. A key revision suggested by experts was removing

Latin script from prayers in the material, ensuring cultural and religious appropriateness. These refinements contributed to an improved user-friendly interface and engagement level, making the material more accessible for young learners.

Teacher Evaluation

Teachers played a crucial role in assessing the usability and practicality of the digital material within a real classroom setting. Their evaluation focused on the feasibility of implementation, alignment with learning objectives, and effectiveness in engaging students. The results showed that teachers rated the material as “feasible” for classroom use, with an average score of 71%. While this score was slightly lower than expert evaluations, it highlighted areas for improvement, particularly in further refining interactive components to sustain student engagement throughout lessons. Teachers emphasized that the multimedia elements, such as videos and interactive quizzes, contributed positively to students' motivation and comprehension.

Field Trial and Student Learning Outcomes

The field trial was conducted with 28 fourth-grade students from class IV C at MIN-2 Palangkaraya to evaluate the effectiveness of the digital interactive learning material in a real classroom environment. The implementation involved guided learning sessions where students engaged with the material through an Android-based platform. The assessment of the field trial focused on student engagement, comprehension improvement, and usability of multimedia elements.

The findings revealed that the interactive learning material significantly enhanced student engagement and comprehension, with an overall feasibility rating of 91% (categorized as "highly feasible"). The integration of multimedia components, including animations, videos, and quizzes, played a crucial role in maintaining students' attention and reinforcing key concepts. Compared to traditional textbook-based learning, students demonstrated higher levels of participation and enthusiasm. Additionally, the material enabled students to interact with content more actively, fostering a constructivist learning environment where they could explore concepts independently.

These findings align with prior research, which emphasized the importance of digital learning materials in enhancing accessibility and comprehension in technology-integrated classrooms. However, unlike previous studies that primarily focused on static

e-books, this study underscores the impact of multimedia-based interactive learning materials, which not only present information but also actively engage students through gamification and real-world contextualization.

DISCUSSION

The development of interactive digital teaching materials aims to enhance student engagement and learning outcomes by leveraging multimedia elements such as animations, videos, and hyperlinks to external resources. The findings of this study demonstrate that the integration of these digital teaching materials significantly improves student learning outcomes, as evidenced by the pretest and posttest scores. The implementation of this media aligns with the needs of Generation Alpha students, who have a strong affinity for technology and interactive learning environments (Hafizah, 2023). This approach is consistent with previous studies indicating that digital learning tools can enhance motivation and conceptual understanding in elementary school students (Putri, 2020).

The statistical analysis using a paired sample t-test confirmed a significant difference between pretest and posttest scores, with a p-value of less than 0.05, indicating that the improvement was not due to random chance. This suggests that the interactive teaching materials contributed to the learning process by providing a more engaging and structured instructional experience. The use of multimedia elements in digital learning has been shown in previous research to facilitate deeper cognitive processing and retention of knowledge (Fauziah, 2020). Additionally, the integration of flowcharts and storyboards in the design phase ensured a well-structured learning experience, allowing students to follow the content logically and systematically (Sari & Atmojo, 2021).

Furthermore, the N-Gain analysis revealed that most students experienced a moderate to high improvement in learning outcomes, indicating that the teaching materials effectively supported concept mastery. However, some students showed only minimal improvement, suggesting that additional scaffolding or differentiated instructional strategies may be necessary to accommodate diverse learning needs (Sumandya, 2019). Previous studies on digital learning tools have emphasized the importance of adaptive learning pathways to address variations in student abilities and learning preferences (Tiara et al., 2023).

In terms of implementation, the teaching materials underwent an evaluation phase involving media and subject-matter experts, followed by student trials (Hasnawiyah & Maslena, 2024). The expert review process provided valuable insights for refining the design and ensuring the instructional quality of the materials. The trial phase confirmed that students responded positively to the interactive components, particularly the use of animations and multimedia content. This is consistent with previous research indicating that visually enriched digital learning materials can enhance student engagement and learning effectiveness (Lestari & Wirasty, 2019).

Overall, this study underscores the potential of digital teaching materials to improve elementary school mathematics education, particularly in contexts where student engagement is a challenge. Future research should explore the long-term impact of such interventions and investigate additional features, such as gamification and adaptive feedback, to further enhance learning outcomes (Rusfriyanti & Rondli, 2023). The findings of this study contribute to the growing body of literature supporting the use of technology-driven instructional strategies in primary education (Azzahro & Subekti, 2022).

CONCLUSION

This study developed an interactive digital teaching material for the "Lihat Sekitar" topic in Bahasa Indonesia, using the ADDIE model to enhance fourth-grade students' learning experiences. The research findings indicate that the media is highly feasible for use, with expert validation scores averaging 88%, and field trials showing significant improvements in student learning outcomes. The T-test result of 6.60 confirms a statistically significant effect, while the N-gain score of 1.00 demonstrates a high level of learning improvement. These results align with previous studies emphasizing the effectiveness of interactive digital media in fostering student engagement and comprehension. The integration of multimedia elements, including animations, videos, and interactive features, aligns with the technological inclinations of Generation Alpha, making the learning process more engaging. Student responses reflected high enthusiasm, suggesting that digital materials could enhance motivation and conceptual understanding compared to traditional textbooks. This study contributes to the growing body of research advocating for technology-enhanced learning, particularly in elementary education.

Future research should explore the long-term effects of interactive media on student learning retention and investigate its adaptability across different subjects and student demographics. Additionally, integrating real-world applications and environmental-based learning activities could further optimize the effectiveness of such teaching materials.

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