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Development of Page Flip-Based Electronic Teaching Materials for IPAS Learning in Fifth-Grade Elementary School

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Abstract

Background - Innovation in teaching materials is crucial in 21st-century learning, especially to address the limitations of conventional methods in engaging students and improving comprehension in Science and Social Studies (IPAS). Page Flip-based electronic teaching materials offer an interactive alternative aligned with the Merdeka Curriculum's emphasis on technology integration.
Purpose - This study aims to develop and evaluate the validity, practicality, and effectiveness of Page Flip-based electronic teaching materials for fifth-grade elementary IPAS learning.
Method/approach - This research employed a Research and Development (R&D) method using the ADDIE model for over one semester. The study involved 28 fifth-grade students and one teacher from SD Negeri 043/IV Kota Jambi. Data was collected through expert validation, small-group trials, and field trials across several learning sessions. The development used 3D Page Flip Professional software, and assessments were conducted through questionnaires, observations, and pretest-post test scores.
Findings - Expert validation by content, media, and language experts showed a high level of validity (final scores above 4.50 on a 5-point scale). Trials revealed a 23% improvement in students' understanding in small groups and a 26% improvement during field trials. Students responded positively to the multimedia and interactive features, while teachers rated the materials as very effective and easy to use. However, implementation faced challenges such as limited digital infrastructure (many schools lack sufficient devices) and teachers' unfamiliarity with educational technology.
Conclusions - Page Flip-based teaching materials are empirically proven to be effective, practical, and valid for enhancing students' conceptual understanding, motivation, and digital skills in IPAS. With proper support and training, these materials can become a transformative tool in primary education.
Novelty/Originality/Value - This study contributes uniquely by integrating Page Flip technology within the Merdeka Curriculum framework and evaluating not only the overall effectiveness but also usability and contextual barriers, making it a reference for future development of interactive learning media.

Keywords: Electronic Teaching Materials; Page Flip; Digital Learning; Educational Innovation.

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INTRODUCTION

Primary education plays a crucial role in shaping students' cognitive, affective, and psychomotor competencies (Supriyani & Winangun, 2024). In the context of the 21st century, education must adapt to technological advancements to stay relevant and effective. Conventional learning methods that rely solely on printed teaching materials often face difficulties in engaging students and improving their understanding of complex content (Helmi, 2016). This challenge has led to the need for innovations in the development of teaching materials that are aligned with current technological trends.

One of the promising innovations in educational media is the use of *Page Flip*-based electronic teaching materials. These materials present content in a digital format that simulates the experience of reading a printed book while integrating multimedia features such as animations, audio, video, and interactive simulations (Rachmah et al., 2018). This combination not only increases the visual appeal of the materials but also facilitates students' understanding of abstract concepts, particularly in science-related subjects like IPAS.

Page Flip-based teaching materials offer numerous benefits, including portability, ease of use across devices, and the ability to integrate various forms of media. These advantages align with the learning characteristics of digital-native students who are familiar with touchscreen devices from an early age (Ahmadi, 2017). Therefore, integrating such materials into the elementary classroom, especially in subjects like IPAS, holds the potential to transform the learning experience into something more engaging and effective.

The Kurikulum Merdeka, a recent educational reform in Indonesia, emphasizes student-centered learning through project-based approaches and technological integration. This curriculum is designed to provide students with meaningful experiences that encourage critical thinking and collaboration. Within this context, IPAS (Ilmu Pengetahuan Alam dan Sosial) serves as an interdisciplinary subject that often includes abstract and complex concepts, such as energy transformation, the respiratory system, and ecological interactions (Agustian et al., 2023).

Students in elementary school frequently struggle to grasp such abstract IPAS concepts when presented through conventional text-based materials (Munawaroh et al., 2022; Ramadhan et al., 2023; Hernanda & Aji, 2024). This difficulty has been confirmed by teachers in the field, who report that students tend to lose interest and show limited retention of information when instruction is not supported by engaging media. Consequently, there is an urgent need for teaching materials that provide clearer visualizations and interactive learning experiences.

Previous research has examined the use of electronic teaching materials in various contexts. For instance, Dewi et al. (2023) developed Flipbook-based e-modules for vocational science subjects and found increased student engagement and comprehension. Similarly, Nabela and Bayu (2022) utilized Flip PDF Professional to improve fourth-grade students' outcomes in social studies. These studies indicate that digital learning tools have significant potential in improving learning effectiveness.

However, research specifically addressing the use of *Page Flip*-based materials in IPAS learning at the elementary level remains limited. Ibrohim (2019) explored the use of 3D *Page Flip*-based e-modules on ecosystem topics in a fifth-grade classroom and found positive impacts on motivation and understanding. Nevertheless, the study was limited to a single topic and did not explore the validity or practicality of the materials on a broader scale, nor did it incorporate the Kurikulum Merdeka framework.

This research seeks to fill the gap by developing *Page Flip*-based electronic teaching materials tailored to IPAS content in fifth grade, aligned with the Kurikulum Merdeka. Unlike previous studies, this research evaluates the materials through both expert validation and practical field-testing involving teachers and students. Furthermore, it emphasizes a

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comprehensive development process that includes multimedia integration to enhance interactivity and understanding.

The core objective of this study is to produce valid and practical *Page Flip*-based electronic teaching materials for IPAS learning in elementary school. These materials are expected to function not only as learning resources but also as tools that actively engage students in the learning process. By combining visual, auditory, and interactive elements, the materials aim to overcome the shortcomings of traditional resources that are often static and less appealing.

In the development process, this study involves multiple stakeholders, including media experts, subject matter experts, and elementary school teachers, to assess the validity and practicality of the teaching materials. The development model consists of four stages: needs analysis, product design, validation, and field testing. This approach ensures that the materials are contextually relevant, pedagogically sound, and technically feasible for implementation in real classroom settings. Educational technology has progressed rapidly in recent years, but its implementation in elementary education still faces challenges, including limited infrastructure, varied digital literacy among teachers, and students' adaptability to digital tools (Fricticarania et al., 2023). This study also investigates these supporting and inhibiting factors to provide a realistic assessment of the application of *Page Flip* in classroom settings.

The specific research questions guiding this study are: (1) How is the development process of *Page Flip*-based electronic teaching materials for IPAS learning in fifth-grade elementary school? (2) What is the validity level of these teaching materials as evaluated by experts? (3) What is the practicality level of the materials based on feedback from teachers and students during field testing? By answering these questions, the research is expected to contribute to the advancement of interactive and engaging digital teaching materials that align with 21st-century learning needs. The outcomes of this study can serve as references for educators seeking to innovate their teaching practices, for policymakers in designing effective digital learning policies, and for researchers aiming to explore similar developments in other subjects or levels of education.

METHODS

This study employs the Research and Development (R&D) method using the ADDIE development model, which consists of five stages: *Analysis*, *Design*, *Development*, *Implementation*, and *Evaluation*. This model was selected because it provides a systematic approach to developing Page Flip-based electronic teaching materials and assessing their validity and practicality in IPAS (Natural and Social Sciences) learning for fifth-grade elementary students.

The study was conducted at SD Negeri 043/IV Kota Jambi during the even semester of the 2024/2025 academic year. The research subjects consisted of 28 fifth-grade students and 1 IPAS teacher, while the object of the study was the Page Flip-based electronic teaching materials developed in this research. In the Analysis stage, observations of the IPAS learning process, interviews with teachers, and curriculum analysis were conducted to identify the need for teaching materials, challenges faced by students, and the potential for integrating digital media into learning. Data from this stage were used as the basis for designing the teaching materials.

The Design stage involves organizing the structure of the IPAS teaching materials based on the Merdeka Curriculum, selecting the core content, integrating supporting media (videos, animations, interactive images), and designing the user interface in a Page Flip format, ensuring it is user-friendly and interactive. Next, in the Development stage, a prototype of the teaching materials is created using 3D Page Flip Professional software and validated by three experts: two IPAS subject matter experts (Master's degree in Education with more than 5 years of teaching experience), one media expert (Master's degree in Educational Technology with more than 3 years of experience), and one language expert (Master's degree in Indonesian Language Education with

more than 5 years of experience). The validation instrument used is a Likert-scale questionnaire. The validation results are used to revise the materials before implementation.

In the Implementation stage, two types of trials are conducted: a small group trial (5 students) to identify technical issues, and a field trial (all fifth-grade students) to assess the practicality and effectiveness of the teaching materials in real learning settings. The teacher integrates the teaching materials into the learning process, while students access the materials independently. Data is collected through observations, interviews, and questionnaires distributed to teachers and students.

The Evaluation stage is carried out formatively at each stage of ADDIE and summative at the end of the development to assess the validity, practicality, and effectiveness of the product. Data analysis is conducted using both quantitative and qualitative approaches. Quantitative data from validation and questionnaire results are analyzed using descriptive statistics (mean, median, mode, and percentage) with the help of software such as Microsoft Excel. Meanwhile, qualitative data from interviews and observations are analyzed using techniques of data reduction, data presentation, and drawing conclusions to obtain a comprehensive understanding of the use of the teaching materials.

RESULTS AND DISCUSSION

This study aims to develop electronic teaching materials based on Page Flip technology for the teaching of Integrated Science and Social Studies (IPAS) in fifth-grade elementary school classes and to examine their validity, practicality, and effectiveness. The research findings were obtained through expert validation, small-group trials, and feedback from teachers and students regarding the developed teaching materials. The analytical phase of this research aimed to investigate the existing challenges in IPAS (Science and Social Studies) instruction for fifth-grade students. Through classroom observations, it was found that students frequently lost focus during lessons and showed low enthusiasm when engaging with conventional textbooks. Many abstract concepts such as ecosystems, the human respiratory system, and energy transformation remained difficult for students to grasp without the aid of visual or interactive elements.

Interviews with teachers further highlighted these challenges. Teachers admitted that their teaching strategies still relied heavily on printed materials, which limited student engagement. One teacher stated, *"Students often get bored because they only read texts and look at static images. It's hard to explain how energy transforms without a moving visual,"* (Teacher Interview, 2024). This reliance on traditional materials hindered students from developing a deeper understanding of complex topics in IPAS.

In addition, the curriculum analysis revealed that the *Merdeka Curriculum* strongly encourages the use of digital resources and project-based learning. However, in practice, the availability of subject-specific digital teaching materials—particularly for IPAS—remains scarce. This gap between curriculum expectations and classroom realities further emphasized the urgency for developing technology-integrated teaching tools that are aligned with curriculum goals. Students also shared their experiences regarding the learning process. One student mentioned, *"I like it better when there are videos or moving pictures because I can understand things faster than just reading,"* (Student Interview, 2024). This indicates a preference for digital and multimedia content that supports various learning styles and allows for more active involvement during the learning process.

Based on this needs analysis, the development of Page Flip-based teaching materials emerged as a relevant and necessary solution. These materials were conceptualized to simulate the look and feel of physical books while incorporating animations, videos, and interactive tasks to enrich student engagement. This design addresses both the motivational and comprehension

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gaps observed during the analytical phase.

In the design stage, specific attention was given to readability, interactivity, and ease of navigation. The materials were structured in a modular format and optimized for use on a range of electronic devices, including tablets and computers. The Page Flip interface was intentionally chosen to maintain a familiar reading experience while enhancing it with digital features that promote better understanding and user engagement. This thoughtful integration aims to meet both pedagogical and technological standards expected in 21st-century education. The design of the materials considered aspects of readability, interactivity, and ease of navigation for students. IPAS content was developed in a digital format integrating multimedia elements such as animations, videos, and interactive exercises to enhance students' comprehension. The Page Flip feature was implemented to create an interface resembling a physical book while providing greater interactivity. The design principles focused on accessibility for students, ensuring that the teaching materials could be used on various electronic devices, including computers and tablets. The developed teaching material design is presented as follows:

Figure 1. Cover of Teaching Materials

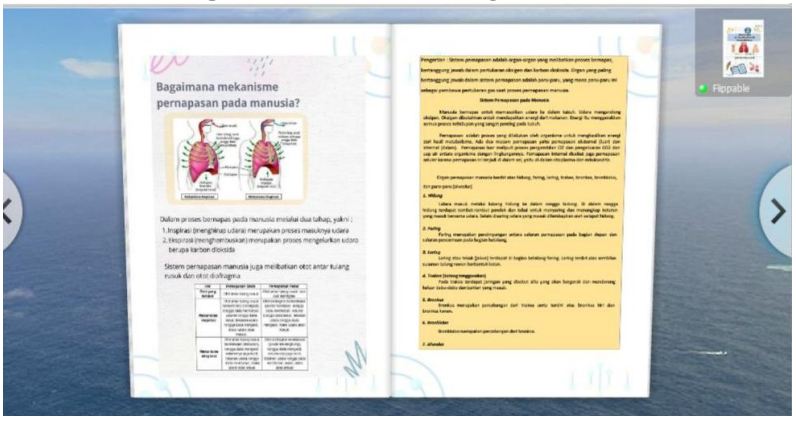

Figure 2. Teaching materials

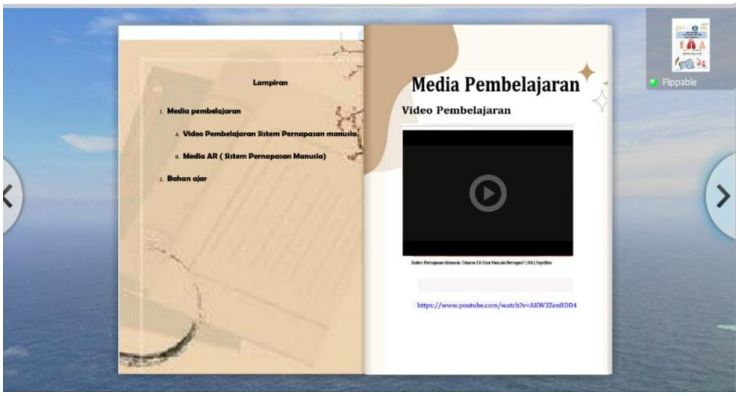

Figure 3. Teaching Materials

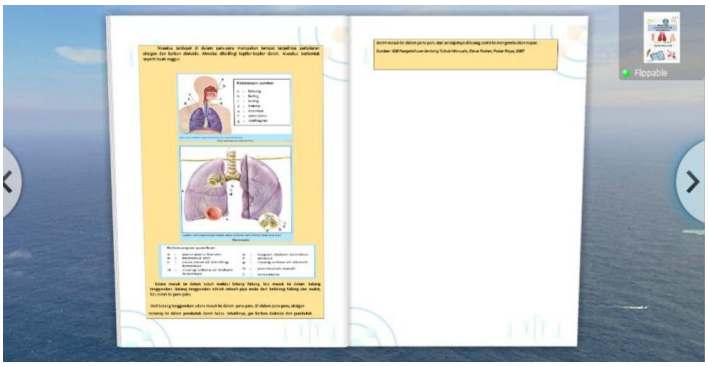

Figure 4. Task

Validation was conducted by three groups of experts: content experts, media experts, and language experts. The assessed aspects included content suitability, readability, and the presentation of teaching materials.

Table 1. Product Validation Results

Validation Aspects	Stage 1 score	Stage 2 score	Final Category
Content	3.75	4.60	Highly Valid
Media	3.60	4.55	Highly Valid
Language	3.80	4.50	Highly Valid

The validation of the teaching materials in this study was carried out by three groups of experts—content, media, and language specialists—focusing on content relevance, readability, and overall presentation. The first validation stage showed that while the materials were generally feasible, several aspects required improvement, such as simplifying the language and adding supporting illustrations. Quality instructional materials should adhere to communicative, informative, and visually engaging principles to enhance student engagement (Santoso, 2011; Ansya et al., 2025; Barkley & Major, 2020). Revisions were then made based on expert feedback to refine both the substance and visual aspects of the materials.

After the revisions, the second validation stage showed a significant increase in scores, with all aspects rated as "highly valid." Which demonstrated that digital materials developed using Page Flip technology can enhance presentation quality and material delivery through interactive elements such as animations and videos (Huang, 2005; Clark & Mayer, 2023; Halem et al., 2022). The high validity also reflects the alignment of the materials with the characteristics of elementary students. Engaging and accessible digital learning media can improve student interest and comprehension. Therefore, the validation results strongly indicate that the developed teaching

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materials are not only appropriate for classroom use but also effectively support 21st-century learning needs. Based on the results of the first validation stage, the teaching materials received an average score indicating that although they were considered feasible, some aspects needed improvement, such as language simplification, the addition of supporting illustrations, and visual layout enhancements. After revisions were made, the second validation stage showed a significant increase in scores, with all aspects categorized as "highly valid" and deemed suitable for use in learning.

Table 2. Teacher Feedback on Teaching Materials

Teacher	Rating	Final Category
Teacher 1	4.5	Very Good
Teacher 2	4.7	Very Good
Teacher 3	4.65	Very Good
Average	4.62	Very Good

Teacher feedback regarding the Page Flip-based teaching materials was highly positive, with all respondents giving an average rating of 4.62, categorized as "Very Good." The teachers stated that the materials were easy to use, engaging for students, and effective in facilitating understanding of abstract IPAS concepts. This finding aligns with prior research emphasizing that digital learning media can support teachers in delivering material more efficiently and flexibly, particularly when multimedia elements are used to accommodate various learning styles (Haniko et al., 2023; Lau et al., 2014; Waang, 2023).

Moreover, the assertion that digital literacy among educators must be accompanied by access to instructional tools that are both pedagogically sound and user-friendly (Spengler, 2015; Diniyati & Mastoah, 2025; Sulianta, 2020). The interactive features of the Page Flip format, such as animations and embedded videos, allowed teachers to present lessons more creatively and reduce reliance on conventional textbooks. Teaching materials that effectively integrate technology have been shown to improve instructional quality and foster student engagement in the learning process (Sabri et al., 2024; Serrano et al., 2019; Firdaus et al., 2023). Thus, teacher feedback confirms the practicality and educational value of the developed Page Flip-based teaching materials in actual classroom settings.

Teachers' feedback on these materials was overwhelmingly positive. Based on the survey results from three fifth-grade teachers, the Page Flip-based teaching materials were considered easy to use, engaging, and effective in helping students understand IPAS concepts.

A small-group trial was conducted involving five fifth-grade elementary school students to identify technical issues and ensure that the Page Flip-based teaching materials were easy to understand and effectively used in IPAS learning. Students participating in the trial were given the opportunity to access the materials, use them independently, and complete a questionnaire regarding ease of use, presentation, and effectiveness in helping them understand IPAS concepts. Additionally, students were given pre-tests and post-tests to measure their understanding improvement after using these materials.

Table 3. Small-Group Trial Results

Assessment Aspects	Average Score Before (Pre-test)	Average Score After (Post-test)	Improvement (%)
Concept Understanding	60	82	22
Learning Motivation	65	87	22
Digital Skills	55	80	25

Assessment Aspects	Average Score Before (Pre-test)	Average Score After (Post-test)	Improvement (%)
Average	-	-	23%

The results of the small-group trial demonstrated a 23% average improvement in students' learning outcomes after using the Page Flip-based teaching materials. Specifically, there was a 22% increase in both conceptual understanding and learning motivation, and a 25% improvement in digital skills. This finding supports the idea that interactive digital materials can significantly enhance learning effectiveness by providing visual and engaging content that accommodates diverse learning preferences (Jayaraman & Aane, 2024; El Sabagh, 2021; Khan et al., 2017).

Students also responded positively to the Page Flip format, noting that the animations, videos, and interactive tasks made the content more accessible and easier to comprehend. Such responses are consistent with the constructivist learning theory, which emphasizes the role of active engagement and multimedia in building conceptual understanding (Suryani, 2024). Moreover, the digital format encouraged students to learn independently, in line with 21st-century learning principles that promote self-directed learning and digital literacy (Ahmadi, 2017). These results affirm that even in small-scale implementations, Page Flip-based materials can be a powerful tool for improving both cognitive and digital competencies in elementary students.

Following the small-group trial, the teaching materials were further tested on a larger scale through a field trial involving an entire fifth-grade class. In this phase, 28 students were given full access to the Page Flip-based teaching materials during several IPAS learning sessions. This trial aimed to measure the effectiveness of the materials in an actual classroom setting and involved students using them over multiple sessions.

Table 4. Field Trial Results

Assessment Aspects	Average Score (Before)	Average Score (After)	Improvement (%)
Concept Understanding	58	85	27
Learning Motivation	63	88	25
Active Participation	60	86	26
Digital Skills	57	84	27
Average	-	-	26%

Following the small-group trial, a field trial was conducted involving all 28 students in a fifth-grade class to assess the effectiveness of the Page Flip-based teaching materials in a real classroom setting. The results showed a significant improvement in students' performance, with an average increase of 26% across four key indicators: conceptual understanding (27%), learning motivation (25%), active participation (26%), and digital skills (27%). These outcomes confirm that the integration of interactive digital materials can positively influence both cognitive and affective aspects of student learning (Capone & Lepore, 2022; Shi et al., 2021).

The substantial gains in conceptual understanding and engagement demonstrate the advantage of using multimedia-supported teaching tools, particularly for abstract subjects such as those found in IPAS. Students reported that animations, videos, and simulations helped them visualize and internalize concepts that were previously difficult to grasp through traditional textbooks. This finding aligns with the work of Khulaifatuzzahra et al. (2024), who emphasized the role of visual media in enhancing comprehension in science-related topics. Furthermore, the trial reinforces the idea that technology-based materials not only increase motivation but also

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foster active learning and digital literacy, which are essential components of 21st-century education (Christensen & Knezek, 2015; Ata & Alpaslan, 2024). Therefore, the field trial validates the effectiveness of Page Flip-based teaching materials as a practical and impactful innovation in elementary education.

Students who used these teaching materials provided positive feedback on their learning experiences. They found the materials more engaging than conventional textbooks due to interactive features like animations and videos. Additionally, the accessibility of these materials across various digital devices allows students to learn more flexibly and independently. This enables them to revisit content they did not understand at any time without waiting for a teacher's re-explanation. It also supports diverse learning styles among students, allowing them to learn at their own pace

Based on the study results, the teaching materials developed in this research were found to be highly valid and suitable for use in elementary school education. The field trial results demonstrated that these materials effectively improved students' conceptual understanding, learning motivation, and digital literacy skills. Furthermore, teacher feedback was overwhelmingly positive, considering the Page Flip-based teaching materials to be user-friendly, engaging, and effective in facilitating students' learning. Thus, these materials serve as an innovative alternative solution to enhance the learning process in primary school IPAS education.

The research findings on the development of Page Flip-based electronic teaching materials in IPAS learning for fifth-grade elementary school students reveal significant insights. Validation conducted by experts in media, content, and language indicates that these teaching materials have a very high level of validity. This confirms that they are suitable for use in elementary school learning. Revisions based on expert feedback have successfully improved the quality of the teaching materials, both in terms of content delivery, visual design, and interactivity. Consequently, these materials can serve as an innovative alternative to enhance students' understanding of IPAS concepts.

Beyond student feedback, teachers who used these materials in teaching also responded positively. They found that the Page Flip-based teaching materials helped them deliver content more variably and interactively. Teachers also reported that these materials were easy to use and could be integrated with other teaching methods. With the availability of Page Flip-based materials, teachers do not have to rely solely on textbooks and can be more creative in presenting lessons (Agapau & Ningsih, 2024). Thus, these materials benefit not only students but also teachers in enhancing learning quality.

One of the main advantages of these teaching materials is their ability to visually and concretely explain abstract IPAS concepts (Zahroh et al., 2025). For example, in explaining concepts such as ecosystems or the respiratory system, the materials present animations that help students understand the interrelationships between components more clearly than merely reading textbook descriptions. With strong visual elements, students can better connect theory to practice, leading to deeper conceptual understanding (Khulaifatuzzahra et al., 2024). This aligns with constructivist learning theory, which emphasizes the importance of real-world experiences in understanding concepts.

Regarding learning effectiveness, Page Flip-based teaching materials enable students to learn at their own pace (Suryani, 2024). They can revisit content they have not yet mastered without waiting for a teacher's repetition. This supports the concept of differentiated learning, allowing each student to learn according to their individual needs. With user-friendly navigation features, students can quickly move from one section to another, making the learning process more efficient. Additionally, these materials can be used for both independent and group learning, offering greater flexibility in teaching methods.

However, despite their proven effectiveness, there are challenges in implementation. One

major challenge is the lack of infrastructure in some schools that do not yet have adequate digital devices. Not all schools have access to computers or tablets that students need to use these materials. Additionally, some teachers are not yet familiar with using technology in teaching, necessitating additional training to maximize the use of these materials. Therefore, support from the government and schools is essential in providing facilities to facilitate the implementation of technology-based teaching materials.

The study results indicate that Page Flip-based teaching materials hold great potential for improving the quality of elementary school learning. With their engaging design and interactive features that support student comprehension, these materials offer a more effective alternative compared to conventional printed materials. With multimedia features such as videos, simulations, and animations, students become more engaged in the learning process, boosting their motivation to learn (Haniko et al., 2023). Therefore, further development of these materials can be pursued to expand their application to various other subjects.

In terms of practicality, the Page Flip-based teaching materials proved to be very easy to use for both teachers and students. Teachers reported that the materials could be easily integrated into a variety of teaching strategies, whether through direct instruction, group discussions, or independent learning. One teacher shared, "I don't need to create additional media anymore. The materials are complete and easy to use, even for teachers who are not familiar with technology," (Teacher Interview, 2024). This suggests that the design of the materials successfully accommodated the varying levels of technological proficiency among educators, in line with Ahmadi's (2017) argument that digital resources must be intuitive and easily accessible to support effective classroom integration.

For students, the materials also offered high usability, with interactive features that could be accessed independently. Students noted that they could easily navigate the content and revisit certain sections without requiring teacher assistance. One student commented, "If I forget the lesson, I can just open the page again and watch the video myself," (Student Interview, 2024). This independence supports differentiated learning and is in line with the concept of student-centered learning emphasized in the 21st century education framework (Fricticarania et al., 2023). Furthermore, since the materials can be revised periodically and enriched with updated content, they remain adaptable to changing curricula and evolving student needs, thus ensuring continued relevance and value of instruction.

Support from schools and the government is crucial in implementing these materials more widely. Providing adequate digital infrastructure and training teachers in technology use are essential steps to ensure the broader adoption of these materials across schools. Additionally, collaboration between educational material developers, educators, and government institutions can contribute to the creation of a more sustainable and effective digital learning ecosystem. As digital technology continues to evolve, the use of Page Flip-based teaching materials is expected to keep improving to become a more effective, engaging, and relevant educational tool for 21st-century learning needs. Through collaborative efforts between educators, technology developers, and policymakers, this innovation can become an integral part of the educational transformation towards a more inclusive and technology-driven learning environment.

CONCLUSION

The results of this study indicate that the development of Page Flip-based electronic teaching materials for fifth-grade IPAS learning is highly valid, practical, and effective in enhancing students' conceptual understanding, learning motivation, and digital skills. These materials successfully address the limitations of conventional textbooks by providing interactive, multimedia-rich content that aligns with constructivist learning principles and supports the goals

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of the Merdeka Curriculum. However, this study has several limitations, including the narrow scope of implementation at a single school, a small sample size, and a relatively short intervention period, which may not reflect the broader educational landscape in Indonesia. Therefore, policy implications include the need for comprehensive teacher training to ensure effective integration of technology into classroom instruction. Additionally, schools and government stakeholders must provide adequate digital infrastructure to support the widespread adoption of such innovative learning tools. Future research is recommended to test the applicability and effectiveness of these materials in different educational contexts, such as rural schools or areas with limited technological access, and to explore integration with other active learning models like Problem-Based Learning or Project-Based Learning. This would offer deeper insights into the scalability and sustainability of Page Flip-based digital teaching materials across various elementary education settings.

REFERENCES

Agapau, J. D. L., & Ningsih, K. (2024). Kajian Konseptual E-Modul Berbasis Discovery Learning untuk Meningkatkan Hasil Belajar. *Jurnal Alwatzikhoebillah: Kajian Islam, Pendidikan, Ekonomi, Humaniora*, *10*(1), 81-93. https://doi.org/10.37567/alwatzikhoebillah.v10i1.2399

Agustian, Y., Saraswati, D. L., & Supardi, U. S. (2023). Pembuatan Alat Peraga Roda Energi Guna Mempermudah Proses Pembelajaran IPA Terpadu. *DIAJAR: Jurnal Pendidikan dan Pembelajaran*, *2*(3), 359-366. https://doi.org/10.54259/diajar.v2i3.1687

Ahmadi, F. (2017). *Guru SD di era digital: pendekatan, media, inovasi*. CV. Pilar Nusantara.

Ansya, Y. A. U., Salsabilla, T., & Rozi, F. (2025). *Strategi Inovatif dalam Pengembangan Media Pembelajaran Sekolah Dasar di Era Society 5.0*. Cahya Ghani Recovery. DOI:10.36088/islamika.v7i2.5603

Ata, R., & Alpaslan, M. M. (2024). The role of digital literacy, epistemological belief and reading motivation and engagement in teaching 21st century skills. *The International Journal of Information and Learning Technology*, *41*(3), 304-317. DOI:10.1108/IJILT-08-2023-0142

Barkley, E. F., & Major, C. H. (2020). *Student engagement techniques: A handbook for college faculty*. John Wiley & Sons.

Capone, R., & Lepore, M. (2022). From distance learning to integrated digital learning: A fuzzy cognitive analysis focused on engagement, motivation, and participation during COVID-19 pandemic. *Technology, Knowledge and Learning*, *27*(4), 1259-1289. DOI:10.1007/s10758-021-09571-w

Christensen, R., & Knezek, G. (2015). Active learning approaches to integrating technology into a middle school science curriculum based on 21st century skills. *Emerging Technologies for STEAM Education: Full STEAM Ahead*, 17-37. DOI:10.1007/978-3-319-02573-5_2

Clark, R. C., & Mayer, R. E. (2023). *E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning*. john Wiley & sons.

Dewi, D. K., Pangesthi, L. T., Purwidiani, N., & Widagdo, A. K. (2023). Pengembangan E-Modul Berbasis Flip Pdf Professional Pada KD Menganalisis Sweet Bread Di SMKN 1 Lamongan. *PUSTAKA: Jurnal Bahasa dan Pendidikan*, *3*(2), 162-179. DOI:10.56910/pustaka.v3i2.507

Diniyati, A., & Mastoah, I, (2025). Peran media video animasi interaktif berbasis canva dalam meningkatkan literasi digital siswa SD. *Didaktika Dwija Indria*, *13*(2). https://doi.org/10.20961/ddi.v13i2.101350

El-Sabagh, H. A. (2021). Adaptive e-learning environment based on learning styles and its impact on development students' engagement. *International Journal of Educational Technology in*

Higher Education, *18*(1), 53. DOI:10.1186/s41239-021-00289-4

Firdaus, A., Amrullah, A., Adawiyah, L. R., Zakiah, Q. Y., & Supiana, S. (2023). Enhancing learning quality and student engagement: Utilizing digital technology in Islamic education. *International Journal of Nusantara Islam*, *11*(2), 206-2018. https://doi.org/10.15575/ijni.v11i2.29960

Fricticarani, A., Hayati, A., Ramdani, R., Hoirunisa, I., & Rosdalina, G. M. (2023). Strategi pendidikan untuk sukses di era teknologi 5.0. *Jurnal Inovasi Pendidikan Dan Teknologi Informasi (JIPTI)*, *4*(1), 56-68. DOI:10.52060/pti.v4i1.1173

Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. *Sustainable operations and computers*, *3*, 275-285. DOI:10.1016/j.susoc.2022.05.004

Haniko, P., Mayliza, R., Lubis, S., Sappaile, B. I., Hanim, S. A., & Farlina, B. F. (2023). Pemanfaatan media pembelajaran online untuk memudahkan guru dalam penyampaian materi dalam pembelajaran. *Community Development Journal: Jurnal Pengabdian Masyarakat*, *4*(2), 2862-2868. https://journal.universitaspahlawan.ac.id/index.php/cdj/article/view/14856

Helmi, J. (2016). Penerapan Konsep Silberman dalam Metode Ceramah pada Pembelajaran PAI. *Al-Ishlah: Jurnal Pendidikan*, *8*(2), 221-245. https://doi.org/10.35445/alishlah.v8i2.20

Hernanda, A., & Aji, A. S. (2024). Pemanfaatan Aplikasi Augmented Reality Untuk Pembelajaran Organ Tubuh Manusia Di Sekolah Dasar. *Jurnal Teknologi Dan Sistem Informasi Bisnis*, *6*(1), 245-251. https://doi.org/10.47233/jteksis.v6i1.1166

Huang, C. (2005). Designing high-quality interactive multimedia learning modules. *Computerized Medical Imaging and Graphics*, *29*(2-3), 223-233. https://doi.org/10.1016/j.compmedimag.2004.09.017

Ibrohim, S. (2019). *Pengembangan Elekonik Modul Menggunakan Aplikasi 3D Page Flip Profesional Pada Tema Ekisistem Untuk Kelas V Sd/Mi* (Doctoral dissertation, UIN Raden Intan Lampung).

Jayaraman, J., & Aane, J. (2024). The impact of digital textbooks on student engagement in higher education: Highlighting the significance of interactive learning strategies facilitated by digital media. In *Implementing Interactive Learning Strategies in Higher Education* (pp. 301-328). IGI Global. DOI: 10.4018/979-8-3693-3559-8.ch011

Khan, A., Egbue, O., Palkie, B., & Madden, J. (2017). Active learning: Engaging students to maximize learning in an online course. *Electronic Journal of e-learning*, *15*(2), pp107-115. https://eric.ed.gov/?id=EJ1141876

Khulaifatuzzahra, I., Arni, Y., Rianti, D. N., & Fathier, S. C. (2024). Pengembangan Media Pembelajaran Berbasis Video Animasi Pembelajaran IPAS, Tentang Pengenalan Sistem Tata Surya Sekolah Dasar Kelas Tinggi di Sumatera Selatan. *Education Achievement: Journal of Science and Research*, 1162-1172. https://doi.org/10.51178/jsr.v5i3.2180

Lau, R. W., Yen, N. Y., Li, F., & Wah, B. (2014). Recent development in multimedia e-learning technologies. *World wide web*, *17*, 189-198. DOI:10.1007/s11280-013-0206-8

Munawaroh, I., Sulthoni, S., & Susilaningsih, S. (2022). Pengembangan Multimedia Interaktif Materi Sistem Peredaran Darah Manusia Untuk Kelas V Sekolah Dasar. *Jurnal Kajian Teknologi Pendidikan*, *5*(2), 190-199. DOI:10.17977/um038v5i22022p190

Nabela, N. W., & Bayu, G. W. (2022). Lembar Kerja Peserta Didik Elektronik Flip Book Berbasis Pendekatan Saintifik di Sekolah Dasar. *Jurnal Edutech Undiksha*, *10*(2), 342-352. https://doi.org/10.23887/jeu.v10i2.48605

Rachmah, A., Rosha, J. M., & Vani, N. D. (2018). Pengembangan Modul Elektronik Berbasis 3D PageFlip Professional pada Materi Usaha dan Energi. *Physics Education*, *1*(2), 1-11.

Ramadhan, W., Meisya, R., Jannah, R., & Putro, K. Z. (2023). E-modul pendidikan pancasila berbasis canva berbantuan flip pdf profesional untuk meningkatkan hasil belajar siswa sekolah

e-ISSN 0216-0847
https://journal.unnes.ac.id/journals/LIK

dasar. *Jurnal Pemikiran Dan Pengembangan Sekolah Dasar (JP2SD)*, *11*(2), 178-195. DOI:10.22219/jp2sd.v11i2.27262

Sabri, S. M., Ismail, I., Annuar, N., Rahman, N. R. A., Abd Hamid, N. Z., & Abd Mutalib, H. (2024). a conceptual analysis of technology integration in classroom instruction towards enhancing student engagement and learning outcomes. *Integration*, *9*(55), 750-769. DOI:10.35631/IJEPC.955051

Santoso, H. (2011). Majalah dinding sebagai media untuk meningkatkan kemampuan menulis dan budaya baca siswa. *Universitas Negeri Malang*.

Serrano, D. R., Dea-Ayuela, M. A., Gonzalez-Burgos, E., Serrano-Gil, A., & Lalatsa, A. (2019). Technology-enhanced learning in higher education: How to enhance student engagement through blended learning. *European Journal of Education*, *54*(2), 273-286. DOI:10.1111/ejed.12330

Shi, Y., Zhang, J., Yang, H., & Yang, H. H. (2021). Effects of interactive whiteboard-based instruction on students' cognitive learning outcomes: a meta-analysis. *Interactive Learning Environments*, *29*(2), 283-300. DOI:10.1080/10494820.2020.1769683

Sulianta, F. (2020). *Menciptakan Produk Pendidikan menggunakan Metode R & D: Disertai Langkah demi Langkah Pengembangan Model Pembelajaran Literasi Digital*. Feri Sulianta.

Supriyani, N. K. R., & Winangun, I. M. A. (2024). Strategi Meningkatkan Pemahaman Peserta Didik Melalui Pembelajaran Berdiferensiasi Di Sekolah Dasar. *Widyacarya: Jurnal Pendidikan, Agama dan Budaya*, *8*(2), 199-207. https://journal.stahnmpukuturan.ac.id/index.php/widyacarya/article/view/358

Suryani, Y. (2024). E-LKM Berbasis PJBL Terintegrasi Etno-STEM pada Materi IPA dalam Menumbuhkan Karakter Peduli Lingkungan pada Mahasiswa. *Harmoni Media Dan Metode Dalam Pembelajaran IPA*, *99*. https://doi.org/10.53624/ptk.v4i2.337

Waang, P. (2023). Maximizing the potential of multimedia in Indonesia: Enhancing engagement, accessibility, and learning outcomes. *Journal of Appropriate Technology*, *9*(3), 235-245. DOI:10.37675/jat.2023.00409

Widodo, M. B. P., Aula, A. F. Y., Riswanti, M. L., & Rozi, A. F. (2023). *Society 5.0 pembelajaran IPS*. Cahya Ghani Recovery.