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Developing a Digital Book of Proficiency in Writing Scientific Articles with Artificial Intelligence to Improve Elementary Education Students' Scientific Writing Skills

Hamdan Husein Batubara
Universitas Islam Negeri Walisongo Semarang, Indonesia
e-mail: huseinbatubara@gmail.com

Abstract: The connectivistic learning theory emphasizes the pivotal role of technology in enhancing students' access to resources and skills, particularly in scientific writing. This study employs the ADDIE model to develop a digital book designed to improve the scientific writing competencies of elementary education students. A needs analysis indicated that students have a limited understanding of research methodologies and academic writing, with an average proficiency rate of only 45%. They expressed moderate difficulty in writing scientific articles and requested the development of a user-friendly and visually engaging digital book. In response to these findings, we produced an innovative digital book in HTML5 and PDF formats, featuring clearly defined learning objectives, AI-integrated materials, concise summaries, project assignments, and interactive quizzes. The content encompasses guidance on writing articles, examples of scientific article structures, and techniques for utilizing AI in writing. Validation by five experts yielded a score of 4.35 out of 5, affirming the material's strong content and presentation quality. A pilot study conducted with 26 students demonstrated a high usability score of 4.60, indicating that the digital book effectively enhances students' comprehension and motivation in scientific writing. The results suggest that integrating Project-Based Learning (PjBL) and AI tools can substantially improve students' writing skills and facilitate their navigation through academic challenges.
Keywords: Ebooks, Scientific Writing, Artificial intelligence, writing skills, elementary education

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A. Introduction

The writing and publication of scientific articles play a critical role in the education of elementary education students. This practice enhances their ability to access, analyze, and communicate knowledge effectively (Eppler et al., 2021). Furthermore, engaging in the process of writing scientific articles helps students develop essential skills such as critical thinking, creativity, and the capacity to utilize credible sources of information (Cintamulya et al., 2023; Rachmadtullah et al., 2024). However, many students struggle with writing scientific articles due to inadequate data literacy, difficulties in constructing

coherent arguments, and limited proficiency in scientific writing (Hernawan et al., 2023; Irma Arifah & Suprapti Suprapti, 2024; Yelliza, 2024).

Preliminary interview findings indicate that several students experience challenges in various aspects of scientific article writing. These challenges include effectively structuring sentences and paragraphs, understanding academic writing conventions, constructing clear and logical arguments, and employing digital tools to aid writing. Additionally, some students have admitted to inadvertently duplicating portions of other authors' texts when citing them, primarily due to their limited experience writing scientific papers in their native language. This observation aligns with the research conducted by Heriyudananta, which reported a general deficit in writing competence among Indonesian students, particularly in adhering to scientific writing standards, avoiding plagiarism, and sourcing high-quality references (Heriyudananta, 2021). Kismiati's research also reveals that a significant percentage of students struggle with writing the introduction (54%), outlining the methods (46%), and presenting research results and discussions (54%) (Kismiati, 2024).

One of the primary challenges that students encounter when writing scientific papers is their limited experience with the various components of scientific articles (Kismiati, 2024). Additionally, factors such as low motivation, insufficient self-confidence, restricted interest in reading, a lack of curiosity, and a limited understanding of scientific writing can impede their ability to produce high-quality work (Heriyudananta, 2021). Furthermore, external factors, such as distracting environments, limited access to credible reference materials, and technical difficulties with digital tools, can significantly undermine students' engagement with writing tasks (Nam Chi et al., 2024). Conversely, support from peers, clear personal goals, and the availability of user-friendly digital resources can positively influence students' motivation to write scientific articles (Alshwairikh et al., 2023). Therefore, developing a practical, easily comprehensible guidebook for writing scientific articles, encompassing comprehensive content and utilizing the latest technology, could enhance students' ability to acquire this essential skill.

Digital book or e-book refers to any electronic book that students can use independently (Afnita et al., 2021; Bozkurt & Bozkaya, 2015). Digital books have several advantages over printed books, such as being more durable, portable, accessible, and engaging (Almekhlafi, 2021; Batubara et al., 2022). However, although digital books are useful for supporting the learning process, the use of digital books also faces various challenges, such as the effect of screens on eye fatigue, addiction to using digital devices, and limited student access to appropriate digital tools (Asrowi et al., 2019; Kang et al., 2009). Therefore, it is necessary to develop a valid and appropriate digital book that can help students to improve their reading skills and learning outcomes, especially in writing scientific articles (Afnita et al., 2021; Masa'deh et al., 2022).

Furthermore, the project-based learning model has also been proven effective in improving writing skills (Indriyani et al., 2023; Pratiwi, 2021). Recent studies have indicated that project-based learning (PjBL) effectively promotes student engagement and independence (Dewi, 2021; Guo et al., 2020; Martiani, 2021; Sofya et al., 2021). Moreover, the PjBL model has enhanced students' problem-solving, decision-making, teamwork, and time-management skills (Beneroso & Robinson, 2022; Gomez-del Rio & Rodriguez, 2022; Mpuangnan et al., 2023). Integrating PjBL into the digital book enriched with AI tools can improve students' enthusiasm, understanding, and ability to write scientific articles (Drolia et al., 2020; Gunnars, 2021; Papadakis et al., 2020; Zakharova & Podvesovskii, 2021).

In addition, artificial intelligence (abbreviated as AI) represents a technology capable of emulating human-like intelligence (Hari et al., 2025). Scholars from different disciplines explore the potential of combining AI in various activities, including writing scientific articles (Altmäe et al., 2023; Pitychoutis, 2024). On the other hand, the use of AI for scientific article writing also presents challenges, such as issues of potentially biased results, misinformation, fake citation sources, plagiarism, integrity, and leakage of personal data (Akın Saygın & Aydın Kabakçı, 2023; Koga, 2023; Sara & Aida, 2024). Therefore, their use must be managed appropriately so that users can optimize their benefits and mitigate the risks of their use. In addition, the use of digital books with AI as learning tools also supports various learning theories, including connectivist, behavioristic, and cognitivist (Atay & Sumuer, 2021; Gr. Voskoglou, 2022).

The successful use of technology in the learning process is influenced by various factors, such as teacher readiness, students' factual conditions, and technology's suitability with the objectives, strategies, and characteristics of learning materials. In addition, students' acceptance of technology also affects their behavior in using technology. Therefore, the use of digital books and other digital tools can be analyzed based on the concept of digital literacy, the ASSURE model, UTAUT, and TAM (Al-Abdullatif, 2024; Batubara, Sumantri, et al., 2023).

The novelty of this research can be identified from various aspects, including limited research that designs and evaluates the effectiveness of a digital book for writing scientific articles that applies project-based learning (PjBL) with AI platforms for elementary education students (Ismi Adnin & Sapriya, 2024; Mukhlis, 2024). In addition, the results of this study are also very important in producing a comprehensive digital book that effectively addresses the unique needs of elementary students in writing scientific articles. Therefore, this study aims to create a practical digital book that aids students in writing scientific articles with the support of artificial intelligence.

B. Method

This research employs the ADDIE model (Branch, 2009) to design, develop, and evaluate a digital book for writing scientific articles supported by artificial intelligence platforms. The ADDIE model was selected for its systematic organization of activity

steps, which includes evaluation at each stage, and its established effectiveness in developing educational products (Mamolo, 2019; Mutma'innah & Hamimi, 2024).

The analysis phase begins with assessing competence gaps of 101 final-year elementary education students, identifying their challenges in writing scientific articles, and analyzing their expectations regarding a digital book for writing scientific articles. Instrument items of the analysis phase were adapted with modifications from the instrument of Batubara et al. (2023) because these instrument items are relevant to this study, which includes ten items to measure students' level of understanding related to scientific article writing, ten items to evaluate students' difficulties in writing scientific articles, and five items to evaluate students' expectations of scientific article writing guidebooks, all instrument items have been validated for reliability through a pilot study.

The initial product was designed in the design phase based on the need analysis results and relevant literature, including learning outcomes, materials, exercises, and evaluations. The digital book offers valuable insights into integrating AI-driven tools to enhance the article-writing process for students. In this study, key considerations for utilizing AI applications encompass practical factors such as ease of use, the utility of features, popularity, and affordability. Furthermore, we developed interactive tutorials, prompt templates, illustrative examples of article components, and quizzes to engage students and provide robust, practical writing support.

During the development phase, the draft digital book undergoes formative revisions based on feedback from expert evaluations. This process involves presenting the draft to five selected experts who provide insights to enhance its quality. Follow-up consultations are conducted to obtain valid judgments. The eligibility criteria for this study's experts include a doctoral degree in educational technology and elementary education, and having a substantial track record in authoring scientific articles. The validation instrument used to evaluate the developed digital book consists of 20 items measured on a Likert scale, adapted with appropriate modifications from established sources (Nurhayati, 2017; Suryani et al., 2018). The expected outcome from this phase is a polished digital book ready for implementation.

The implementation phase is carried out through a pilot study involving 26 final-year students of the elementary education program. This phase begins with introducing the features and techniques of using digital books. After that, the researcher tested the product for five lessons in the classroom and collected feedback from the participants on the practicality of the digital book. Instrument items of the implementation phase were adapted and modified from some previous researchers' instruments (Gao et al., 2018; Lund, 2001). These items consist of 15 questions to evaluate their perceptions about usefulness, ease of use, and attractiveness of developed products. The instrument's validity was double-checked before use by asking two reviewers to assess the internal validity of the instrument and testing the instrument items on 30 students.

The qualitative data from this study were analyzed systematically through data reduction, classification, and thematic presentation processes. In addition, the quantitative data were examined using descriptive statistics, and the average value was interpreted into three parts using Likert scale guidelines: 1.00 - 2.33 indicating low, 2.34 - 3.67 representing moderate, and 3.68 - 5.00 denoting high levels (Alkharusi, 2022).

C. Results and Discussion

Results

The Need for Developing a Digital Book on Writing Scientific Articles with AI

The findings of this study indicate that students possess a moderate understanding of scientific article writing, with an average comprehension level of 45%. This highlights a significant knowledge gap in their ability to effectively integrate digital tools, methodologies, and principles of academic writing. Key areas identified for improvement include: understanding the types of AI applications suitable for reviewing and discussing the limitations of existing literature (15%), techniques for determining research samples (30%), methods for managing references with Mendeley (32%), strategies for articulating the novelty and contributions of research (34%), skills for paraphrasing and correcting grammar using AI applications (43%), approaches for writing introductory sections (57%), techniques for validating research instruments (66%), and methods for presenting research results (68%). Addressing these gaps will enhance students' competencies in scientific writing and research methodologies.

The needs analysis has indicated that 65% of students consider writing scientific articles moderately difficult, while 19% find it challenging, and 16% consider it easy. Key challenges identified include the formulation of engaging titles, composition of relevant results sections, selection of appropriate journals for submission, navigation of the submission and revision processes, crafting of compelling introductions, sourcing of quality references, thorough discussion of results, effective utilization of AI tools to enhance language quality, efficient management of references, and clear delineation of research methodologies. These findings highlight the necessity for a digital resource that offers comprehensive material, presents information in a structured manner, incorporates easily understandable illustrations and examples, and facilitates the integration of AI tools in academic writing.

Students have articulated their expectations for a digital book on scientific article writing by emphasizing the importance of practical examples, which received a rating of 4.5 out of 5. This suggests a strong preference for relevant content that supports their writing processes. Visual aids, such as tables and images, scored 4.4, underscoring their significant role in facilitating comprehension. The digital format of the resource was also rated 4.4, indicating a clear desire for easily accessible materials. The integration of technology, including reference management tools and artificial intelligence, received a rating of 4.3, reflecting recognition of AI's potential contributions to academic writing. Engaging features, such as case studies, video tutorials, quizzes, and summaries, garnered a score of 4.2, highlighting the demand for interactive content. Based on the findings from

the needs analysis, it is clear that students require a comprehensive digital guidebook for scientific writing. This guidebook should encompass tutorials on artificial intelligence (AI), illustrative text examples, visual aids, and project assignments.

The Design of a Digital Book on Writing Scientific Articles with AI

The digital book of scientific article writing with AI is systematically structured to help students master scientific writing techniques, particularly with modern technology and artificial intelligence (AI) integration. This 329-page book, adhering to UNESCO standards with dimensions of 15.5 cm x 23 cm, is designed to address students' challenges in writing academic articles. It provides comprehensive guidance, examples of writing the body of a scientific article, practical tools, and features tailored to enhance students' understanding and skill development. The digital book is organized into eight chapters, each containing a title, learning outcomes, discussion materials, summaries, project tasks, and interactive quizzes. An overview of the digital book's contents can be seen in Figure 1.

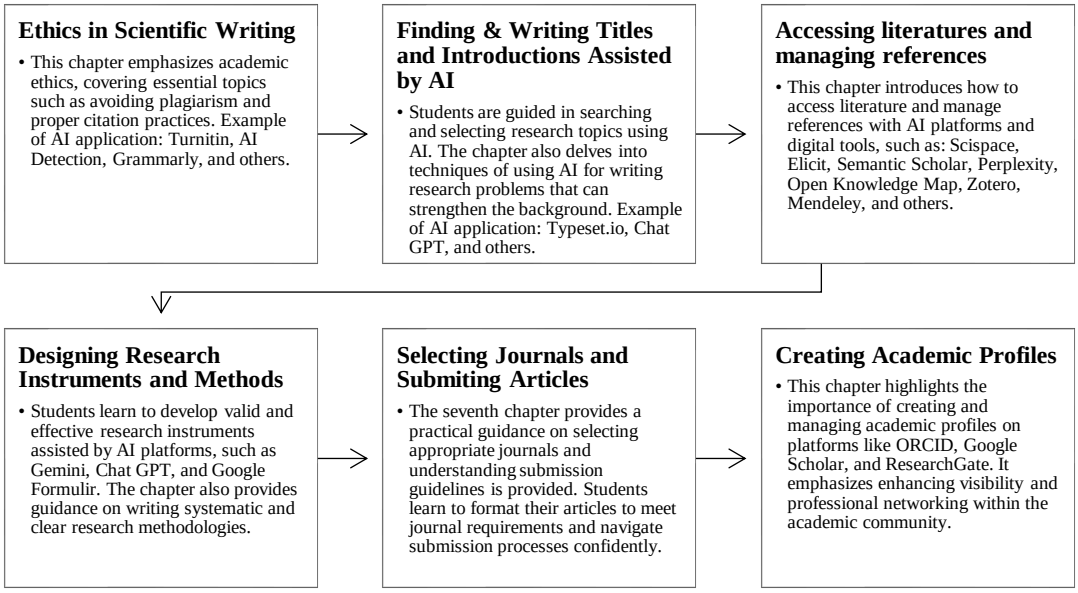

Figure 1. An overview of the digital book's contents

The digital book leverages many AI tools to enhance the scientific article writing process. For example, generative AI platforms, such as Chat GPT and Gemini, were used as tools in searching ideas and titles; research platforms powered by AI, such as Open Knowledge Maps, Consensus, Scispace, Elicit, and Perplexity, were used as tools in searching and reviewing literature; communication platforms, such as Zoom Meeting, WhatsApp, Quizizz, Google Forms, and KirimPesan.net, were used as tools in collecting research data. In addition, DeepL was used for translating, Grammarly and Quillbot were used to check grammar, Turnitin was used to check similarity levels, and Scispace was used to detect AI-generated text. By incorporating these tools, writing the digital book is easier.

A key feature of the digital book is its incorporation of artificial intelligence and Project-Based Learning (PjBL). This approach actively engages students by encouraging them to apply theoretical knowledge to real-world tasks. Each chapter includes project assignments that lead students through the process of producing an academic article, providing hands-on experience and practical skill development. PjBL ensures that students do not simply learn about scientific writing; instead, they actively participate in the process, resulting in tangible outcomes such as completed articles ready for submission. This method fosters a deeper understanding and instills confidence in students regarding their academic abilities.

The digital book for writing scientific articles was packaged in HTML5 and PDF format to enable students to access materials anytime, anywhere. The selected format allows compatibility with various devices, including computers, tablets, and smartphones. Interactive elements such as quizzes, videos, and visual aids cater to diverse learning preferences, ensuring students remain engaged throughout the learning process. Practical tasks such as conducting literature searches or drafting research sections are integrated, promoting active participation and immediate application of knowledge. By combining project-based learning, AI integration, and a strong emphasis on ethics, the developed digital book equips students with essential skills to produce high-quality scientific articles.

The Validity of a Digital Book on Writing Scientific Articles with AI

The digital book of scientific article writing with AI has undergone a rigorous validation and revision process based on expert feedback to achieve high validity in content, presentation, language, and display. Expert validators have praised the quality of the content and presentation, as it covers a wide range of essential topics supporting scientific article writing. An expert noted, "*This module covers the basic aspects required for scientific writing*." However, one validator suggested expanding the examples to different disciplines, saying, "*Including cases from different fields would make this guide more inclusive and applicable*." Another suggested, "*Project-based exercises and critical literature analysis would greatly enhance the learning experience*."

Regarding the quality of language, validators praised the use of clear and concise academic language in this module by commenting, "*The language is simple yet academically rigorous, suitable for students at different stages of learning*." Nonetheless, one validator recommended adding real-life examples of technical terms to help students understand and use them accurately in their writing. As for the display quality, validators revealed areas that need improvement, such as page layout, color scheme, and better font choice. One validator stated, "*Adding illustrations, diagrams, and tables would clarify complex concepts and increase visual appeal*."

Comments and suggestions from expert validators have been followed up to develop it, improve its validity, and make it an attractive and practical learning resource in supporting the students' learning process. Furthermore, the expert validators checked

and assessed the revised content, presentation, language, and display quality results. The results of the validity test can be seen in Table 1.

Table 1. The validity of a digital book of scientific article writing with AI

Aspect	Min	Max	Mean	Percentage	Category
Content Quality	4,00	5,00	4,43	89%	High
Presentation Quality	3,80	5,00	4,32	86%	High
Language Quality	4,00	5,00	4,52	90%	High
Display Quality	3,60	4,80	4,12	82%	High
		Average	4,35	87%	High

The validity test results indicate that the digital book of scientific article writing with AI is valid in the high category, with an average score of 4.35. Evaluated by five validators, it scored highly in four areas: content (M=4.43), presentation (M=4.32), language (M=4.52), and display (M=4.12). The content quality was praised for its depth and relevance to the writing process. A good presentation quality score also indicates that the digital book is well-presented and organized. The high language score reflects clarity and adherence to academic standards. Although the display received the lowest score, it still indicates a good appeal with an organized layout and appropriate design. Recent improvements have been made in layout, color choices, font selection, and illustration quality.

The Usability of a Digital Book on Writing Scientific Articles with AI

The digital book of scientific article writing with AI was implemented in the pilot group to evaluate its usability from three dimensions: usefulness, ease of use, and attractiveness. The findings indicate a high level of practicality, with an overall average score of 4.60, demonstrating that the module is a highly effective academic resource for students. See details in Table 2.

Table 2. The practicality of a digital book of scientific article writing with AI

Aspect	Maximal	Minimal	Mean	Category
Usefulness	4,58	4,46	4,53	High
Ease of use	4,77	4,46	4,66	High
Attractiveness	4,65	4,54	4,61	High
		Mean	4,60	High

Regarding usefulness, the developed digital book achieved an average score of 4.53. Students particularly valued its ability to simplify the process of writing scientific articles, with the highest scores (4.58) attributed to its alignment with their expectations and its role in facilitating academic tasks. The digital book also significantly increased students' interest in scientific writing and improved their understanding of writing techniques, scoring 4.46. These results underscore the digital book's ability to address students' challenges and enhance their writing competencies.

Ease of use was the highest-rated dimension, with an average score of 4.66. Students highlighted that the module was easy to read (4.73), understand (4.77), and use

for independent study (4.73). These findings reflect the module's user-friendly design and flexibility, enabling students to navigate the content effortlessly and learn at their own pace. The clear organization and accessibility of the material contribute to its practicality as an academic tool.

The digital book's attractiveness also received a strong rating, with an average score of 4.61. Students expressed a high level of interest in using the module, as reflected by scores of 4.65 for overall satisfaction and willingness to use it. Its visually appealing design was rated at 4.62, suggesting that the module informs and engages students, making the learning experience enjoyable. These aspects highlight the digital book's success in motivating students to engage in academic writing actively.

Qualitative feedback from students further supports these quantitative findings. Many students emphasized the relevance and timeliness of the module's content, noting its effectiveness in improving writing quality and integrating modern technology. One student remarked that the module "*enhances efficiency, accuracy, and quality in writing while providing clear guidance on AI use*." This feedback reflects the module's ability to bridge the gap between academic expectations and the challenges faced by students. Another student highlighted its practicality, stating that the module is "*highly relevant and simplifies the process of drafting scientific articles*," demonstrating its alignment with current academic demands.

The systematic presentation of the material was frequently praised by students, who found the digital book easy to follow and well-organized. One respondent noted, "*The content is presented systematically and practically, making it easy to understand*." However, some students pointed out specific areas for improvement, such as the clarity of images in the printed version, particularly those illustrating AI tools. Suggestions included enhancing image resolution and incorporating video tutorials to complement the text and aid comprehension.

Students also recognized the module's strength in integrating artificial intelligence (AI) to support academic writing. They appreciated its detailed guidance on leveraging AI tools, describing it as "*a solution to academic writing challenges*." Several students noted that the module helped them improve the efficiency of their writing process while providing practical and actionable steps. Moreover, students expressed that the module motivated them to pursue writing and publishing in scientific journals, with one student stating, "*This module boosts productivity and encourages students to publish their academic work without fear*."

Despite its many strengths, some challenges were noted. One student stated, "*I have limited knowledge of the AI tools introduced in this digital book*," suggesting a need for more detailed examples and explanations. Another student also proposed including chapter practice questions and tutorial links to enrich the learning experience further. Some students also emphasized the importance of ethical considerations in using AI for academic writing. For example, one student said, "Academic *institutions should make clear regulations on the use of AI, emphasizing its role as a tool, not as a substitute for*

original authorship." This feedback underscores the need to integrate ethical guidelines into the digital book of scientific article writing with AI to align it with academic integrity standards.

Discussion

The results of the analysis of students' needs revealed significant insights into the specific challenges students face in scientific writing and the potential of the digital book of scientific article writing with AI to address these issues. These findings corroborate the results of previous research that identified various types of student difficulties in writing scientific articles and indicate an uneven understanding of technology among students (Tumiran et al., 2024; Yelliza, 2024). In addition, this study's results align with another study that highlighted students' needs and expectations for practical digital books that incorporate real examples, visual elements, and interactive features (Batubara et al., 2022).

The findings regarding users' expectations align with previous research, which shows that Generation Z prefers interactive, technology-based tools for writing scientific articles (Wajdi et al., 2024). However, there are concerns about potential over-dependence on technology and ethical issues (Hosseini et al., 2023; Pashkov & Pashkova, 2022). Therefore, the digital book of scientific article writing with AI should emphasize the responsible and ethical use of digital resources (Khalifa & Albadawy, 2024). The results of the analysis clearly outline students' conditions and expectations, which are essential for developing relevant teaching materials that meet their needs.

This research presents a novel approach integrating comprehensive materials, artificial intelligence platforms, and project-based learning into a digital book. It aims to balance leveraging AI support and the essential requirement for critical human oversight, thereby promoting academic integrity and facilitating skill development (Koga, 2023). Starting the first chapter with scientific writing etiquette highlights the importance of ethical considerations in writing scientific articles (Koromila, 2024; Sari et al., 2024). Integrating AI platforms and project-based learning supported previous research results that emphasize the role of AI and project-based learning in improving text quality and streamlining the writing process (Ismi Adnin & Sapriya, 2024; Kyselova, 2024; Mukhlis, 2024). Adopting project-based learning also aligns with constructivist learning theory, which emphasizes a student-centered approach to learning experiences (Y. Wang, 2022).

Incorporating interactive elements, such as tutorial materials, exercises, and interactive quizzes, resonates with cognitivist learning theory and media richness theory, highlighting the significance of scaffolding and mental engagement in learning (Harasim, 2017; Zakharova & Podvesovskii, 2021). Furthermore, including an AI-assisted scientific article writing project task emphasizes the importance of human and AI collaboration in producing high-quality academic work (Aure & Cuenca, 2024; Yildirim et al., 2023). Thus, the design of a digital book of scientific article writing with AI in this study has offered a learning resource model relevant to students' needs in this era.

The high validity value obtained by the digital book of scientific article writing with AI indicates that its internal quality has met the requirements as an independent teaching material (Nurvidia & Yulianto, 2024). The eligibility score also shows that the quality of the content, presentation, language, and appearance has met the standards, so that it can be used to support the learning process of scientific writing (Batubara et al., 2022; Nurhayati, 2017; Suryani et al., 2018). The findings from the validity testing emphasize the necessity of continuous evaluation by expert validators to generate ideas suitable for product development (Rusdi, 2019).

One of the aspects considered in the validity test is the quality of the content. This aligns with constructivism theory, emphasizing the importance of relevant, actual, and in-depth learning materials to support meaningful learning (Tsai et al., 2023). Content quality is improved by supporting abstract and procedural material with effective visual representations, such as pictures, diagrams, and tables (Getahun et al., 2022). Citation writing is also precise to ensure the credibility and traceability of the information presented (Setyawati & Fitriani, 2023). In addition, the presentation of material following learning design principles emphasizes organization logically and straightforwardly to minimize cognitive load (Getahun et al., 2022).

The results of this study also identified language quality as an important part of the validity test to ensure that the digital book developed is easy to understand and follows cultural norms (Arifa et al., 2023). Furthermore, the quality of the book's appearance is also in line with visual design principles that emphasize the readability and attractiveness of the digital book content to enhance the learning experience (Nissa et al., 2023). Based on these findings, the results of this validity test emphasize the importance of content, presentation, language, and appearance validity tests to ensure the feasibility of independent learning resources.

The high usability value obtained by the digital book of scientific article writing with AI indicates that its practicality has met the requirements as an independent teaching material. This finding aligns with a previous study observing improvements in students' writing scores because AI can enhance writing efficiency, streamline manuscript revisions, and enable researchers to focus on innovation while automating routine tasks (Z. P. Wang et al., 2024). The findings of this study also reinforce connectivist learning theories that emphasize the important role of digital technology in facilitating students to build connections with global resources, peers, and experts (Al-Mutairi, 2021; Boyraz & Ocak, 2021). In addition, this study also supports constructivist, cognitive, and behavioristic learning theories that emphasize the important role of digital technology in helping students access information, build understanding, gain stimulus, and expand their understanding (Karakose et al., 2021; Liu & Li, 2021; Paas & Ayres, 2014).

However, it is essential to acknowledge the risks associated with artificial intelligence, including the importance of thorough fact-checking, reference accuracy, potential impacts on creativity, and concerns regarding misinformation and plagiarism (Mehta et al., 2024). Consequently, the creation of a comprehensive guidebook on

scientific article writing that incorporates AI tools has to emphasize the necessity for transparency, the careful application of these technologies, and the critical role of human oversight in validating AI-generated information. Such measures will ultimately enhance the quality of scientific publications (Elbadawi et al., 2024).

The high scores on the ease-of-use aspect align with the learning design theory that emphasizes the importance of simple and easy-to-understand user interfaces to enhance the learning experience and student performance (Kogan et al., 2024). The attractiveness of the learning materials, as seen in the high scores for the developed digital book, is also supported by the idea that good visual design can increase motivation and engagement, as evidenced by the positive impact of visual appeal on user acceptance and motivation in various educational contexts (Kim, 2024). These findings underscore the importance of integrating user-friendly and visually appealing design elements in educational technology to foster motivation, engagement, and continued use.

Furthermore, while this digital book has addressed the fundamental principles of ethics in scientific writing and the application of AI, there remains a vast opportunity for further inquiry into the ethical implications of AI use. This exploration should delve deeper into the importance of transparency when deploying AI tools, the necessity of protecting personal data, and the crucial need to avoid becoming overly dependent on technology. Strengthening these aspects is vital to ensure that the integration of AI into scientific writing upholds academic integrity and promotes a responsible and ethical approach to research.

Although the findings of this study are promising, it is essential to acknowledge several limitations. These include the small-scale pilot implementation and the limited duration of the evaluation, which may affect the broader applicability of the results. To enhance the validity of future research, it is recommended to engage a larger participant cohort, implement the intervention across various academic disciplines, and investigate the long-term impact of AI-integrated instructional media on students' academic performance. Furthermore, examining the evolution of students' ethical awareness and AI literacy over time will be critical for advancing this line of inquiry.

D. Conclusion

This study outlines the development of a digital book aimed at enhancing the scientific article writing skills of students enrolled in elementary school teacher education programs. Employing artificial intelligence (AI) and adhering to the ADDIE instructional design model, this research identifies several significant challenges faced by students, including the construction of coherent arguments, comprehension of academic conventions, and the effective integration of digital tools into the writing process.

The digital book was developed using a project-based learning (PjBL) approach and integrates advanced AI technology. Expert evaluations reported a high quality score of 4.35 on average. Additionally, usability testing with users resulted in an impressive

score of 4.60. These findings indicate that the digital book possesses strong internal quality, is user-friendly, and effectively engages students.

Moreover, this study emphasizes the important role that AI can play in enhancing the quality of academic writing. The technology supports students in locating pertinent references, structuring their articles, and identifying errors in their work. However, it is crucial to stress the necessity for responsible and ethical use of AI to maintain academic integrity. Therefore, teachers must guide students in appropriately acknowledging the use of AI tools, preventing plagiarism, and critically assessing AI-generated content.

This study suggests improvements to the digital book by incorporating more interactive features and discipline-specific AI tools. The findings recommend that educational institutions consider integrating this digital book to effectively enhance students' academic writing skills.

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