



Development of a blended learning-based electronic worksheet for students' writing skills

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Abstract

The requirement for this final assignment to create a scientific paper requires reliable scientific writing skills. This study aims to develop blended learning-based electronic worksheet (EWs) on writing material for students of Elementary School Madrasah Teacher Education Study Program at Imam Bonjol State Islamic University Padang, Indonesia. The research method used is the development research from Thiagarajan with the 4D development model. The developed EWs is designed to improve students' writing skills through a combination of online and face-to-face learning. Data were collected through questionnaires and writing skills tests before and after the use of EWs. The results of the study indicate that the use of EWs assisted by blended learning can significantly improve students' writing skills. Student responses to EWs also showed positive results, with a high level of satisfaction with the materials and learning methods used. This study concludes that blended learning-based EWs is effective in improving the writing skills for students and contributing to the development of innovative learning methods in the digital era.

ARTICLE HISTORY

Received:

10 November 2025

Accepted:

28 February 2026

Published:

31 March 2026

KEYWORDS

Electronic
Worksheet (EWs);
blended learning;
writing skills;
students;
instructional media.



1. Introduction

Writing skills are a fundamental productive competency that students must master as a foundation for academic and professional development. From a global perspective, strengthening students' writing skills is closely related to the achievement of the Sustainable Development Goals (SDGs), especially Goal 4 (Quality Education), which emphasizes the importance of quality, inclusive, and sustainable education (Apridayani, 2024). Good writing skills contribute directly to improving the quality of learning, developing academic literacy, and forming superior and competitive human resources (Septiari, 2025). In addition, writing skills also support Goal 8 (Decent Work and Economic Growth) by preparing graduates who have professional communication competencies, as well as Goal 16 (Peace, Justice, and Strong Institutions) through strengthening critical literacy and the ability to convey ideas responsibly (Magraner, 2025).



Writing is defined as the activity of conveying messages or communication through written language (Suparno & Yunus in Dalman, 2018; Zahari, 2025), as well as the skill of expressing ideas in writing (Suhendra, 2015). This skill requires development, practice, and systematic thinking to be able to express it effectively in written language (Mahendra, 2022). The urgency of writing skills is not only academic, but also spiritual and legal. Spiritually, the Qur'an emphasizes the importance of documenting knowledge through writing (pen), which, according to M. Quraish Shihab's interpretation in Dozan, (2020). It serves to pass on and transform knowledge between generations. Legally, higher education regulations mandate research standards, reinforced by the Minister of Education and Culture Regulation Number 3 of 2020 and the Minister of Education and Culture Regulation Number 53 of 2023, which require students to produce scientific papers as their final assignments (Permendikbud, 2023). This directly demands reliable scientific writing skills.

Despite its crucial role, a common problem in the learning process is students' poor writing skills. One of the main contributing factors is educators' tendency to prioritize grammar over how to express ideas effectively in writing (Abidin, 2017). As for the student factor, the difficulty of writing skills includes writing a doctoral study thesis and writing an essay (Dardour, 2021). Literature studies show that the improvement of argumentative essay writing skills in a period of 40 minutes with the help of ChatGPT, Grammarly, and course instructors (Suh, Simon, 2025), also has a positive and significant impact on grammatical accuracy, academic performance, and confidence in writing (Khudai, 2025; Sumbayak, 2024). However, it is important to underline the importance of human supervision to ensure originality and encourage critical thinking (Andika, 2025). Therefore, courses like Research Methodology require innovation and more adequate knowledge resources, as well as the integration of technology, especially AI in learning.

To address boredom and poor writing skills, this study highlights the importance of technology integration in learning. The Blended Learning Model, a combination of conventional and distance learning patterns involving technology (Marlina, 2020) It is considered highly relevant. Students can maximise access to online resources and feedback (Ruan, 2024), the benefits of face-to-face time and online resources are effectively (Wang, 2025). Blended learning is an adaptive model that is flexible, interactive, effective, and conducive (Abdullah, 2018; Alwan, 2017 ;Tanjung, 2021).

To optimize Blended Learning in courses requiring writing practice, Electronic Worksheets (EWs) are used. EWs are a practical and easily accessible digital innovation that allows students to complete assignments, receive feedback in the form of video reviews, and practice questions electronically (Aldresti, 2021).

The development of EWs is a necessity as a form of technological adaptation and innovation in digital learning.

Although the Blended Learning model and the use of EWs have been extensively researched, a critical gap exists in the existing literature. The research is related to worksheets based on blended learning, not for writing skills, but for structured tasks (Zahro, 2025). critical thinking skills (Winarti, 2024; Novitasari, 2021), student learning outcomes (Zen, 2025), metacognitive skills (Mustafidah, 2022). This gap lies in the limited development of EWs products specifically designed for scientific writing skills (proposals) that are fully integrated with the Blended Learning model. These EWs are designed as a comprehensive scaffolding tool for scientific proposal writing. The novelty resides in the structural integration of the worksheet. It bridges the gap between independent digital exploration and synchronous face-to-face feedback, a hybrid approach that is specifically optimized for the iterative nature of writing skills. While the 4D Model (Define, Design, Develop, Disseminate) is established, this research demonstrates novelty through its cross-disciplinary dissemination phase. This study aims to bridge this gap by offering new insights and perspectives through EWs products that have been tested for validity and practicality, which directly support students in achieving reliable scientific writing standards.

The main focus of this research is the development of EWs based on blended learning for students' writing skills. In contrast to previous research that separated the study of blended learning from worksheets, as well as writing skills. In this study, the integration of EWS with the blended learning approach focuses on writing skills as a student's productive competence. Further measure the feasibility of the product with a specific purpose to describe the procedure for developing EWs based on blended learning, analyzing the level of validity, practicality, and effectiveness of EWs based on blended learning for students' writing skills of Elementary Madrasah Teacher Education at Imam Bonjol State Islamic University, Padang. The benefits of this research academically are to provide a tested learning model to address the specific problems of scientific writing skills in higher education, which aligns instructional design with the learning needs of the digital era, practically this research contributes to producing ready-to-use EWs products for lecturers to systematically improve students' scientific writing standards with the flexibility of time and space, also supports the achievement of SDG 4 (Quality Education) by creating competent human resources in academic literacy and professional communication.

2. Methods

This study used a Research and Development (R&D) approach with reference to Thiagarajan's 4-D model (Define, Design, Develop, Disseminate) (Thiagarajan, 1974), which aims to produce a valid, practical, and effective

Blended Learning-based EWs. The research participants were selected according to specific objectives, namely lectures that pay attention to research methods courses, which include three expert validators (media, language, and materials) for validity testing. The selection of validators is based on the areas of expertise and work experience of the lecturers and teachers. The practicality test was given to one lecturer and 42 students of the elementary education study program at the State Islamic University of Imam Bonjol, Padang, Indonesia, and at the end of the course, effectiveness testing was carried out by giving essay questions. The identity of the questionnaire respondents is written with initials to maintain confidentiality as part of academic ethics.

For the needs analysis, data were gathered through structured interviews using an interview grid covering mastery of the material, lecture delivery, learning effectiveness, and preferred learning strategies. Additionally, a questionnaire was developed based on the literature to assess the validity of the students' worksheets. Documentation was also conducted to collect relevant materials such as the RPS, teaching resources, and Student Worksheets (Saswandi, 2025; Nasruddin, 2023).

Product validity was tested through expert validators. The selection of validators is based on the areas of expertise and work experience of the lecturers and teachers, which generated qualitative input for product revision. Meanwhile, to test the product's effectiveness in writing skills, quantitative data was obtained from a writing skills test (essay) guided by the rubric of academic writing assessment, which includes: content of ideas, content organization, grammar, style, and spelling (Yanti, 2018).

To determine product eligibility criteria, this study refers to predetermined percentages. These percentages are used to interpret the results of the validity, practicality, and effectiveness questionnaires to determine whether the product falls into the highly valid, practical, or effective categories. Table 1 presents the assessment criteria used in this study.

Table 1.

Validity, practicality, and effectiveness value criteria.

Percentage	Criteria
81%-100%	Very Valid/Practical/Effective
61%-80%	Valid/Practical/Effective
41%-60%	Quite Valid/Practical/Effective
21%-40%	Less Valid/Practical/Effective
<21%	Very Invalid/Impractical/Ineffective

Source: Wulandari, 2021

3. Results

This section presents the findings from the overall development process of blended learning-based EWs, in accordance with the research objectives. It focuses on the development procedure based on the 4D model, the level of validity, practicality, and effectiveness of the product for the writing skills of elementary school teacher education (PGMI) students at Imam Bonjol State Islamic University, Padang.

3.1 Define stage

This stage focuses on needs analysis to establish product specifications. The process began with in-depth interviews with three lecturers and students from the PGMI UIN Imam Bonjol Padang. Question 1: "Through the lectures that have been carried out, are students able to master the lecture material in accordance with the CPL and CPMK that have been formulated?" In my opinion, during lectures, students are not prepared to do learning in class, such as the habit of reading the material to be studied, so some of the questions I give cannot be answered properly. The assignments given are not done optimally, such as not being able to write direct quotations, providing arguments and bibliographies completely and correctly. (Informan A. D1) The 2nd question is "How is the lecture system implemented? Is it in accordance with the RPS?" The lectures I did took place face-to-face with a group discussion system. Each group is responsible for the distribution of materials provided and displayed weekly according to the given RPS (Informant B. D2).

Question 3: "Is the learning that has been carried out able to overcome the difficulties experienced by students in their writing skills?" So far, the learning carried out has been very well used, but it is still not able to overcome the problem of students' writing skills. It seems that students need to be given a guide in scientific writing that is not the same as a thesis guide (Informan C, D3). Question 4: "What kind of learning is done to overcome these difficulties?" To overcome these problems, students actually need more learning time, and also continue to try to practice their writing skills by reading and practicing writing from the journals they read (Informan D, D4).

These interviews consistently identified a key issue: students' poor proposal writing skills, driven by conventional methods and a lack of interaction with printed worksheets. This finding was reinforced by analysis of students, assignments, and concepts, which then formulated the product requirements: a digital, flexible, and structured EWs for proposal writing materials using a blended learning approach.

3.2 Design stage

This stage produced a draft prototype of the EWs. The design results included a visual design (using a bright, professional, and interactive scheme), the selection of digital media formats, and a detailed product design. This product draft included an attractive cover, a formulation of learning outcomes, clear instructions, a structured presentation of proposal writing materials, and a writing process-based assessment format. This draft served as an initial product ready for feasibility testing.

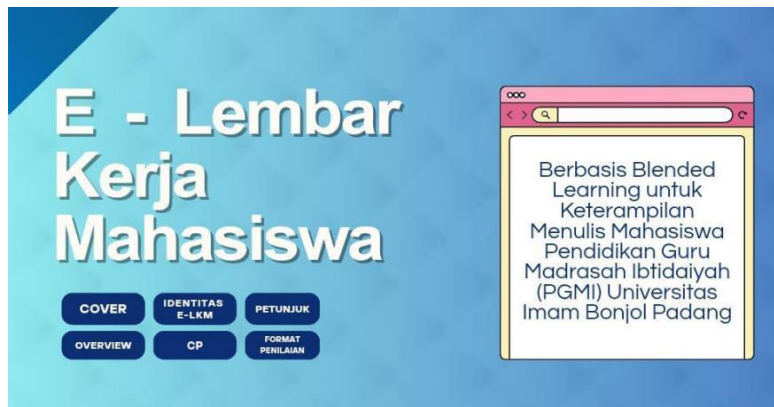


Fig. 1. Cover View Electronic Worksheet (EWs)

Figure 1 presents the cover of the Electronic Worksheets (EWs), which functions as an instructional identifier by displaying the worksheet title and visual design that reflects a blended learning environment.

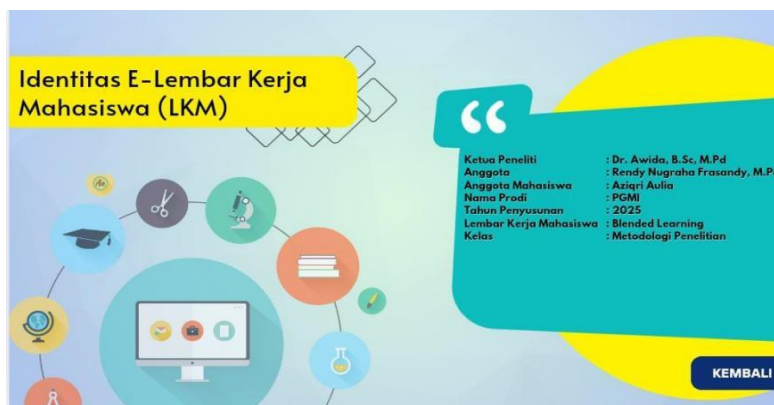


Fig. 2. Identity of EWs

Figure 2 shows the identity section, providing essential academic information such as course name, study program, and target users to ensure contextual clarity.



Fig. 3. Media Learning Outcomes

Figure 3 illustrates the learning outcomes component, which specifies the writing competencies students are expected to achieve in alignment with course objectives.

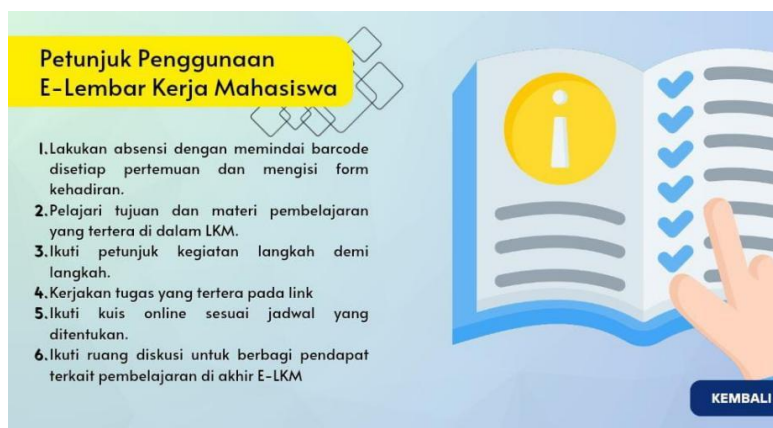


Fig. 4. Media Usage Instructions

Figure 4 depicts the usage instructions, designed to guide students in navigating the EWs effectively during both online and face-to-face learning activities.



Fig. 5. Media Draft

Figure 5 displays the draft of learning materials, consisting of systematically organized writing content and guided tasks based on the writing process approach to support progressive skill development.

Format Penilaian

Pedoman Penilaian UTS Metodologi Penelitian

No	Unsur yang Dinilai	Skor Maksimal
1.	Isi gagasan yang dikemukakan	
a.	Orisinalitas penulis dalam hal ide dan argumentasi serta seberapa menariknya judul dan topik yang diangkat. Kemampuan merumuskan masalah sesuai tema dan materi tulisan yang diberikan.	10
b.	Kemampuan menguraikan faktor-faktor yang mempengaruhi timbulnya masalah atau latar belakang masalah.	10
c.	Kesesuaian gagasan masalah artikel dengan perumusan masalah yang disertai dengan argumentasi ilmiah. Kemampuan dalam argumentasi yang dituangkan dalam eksplorasi tema.	10
d.	Kesesuaian lingkup eksplorasi tema	5
2.	Organisasi Isi	
a.	Ukuran kertas, tipografi, kerapian ketik, tata letak, dan jumlah halaman.	10
b.	Tulisan dibagi tiga bagian, inti/pembahasan, dan bagian penutup, yakni bagian pendahuluan, bagian.	10
c.	Ketepatan format penulisan sehingga menarik untuk dibaca.	5
3.	Tata Bahasa	
a.	Penggunaan bahasa Indonesia yang baik dan benar.	5
b.	Gaya penulisan dan kemampuan (atraktivitas dan inovasi) dalam menggunakan kata.	5
c.	Kalimat disusun dengan efisien dan enak dibaca.	5
d.	Mencantumkan catatan perit (<i>running note</i>), apabila mencuplik tulisan dari orang lain.	3
e.	Bila menggunakan istilah asing secara tepat.	2
4.	Gaya	
a.	Pemilihan kosa kata yang tepat.	10
b.	Tulisan disajikan dengan struktur kalimat yang baik sehingga mudah dipahami.	5
5.	Ejaan	
a.	Penulisan disesuaikan dengan kaidah PUEBI (Pedoman Umum Ejaan Bahasa Indonesia)	5
Jumlah		100

← KEMBALI

Figure 6. Assessment format

Figure 6 presents the assessment format, which applies process-based evaluation criteria to measure students' writing performance objectively and consistently.

3.3 Development stage

The development phase of this blended learning-based product is conducted through a series of systematic trials to ensure that the resulting product meets quality standards, is suitable for use, and positively impacts student competencies. This testing is divided into three main steps: validity, practicality, and effectiveness.

This stage involves testing feasibility and modifying the product draft through expert appraisal. Validation results by media expert validators, material experts, and language experts indicate that the EWs product is highly valid, with an average score of 95.67%. Specifically, validity was assessed as high for the aspects of material suitability, media suitability, and language accuracy. Based on the scores and suggestions from the experts, a comprehensive design revision was conducted until the final product was deemed feasible.

Table 2.

Validation results.

Validation Aspects	Average Percentage	Category
Media expert validation	96%	very valid
Linguist validation	96%	very valid
Subject matter expert validation	95%	very valid
Average	95,67%	very valid

After considering expert suggestions for improvement, a practicality test was conducted by administering a questionnaire to one lecturer and 42 students. The practicality results showed that the product was categorized as very practical, with an average score of 94.26%, and was suitable for use in learning.

Table 3.

Practicality results.

Practical Aspects	Percentage	Category
Educator (lecturer)	97%	Very practical
Students	91,52%	Very practical
Average	94,26%	Very practical

The effectiveness test was conducted using an essay-writing skills test administered to 42 elementary education students who had used EWs. The results showed a final average student effectiveness score of 85.71%. Based on the established assessment criteria, this figure places the blended learning-based EWs in the highly effective category.

Table 4.

Effectiveness of blended learning-based EWs for elementary education students.

Rated aspect	Average Value	Category
Essay test results	16,67%	Effective
	83,33%	Very effective
Average overall	85,71%	Very effective

3.4 Disseminate Stage

As the final stage of research and development, the dissemination test aims to measure the product's applicability in different academic environments. Dissemination was conducted by implementing the EWs on 42 students of the Islamic Religious Education (IRE) study program. The test in the IRE study program yielded an average effectiveness of 80.23%. Based on the assessment criteria, these results placed the EWs media in the effective category. These results confirm that the blended learning-based EWs are acceptable and function effectively in a broader learning context, making them suitable for use by other study programs.

Table 5.

Effectiveness of blended learning-based EWs for Islamic religious education students.

Rated aspect	Average Value	Category
Essay results	61,90%	Effective
	38,10%	Very effective
Average overall	80,23%	Effective

4. Discussion

This discussion interprets the significance of the findings from the development of blended learning-based EWs, which have undergone a series of trials. Overall, the EWs product was successfully developed using the 4-D procedure (Thiagarajan, 1974) and was declared highly valid by expert validators and highly practical by lecturers and students. The high level of validity demonstrates that the content (proposal writing material), media, and language aspects have met eligibility standards. Satisfactory practicality confirms that EWs, as a form of adaptation of digital learning innovation (Widaningsih, 2019), has been effectively integrated into the Blended Learning model, offering flexibility and interactivity (Tanjung, 2021).

This study provides a comprehensive understanding of the development and implementation of blended learning-based Electronic Worksheets (EWs) for students' writing skills by interpreting the findings through the perspectives of grounded theory and middle-range theory. From a grounded theory standpoint, patterns emerging from the needs analysis revealed that students experienced persistent difficulties in proposal writing, particularly in organizing ideas, integrating references, and applying academic conventions. These difficulties were not merely individual deficiencies but were systematically linked to instructional practices that relied heavily on conventional face-to-face discussions and static printed worksheets. This empirical evidence supports recent findings that writing problems in higher education often stem from misalignment between instructional design and students' actual learning needs in digital learning contexts (Ruan, 2024; Wang, 2025). Consequently, the need for a flexible, process-oriented, and technology-integrated learning tool became a central category that guided the design and development of the EWs.

At the design stage, the formulation of learning outcomes, structured writing materials, and process-based assessment reflected a middle-range theoretical framework grounded in constructivist learning and self-regulated learning theories. Middle-range theory is particularly relevant because it bridges abstract learning theories and practical instructional design. The writing process approach embedded in the EWs operationalizes constructivist principles by allowing students to construct knowledge through iterative drafting, feedback, and revision rather than focusing solely on grammatical accuracy. This finding aligns with

contemporary research indicating that process-oriented digital writing tools significantly enhance students' ability to express ideas coherently and critically (Sumbayak et al., 2024; Wang, 2025). Thus, the design of the EWs represents a theoretically informed response to empirically identified learning problems.

The development stage further strengthened the theoretical-practical linkage. The high validity scores from media, material, and language experts indicate that the EWs met essential instructional quality standards, supporting the argument that well-designed digital worksheets can function as effective mediating tools between content knowledge and learner engagement. From a grounded theory perspective, expert feedback functioned as constant comparative data that refined the product iteratively, ensuring alignment between theoretical intentions and practical usability. This process corroborates previous studies emphasizing that iterative expert validation is critical for ensuring the pedagogical soundness of digital learning materials (Novitasari, I., & Yonata, 2021; Winarti, et al., 2024).

The practicality test results demonstrate that both lecturers and students perceived the EWs as easy to use and supportive of blended learning activities. This finding supports middle-range theories of technology acceptance in education, which posit that perceived ease of use and usefulness are decisive factors in successful instructional technology adoption. The integration of clear usage instructions and structured tasks reduced cognitive load and facilitated autonomous learning, which is essential in blended learning environments (Ruan, 2024). Therefore, the practicality of the EWs confirms their functional role as an instructional scaffold rather than a mere digital supplement.

The effectiveness test provides the strongest empirical support for the developed product. The significant improvement in students' writing scores indicates that the blended learning-based EWs effectively enhanced students' writing competencies. From a grounded theory perspective, this improvement can be traced back to the alignment between identified needs, instructional design, and assessment strategies. From a middle-range theoretical lens, the results support the claim that blended, process-oriented writing instruction fosters deeper engagement and higher-order thinking, particularly in academic writing contexts (Wang, 2025). These findings reinforce prior empirical evidence that blended learning environments are particularly effective for skill-based courses requiring sustained practice and feedback (Sumbayak, et al., 2024).

Regarding product advantages, the developed EWs offer several strengths: flexibility in learning time and space, structured guidance aligned with the writing process, and transparent assessment criteria that support formative feedback. These features position the EWs as a practical solution for improving scientific writing skills in higher education, particularly in teacher education programs. However, challenges in implementation were also identified, including varying

levels of students' digital literacy and the increased workload for lecturers in providing feedback. To address these challenges, this study suggests providing preliminary digital literacy training for students and utilizing peer-feedback strategies to complement lecturer feedback, as recommended in recent blended learning research (Ruan, 2024).

For practitioners wishing to develop or use similar products, several practical guidelines can be derived from this study: conducting a thorough needs analysis, integrating writing process stages into digital worksheets, ensuring alignment between learning outcomes and assessment, and implementing iterative validation involving experts and users. Despite its contributions, this study has limitations. The sample was limited to specific study programs within one institution, which may affect generalizability. Future research should involve larger and more diverse samples and explore the integration of EWs with emerging technologies such as AI-assisted feedback to further enhance writing instruction.

The most crucial finding lies in the post-test results of students' essay writing skills, which showed an average score in the very effective category after the treatment. These results imply that the Blended Learning-based EWs effectively facilitate students' mastery of structured proposal writing competencies, in line with the principle that writing is a skill for expressing ideas that requires organized thinking.

Electronic Worksheet (EWS) with its adaptive nature (Novelti, 2023), specifically succeeded in shifting the focus from minor grammatical issues to the production of complete ideas (Abidin et al., 2018). This is an important contribution of this study as an empirical solution to improve scientific writing skills in higher education. This shift aligns with recent findings that writing instruction in the digital age should prioritize global coherence and argumentative structure over isolated linguistic accuracy (Apridayani, et al., 2024). Furthermore, the integration of EWs within a blended learning framework facilitates "scaffolding," where digital tools act as mediators that bridge the gap between students' current abilities and their academic targets (Ruan, 2024; Wang, 2025). which is an important contribution of this study as an empirical solution to improve scientific writing skills in higher education.

From the perspective of Digital Media Theory, the EWs developed in this study function as a "technological affordance" that promotes self-regulated learning. As noted by Zahari et al. (2025), digital environments provide the necessary flexibility and immediate feedback loops that are crucial for mastering productive competencies like writing. The interactivity of EWs allows students to engage in iterative drafting—a process essential for scientific writing that conventional, static media often fail to support. By leveraging digital media, this study demonstrates that instructional tools can transcend physical limitations,

offering a more inclusive and sustainable approach to quality education in line with SDG 4 (Septiari, 2025). However, this study has limitations because the trial subjects were limited to the PGMI Study Program at UIN Imam Bonjol Padang. For future research, it is recommended to conduct trials on a wider scale and develop EWs for other types of scientific writing skills to expand the product's contribution.

5. Conclusion

This research conceptually proves that digital teaching material innovation, specifically Blended Learning-based EWs, is a valid and practical solution to bridge the gap between the demands of scientific writing skills in higher education and the low competency experienced by students. Through a systematic development procedure, this EWs product has been thoroughly tested for its feasibility by experts, both in terms of material, media, and language, and has been well received by field users (lecturers and students). Conceptually, the successful implementation of this EWs confirms the principle that a learning model that combines online flexibility with face-to-face interaction is able to provide an adaptive and interactive learning environment, which is very necessary for practice-based courses such as Research Methodology.

The crucial impact of this research is the finding that treatment with EWs resulted in an average score of 85.71% in essay writing skills in students, which implicitly shows the effectiveness of EWs in facilitating PGMI students to master the skills of expressing scientific ideas in a structured manner. This adds insight by providing a tested learning model to address specific problems in scientific writing skills in the context of higher education. This developed EWs offers a sustainable conceptual contribution, namely that carefully and specifically designed technology integration can improve the quality of students' academic competence.

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