Open access: https://journal.icpa-banyuwangi.ac.id/index.php/skyhawk

SKYHAWK: Jurnal Aviasi Indonesia
Volume. 6, Number. 1, 2026, pp. 618-627

P-ISSN: 2745-6102
E-ISSN: 2776-3854

Blended Learning as a Supporter of the Synergy of Academic Guidance and AI Technology in Scientific Writing

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ARTICLE INFO

Article History

Received: 08 Januari 2026
Revised: 09 Februari 2026
Accepted: 27 Maret 2026

Keywords

Blended learning, Academic supervision, Artificial Intelligence.

ABSTRACT

This study examined students' perceptions of the integration of blended learning, academic supervision, and artificial intelligence (AI) technologies in the scientific writing process. Employing a qualitative research design, data were collected through semi-structured interviews, observations, and document analysis involving undergraduate students who had participated in academic writing supervision and used AI-based tools. The findings showed that blended learning provided greater flexibility, enhanced self-regulated learning, and improved students' engagement in academic writing. Students reported that AI tools such as ChatGPT and Grammarly offered instant feedback, assisted in generating ideas, and supported linguistic accuracy, although concerns regarding originality and the need for critical evaluation of AI-generated outputs remained. The integration of AI and blended learning was found to be effective only when it was accompanied by continuous academic supervision. This study concluded that the synergy of the three components created an adaptive and supportive learning ecosystem that significantly improved the structure, coherence, and analytical depth of students' scientific papers.

1. INTRODUCTION

The ability to write scientific articles has become a fundamental competency for students in the 21st century, as both academic and professional environments increasingly require evidence-based written communication. In the context of higher education, scientific writing is not merely a technical skill, but a critical academic practice that reflects students' ability to think analytically,

construct logical arguments, and engage with scholarly discourse. Effective writing requires well-planned strategies and structured processes to ensure clarity, coherence, and academic rigor (Seyri & Ghiasvand, 2025). In a rapidly evolving knowledge ecosystem, students are expected not only to comprehend subject matter, but also to transform their understanding into scientifically grounded ideas presented through systematic writing. Moreover, scientific writing functions as a medium for documenting knowledge, validating arguments, and disseminating research findings to a broader academic community. Therefore, proficiency in scientific writing is a key indicator of academic literacy and an essential requirement for students' active participation in the advancement of science.

Apart from being a communication skill, scientific writing is also a learning medium that guides students to develop high-level thinking skills such as analysis, synthesis, and evaluation. High-level thinking skills need to be stimulated with learning strategies that can motivate students (Soltis et al., 2015). The writing process forces students to read critically, understand theoretical frameworks, identify knowledge gaps, and connect academic concepts in a coherent format. Therefore, this skill plays a big role in building students' intellectual power and preparing them to continue their studies, conduct research, and work in fields that require professional literacy skills.

Although scientific writing is essential, many college students face substantial challenges in the process of drafting it. One of the biggest obstacles is the difficulty in finding and formulating relevant and original research ideas. The lack of experience reading scientific articles makes it difficult for students to understand how to assess the relevance of topics and place them in a broader research context. This condition causes the initial process of writing to be long and full of uncertainty.

Academic guidance plays a crucial role in helping students overcome various challenges of scientific writing. Through direct assistance, lecturers or supervisors can provide methodological direction, clarification of concepts, and feedback needed to improve the quality of writing. Theoretically, the success of the guidance process is greatly influenced by the interactional and dialogical approach between lecturers and students. Reflective interactions encourage students to express personal meaning and build self-understanding, which is an important prerequisite for a meaningful learning process (Sucylaite, 2012). Supervisors help students identify and develop research ideas, understand scientific writing standards, and direct the reasoning process to be more systematic and analytical. Without adequate guidance, students can potentially get lost in the complex and exhausting writing process.

The effectiveness of academic guidance increasingly depends on the ability of the supervisor to adjust the approach to the needs of students. Each student has a different learning style, initial ability level, and motivation. Therefore, the supervisor needs to implement a guidance personalization strategy so that the process is more relevant and meaningful. A responsive and adaptive approach has been proven to improve the quality of writing results, speed up the writing process, and build more mature scientific literacy competencies for students.

In the last decade, blended learning has evolved as a learning model that combines face-to-face interaction and digital technology to create a more flexible and dynamic learning experience. Adaptive instructional design in blended learning can improve student engagement and self-regulation (Zou & Jiang, 2025). This model allows students to utilize digital materials, online discussion forums, and direct consultations in one integrated learning ecosystem. This combination not only expands access to learning resources, but also allows for a learning rhythm that is more

suited to the needs of students. The application of blended learning has become a global trend in higher education because it can improve effectiveness, efficiency, and accessibility.

In addition to increasing flexibility, blended learning also contributes to increased student engagement in the learning process. Materials, video tutorials, writing guides, and other digital resources can be accessed at any time, providing space for students to learn independently. Meanwhile, face-to-face interactions remain a space for clarifying complex concepts, critical discussions, and providing personalized guidance. The synergy of these two modes creates a more adaptive and comprehensive learning environment to support scientific writing.

The development of artificial intelligence (AI) technology has created significant changes in academic writing practices. AI-based applications such as ChatGPT, Grammarly, and various natural language processing tools provide support for students in structuring writing, improving grammar, and generating initial ideas. AI's ability to provide instant feedback makes this technology a relevant tool to improve the efficiency of the writing process. Its wider use shows a paradigm shift in the way students develop academic literacy.

The scientific writing guidance process implemented in many universities continues to face structural and pedagogical challenges, particularly in relation to limited time, lack of personalized supervision, and restricted access to timely feedback. In practice, supervisors are often responsible for a large number of students, which reduces opportunities for intensive and continuous mentoring. Consequently, the consultation process becomes less effective, and students receive insufficient support to develop their scientific writing progressively. Although previous studies have highlighted the importance of mentorship in fostering intrinsic motivation and strengthening students' academic commitment (Alchin et al., 2025), most guidance practices remain conventional and have not fully integrated adaptive learning approaches or technological support systems. Furthermore, existing models tend to apply a one-size-fits-all approach, overlooking students' individual needs and learning differences. At the same time, access to immediate and iterative feedback—an essential component in the academic writing revision process—remains limited. This gap indicates a lack of integrative approaches that combine flexible learning environments, personalized academic supervision, and technology-assisted feedback mechanisms. As a result, many students experience stagnation in developing their scientific articles and struggle to meet expected academic standards.

This study aims to comprehensively describe students' perceptions of the application of blended learning in the scientific writing guidance process, especially how the blended learning model facilitates interaction, flexibility, and access to learning resources. In addition, this study analyzes the use of artificial intelligence (AI) technology as an increasingly common tool used by students in compiling scientific articles, including how applications such as ChatGPT, Grammarly, and other AI-based language tools are utilized in the stages of idea exploration, argument structuring, and writing revision. Furthermore, the study identifies how the synergy between academic guidance, blended learning, and AI technology contributes to improving the overall quality of scientific writing. By examining students' direct experiences, this research is expected to produce a deep understanding of integrative practices that can be used as a more effective and contextual learning model in higher education environments.

A review of the literature shows that most previous research has focused on the use of AI technology in academic writing, but rarely relates it to the context of scientific guidance conducted by supervisors. In addition, a number of studies on blended learning have focused more on improving

general learning outcomes, rather than specifically examining students' scientific writing processes or their relationship to academic guidance. The research gap is even more apparent when reviewing the literature that combines all three elements at once—academic guidance, blended learning, and AI technology—which is still very limited. Most studies only highlight the technical aspects of technology or the effectiveness of learning platforms, without analyzing how students as active users interpret and feel these integrative experiences in the process of scientific writing guidance. This opens up space for more holistic and experience-centered research.

The uniqueness of this research lies in its holistic approach by integrating three key components in the modern learning ecosystem: academic guidance, blended learning, and AI technology. This approach not only fills in the gaps in the literature, but also provides an empirical perspective that is relevant to current educational practices. The focus on student perceptions offers a perspective that has rarely been used in previous research, so that it can provide a more authentic picture of the effectiveness and challenges of technology integration in the scientific writing guidance process. Thus, this research makes a significant contribution to the development of technology-based learning strategies, especially in designing academic guidance approaches that are responsive, adaptive, and in accordance with the needs of the digital era.

In addition to contributing new concepts in academic studies, this research has strong practical relevance in an effort to improve the quality of scientific writing guidance in higher education. The integration of AI literacy in the guidance process can ensure that technology is used ethically, critically, and productively, so that it is able to support the development of students' thinking skills without replacing essential intellectual processes. The findings of this research are expected to be the basis for the development of digital curriculum policies, guidelines for the use of AI in scientific writing, and a more structured academic guidance strategy. The urgency of research is even higher in the post-pandemic era, when digital transformation in education is taking place faster and demands more innovative and sustainable learning models. Thus, this research is present as a strategic response to the changing landscape of modern higher education.

2. METHODS

This study employed a qualitative research design to explore students' perceptions and experiences regarding the integration of blended learning, academic supervision, and artificial intelligence (AI) in the scientific writing process. A qualitative approach was chosen to gain an in-depth understanding of participants' perspectives, learning processes, and interactions within a natural academic context.

Participants and Data Sources

The participants of this study were undergraduate students from the Islamic Religious Education program who met specific inclusion criteria: (1) active students, (2) had participated in scientific writing supervision, (3) had experience using AI-based tools such as ChatGPT or Grammarly, and (4) were willing to be involved in interviews and observations. The data consisted of verbal and textual information obtained from interview transcripts, observation notes, and student writing documents (drafts and revisions).

Data Collection Techniques

Data were collected through multiple techniques to ensure data richness and triangulation. First, semi-structured interviews were conducted to explore students' perceptions of blended

learning, AI use, and supervision processes. Second, observations were carried out during both face-to-face and online learning sessions to capture interaction patterns, student engagement, and the use of digital tools. Third, document analysis was conducted on students' writing drafts, revision histories, and feedback records (both from supervisors and AI tools) to identify changes in structure, coherence, and analytical depth.

Data Analysis Procedure

The data analysis followed an interactive and iterative process based on thematic analysis. The stages included:

1. Data Reduction and Organization

   All collected data (interview transcripts, observation notes, and documents) were transcribed, organized, and coded. Initial coding focused on key themes such as learning flexibility, AI utilization, feedback mechanisms, supervision effectiveness, and writing development.

2. Data Categorization and Thematic Development

   Codes were grouped into broader categories representing patterns found in the data, such as students' perceptions of blended learning, the role of AI in writing, collaborative learning experiences, and challenges in digital literacy. These categories were then developed into main themes reflecting the integration of blended learning, AI, and academic supervision.

3. Data Display and Interpretation

   The categorized data were systematically presented in descriptive and tabular forms to facilitate interpretation. Cross-data analysis was conducted to compare findings from interviews, observations, and documents, particularly to examine consistency between students' perceptions and actual improvements in writing quality (e.g., structure, coherence, and argumentation).

4. Triangulation and Validation

   To ensure credibility, data triangulation was applied by comparing multiple data sources (interviews, observations, and documents) and perspectives. Member checking was also conducted by confirming key findings with participants to ensure accuracy of interpretation.

5. Conclusion Drawing

   Conclusions were drawn by synthesizing all identified themes, focusing on how the synergy between blended learning, AI, and academic supervision influenced students' scientific writing processes and outcomes. The analysis emphasized the relationship between learning experiences, feedback mechanisms, and improvements in writing quality.

3. RESULTS

The results of the study show that students have a positive perception of the use of blended learning in the scientific writing guidance process. The majority of informants stated that the combination of face-to-face sessions and online learning activities provided flexibility that they did not get in conventional tutoring models. It is undeniable that in learning, the effectiveness of blended learning is undoubted (Li et al., 2026). Students feel more free to manage their study time, access materials, and prepare drafts before the next tutoring session, so that the writing process becomes more directed and structured.

These findings are in line with the literature that explains that blended learning can increase learning independence and encourage students to play a more active role in their academic process. In the context of scientific writing, this flexibility provides a wider space for reflection, so that

students can process supervisor feedback independently before revising. The pedagogical implications of this condition are the improvement of the quality of the written manuscript and the efficiency of the guidance time. Although teachers should also not be left behind and continue to learn to optimize blended learning (Oyelade et al., 2025).

The research also found that students found that digital features such as online discussion rooms, uploading drafts, and access to writing guide materials were very helpful in understanding scientific writing standards. They stated that the guidance carried out Through the digital platform, it provides the opportunity to repeat the material, read instructions independently, and compare available writing examples.

In terms of experience, students feel that blended learning creates a more collaborative learning environment. They can discuss not only with the supervisor, but also with colleagues through group forums. These discussions enriched their understanding of the structure of scientific articles, the use of theories, and effective argumentation strategies.

Regarding the use of artificial intelligence (AI) technology, students admitted that they were very helpful, especially in preparing initial drafts, identifying research ideas, and improving grammar. Not only in Indonesia, but in all parts of the world, it is already literate about the benefits of AI for learning (Abdulkareem et al., 2024). AI technology also facilitates the process of exploring ideas through structure recommendations, examples of academic paragraphs, and relevant references that can be used as starting points.

Table 1. Findings on the Impact of Blended Learning and AI on Students' Scientific Writing Process

No	Aspect	Description	Implication
1	Perception of Blended Learning	Students have a positive perception of the use of blended learning in scientific writing guidance	Enhances students' acceptance and readiness for technology-based learning
2	Learning Flexibility	The combination of face-to-face and online learning provides flexibility in time management, access to materials, and draft preparation	Makes the writing process more structured, directed, and efficient
3	Learning Autonomy	Blended learning encourages students to be more independent in managing their learning and revising their writing	Improves reflective ability and academic responsibility
4	Understanding of Scientific Writing	Digital features (online discussions, draft submission, and guide materials) help students understand scientific writing standards	Improves understanding of article structure and academic conventions
5	Collaborative Environment	Students can interact and discuss with supervisors and peers through online forums	Enhances more intensive and inclusive academic interaction
6	Guidance Effectiveness	The supervision process becomes more efficient as students can prepare drafts in advance	Optimizes and improves the productivity of supervision time
7	Use of Digital Technology	Digital platforms allow repeated access to materials, independent reading of instructions, and comparison of writing examples	Supports continuous learning and deeper understanding
8	Use of Artificial Intelligence (AI)	AI tools (e.g., ChatGPT, Grammarly) assist in drafting, generating research ideas, and improving grammar	Enhances writing quality and efficiency in the writing process
9	Idea and Structure Development	AI provides recommendations for structur	

4. DISCUSSION

Nevertheless, several students recognized that the use of AI without proper academic guidance may compromise the originality of their writing. Some participants reported difficulties in distinguishing between their own ideas and those generated by AI tools (Minsky, 2007), (Garbuio & Lin, 2021). This finding indicates that AI literacy extends beyond technical proficiency, encompassing the ability to critically evaluate, filter, and adapt AI-generated outputs. From a theoretical perspective, this issue can be understood through the lens of metacognitive regulation, where learners are expected to monitor and control their cognitive processes. The inability to differentiate between self-generated and AI-generated ideas suggests a gap in students' metacognitive awareness, potentially leading to cognitive dependency on technology rather than meaningful knowledge construction.

Academic supervisors play a pivotal role in ensuring that AI usage aligns with academic ethical standards (Thottoli et al., 2024), (Gulumbe et al., 2025). Students noted that supervisors provided explicit guidance regarding the boundaries of AI use, particularly in relation to plagiarism, citation practices, and academic integrity. Such guidance encourages students to adopt a more cautious and critical stance, positioning AI as a supportive tool rather than a replacement for their own scientific reasoning. This aligns with Vygotsky's concept of the Zone of Proximal Development (ZPD), where the supervisor functions as a mediator who scaffolds students' learning and ensures that technological assistance does not replace cognitive effort. In this context, supervision acts as a regulatory mechanism that maintains the balance between external support and internal intellectual development.

Furthermore, several students reported increased confidence in their writing as a result of receiving iterative feedback from both AI tools and academic mentors. While AI offers immediate feedback on technical aspects such as grammar and structure, supervisors contribute more comprehensive evaluations related to methodology, argumentation, and scientific content (Dzogovic et al., 2024), (Papaneophytou & Nicolaou, 2025). This complementary feedback mechanism reflects the principles of formative assessment, where continuous and multi-source feedback supports deeper learning and skill development. The interaction between automated and human feedback can also be interpreted as a form of cognitive apprenticeship, in which learners gradually develop expertise through guided practice and reflective revision. Consequently, this dual feedback system not only accelerates improvements in writing quality but also strengthens students' critical thinking, analytical reasoning, and academic autonomy.

The findings confirm that blended learning creates an ideal pedagogical context to elaborate on the potential of AI without neglecting academic values (Sanders & Mukhari, 2024), (Mulenga & Shilongo, 2025). Blended Learning has a great effect on Increasing Achievement Motivation Student Academics (Bani et al., 2025). This blended model allows students to conduct self-exploration before consulting with their supervisors, making mentoring sessions more productive because students already have more mature drafts to review. Although there are also students who are less motivated in the activities of setting up mixed learning.

In terms of challenges, some students still experience limitations in digital literacy, especially in understanding advanced features of learning platforms and AI (Zhang & Zhang, 2024), (Chiu et al., 2024). There are also students who feel overwhelmed because they have to combine various digital tools for one scientific writing assignment. This is an indicator that increasing digital literacy needs

to be done systematically in the curriculum. Digital literacy is very important in various fields. Its existence is undeniably always co-existing with areas in human life today (Di & Liu, 2025).

Supervisors also face similar challenges, especially in adapting their guidance style to a blended learning model (Shah et al., 2024), (Dyrstad et al., 2024). Some supervisors are still more comfortable providing face-to-face guidance and are not used to providing structured feedback through digital platforms. This condition shows the importance of training for lecturers to optimize the implementation of blended learning.

Overall, students assessed that the use of AI in scientific writing tutoring provides a more personalized learning experience. AI can act as an additional tutor that helps students understand technical weaknesses in their writing (Al-Motrif et al., 2025), (Walker, 2019). Meanwhile, the supervisor remains the academic authority that ensures the scientific validity and relevance of the material.

The synergy between supervisors, AI, and blended learning results in a learning model that is adaptive, responsive, and oriented to student needs. These three elements complement each other: AI speeds up the technical revision process, blended learning provides flexible space for consultation, and mentors provide in-depth conceptual and methodological direction (Kumar et al., 2021), (Fradalé, 2024).

In the context of improving the quality of scientific writing, students stated that these three elements help them understand the structure of articles, improve the quality of arguments, and develop reasoning skills. The final results of student writing generally show improvements in the aspects of cohesion, coherence, and depth of analysis after going through the synergistic process.

The discussion of these findings shows that the integration of AI in the blended learning framework cannot run optimally without academic guidance. AI is not able to fully assess the context of the research, the relevance of the theory, or the quality of the argument. Therefore, the supervisor remains a key element that provides meaning and direction in the scientific writing process.

These findings also indicate the need for higher education institutions to develop clearer policies regarding the use of AI in academic writing. This policy is important to ensure that the use of technology runs according to the principles of academic integrity and does not neglect students' cognitive processes.

This study confirms that students' understanding of the role of AI, blended learning, and academic guidance is influenced by their respective learning experiences. Therefore, a personalized approach is needed in scientific writing guidance in order to accommodate different needs, motivations, and levels of digital literacy.

Overall, this study concludes that the synergy between blended learning, academic guidance, and AI technology has a significant influence in improving the quality of students' scientific writing. This integrative model provides flexible learning spaces, prompt technical support, and comprehensive scientific direction. Thus, the results of this research can be used as a basis for designing a scientific writing guidance model that is more effective, adaptive, and in accordance with the demands of modern higher education.

5. CONCLUSION

This study shows that the synergy between blended learning, academic guidance, and artificial intelligence (AI) technology forms an effective learning support model in improving the quality of

students' scientific writing. Blended learning provides flexibility, accessibility, and space for reflection that can't be obtained through conventional guidance, while AI acts as an instant tool that accelerates technical revision and exploration of ideas. Academic guidance remains the main foundation that ensures the direction of writing, the validity of scientific substance, and the strengthening of students' critical thinking capacity. The integration of these three elements results in a learning experience that is more adaptive, personalized, and responsive to the needs of students, thereby encouraging increased cohesion, coherence, and depth of analysis in the scientific articles they write.

The urgency of this research's findings lies in the need for higher education institutions to develop writing guidance models that no longer rely on traditional practices, but accommodate digital dynamics and the development of AI technology. The increasing use of AI and digital learning platforms demands clearer academic policies regarding ethics, digital literacy, and limits on the use of technology, while also requiring training for lecturers to be able to optimizing blended learning approaches. Thus, this research makes an important contribution to the formulation of new pedagogical strategies that are more relevant to the post-pandemic educational context, accelerating digital transformation, and ensuring that technological developments are truly used to strengthen, rather than replace, students' scientific learning processes.

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