



Developing AI-Based Academic Writing Materials for EFL Students

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Abstract

The purpose of this study was to analyse how AI can be effectively utilized in the process of developing academic writing materials, which AI features are most suitable for integration, and evaluate the extent to which AI-based academic writing materials improve students' academic writing skills. Specifically, the study aimed to develop AI-integrated academic writing materials for EFL students using the ADDIE model. This Research and Development (R&D) study was carried out in an Academic Writing course at the Faculty of Teacher Training and Education, Universitas PGRI Madiun. Data were collected through a needs analysis, expert validation, questionnaires, interviews, and writing assessments. The needs analysis showed that students wanted concise, practical materials that incorporate AI tools to help with grammar, vocabulary use, and coherence. The resulting materials were then evaluated by experts and received an overall score of 88.6%, placing them in the "very good" category. When implemented in the classroom, the materials led to a significant improvement in students' writing skills, as indicated by the differences between pre-test and post-test scores. Questionnaire results showed that students viewed the materials positively, especially in terms of usefulness, ease of access, and their ability to increase motivation. Interview data also revealed that students became more aware of their errors, felt more motivated, and appreciated the complementary relationship between teacher guidance and AI tools. Overall, the study concludes that integrating AI into academic writing materials is effective and can support the development of students' writing proficiency.

Keywords: Artificial Intelligence, Academic Writing, AI Writing Tools, Educational Technology

1. Introduction

Academic writing remains as an essential skill for both students and academics in the rapidly changing landscape of higher education. It is not only a question of syntax and language; it is a complex process involving debate, research synthesis, critical thinking, and discipline-specific customs. Nevertheless, despite its significance, teaching academic writing still presents many difficulties for both teachers and students (Oshima & Hogue, 2007). Particularly in multilingual and multicultural academic settings, traditional teaching approaches frequently find it difficult to meet the varied backgrounds, skill levels, and learning requirements of students (Ansary, 2022). The use of technology, such as artificial intelligence (AI), has become a revolutionary force in instructional design as educational institutions throughout the world look for creative ways to increase student engagement and improve writing results.

Artificial intelligence has evolved from sci-fi idea to a useful instrument that is influencing how knowledge is

created, distributed, and accessed. AI-powered technologies like writing assistants, grammar checkers, paraphrase engines, and automated feedback are becoming standard in the field of language instruction (Monika et al., 2023). As students work through challenging writing assignments, these tools can offer scaffolding, individualised learning paths, and immediate feedback (Mujahidin et al., 2024). Darwin et al. (2024) claim that while AI tools have helped students increase their writing output, they have also assisted educators in recognising potential shifts in writing style and argument complexity brought by AI participation. Although artificial intelligence (AI) technologies are becoming more popular in classrooms, little is known about how to include them into organised, pedagogically sound academic writing components. AI technologies should be seen as a component of a broader educational ecosystem that incorporates student autonomy and instructor participation rather than only as technical helpers, as Sasaki (in Monika et al., 2023) points out. Current implementations frequently use generic AI application without integrating them completely into instructional design that is based on curricula. Intentionally creating AI-supported resources that meaningfully direct and enhance academic writing practice is a crucial step that instructors can go beyond just adopting new tools.

The relationship between academic writing and artificial intelligence (AI) has been the subject of more recent research, which has highlighted both the educational potential and related drawbacks of AI. A qualitative case study on the opinions of EFL undergraduate students on the use of ChatGPT in academic writing was carried out by Artiana & Fakhurrriana (2024). The researchers discovered that although students appreciated the tool's assistance with idea production, grammatical correction, and feedback, they still had reservations about its over-reliance and lack of human-like contextual knowledge. In a more comprehensive analysis, Khalifa & Albadawy (2024) have conducted a systematic evaluation that identified six key areas where AI supports academic writing and research, from content structuring and idea generation to publication preparation and ethical compliance. The researchers underlined that while AI improves organisation and productivity, its use must be weighed against human judgement in order to uphold ethical norms. The use of AI-supported writing tools by German university students was also examined by Schmohl et al. (2020), who showed how these tools were crucial for providing scaffolding for those with little access to supervision. However, it also draws attention to AI's shortcomings in expressing deeper semantic meaning and rhetorical complexity, two crucial components of academic writing growth.

More critically, Aljuaid (2024) examined the benefits and drawbacks of AI in educational settings, coming to the conclusion that although AI can be useful for correcting grammar and syntax, it is not very effective at fostering higher-order abilities like creativity and critical thinking. It is suggested an integrated educational approach in which artificial intelligence enhance education rather than takes its place. In support of this, Song & Song (2023) conduct a mixed-methods study which has found that academic writing abilities and motivation among EFL students were greatly enhanced by ChatGPT assisted instruction. The researchers point out that by offering prompt feedback and encouraging self-revision, AI acted as a "virtual peer," particularly in a social constructivist learning setting. When combined, these studies present a strong argument for incorporating AI into academic writing instruction, but they also urge the development of careful, theory-based frameworks to handle its drawbacks, moral dilemmas, and the requirement for genuine student participation.

Furthermore, the use of AI in academic writing training needs to be carefully considered in context with larger social, ethical, and educational contexts. Pakkala (2025) asserts that AI-supported systems raise moral and scholarly issues, especially with relation to authorship, responsibility, and openness in student writing practices. The results of AI-enhanced learning environments are influenced by factors including digital literacy, algorithmic bias, data privacy, and equality of access. According to Kholis et al. (2024), there are differences in participation and performance when using AI-powered academic writing tools since students from less technologically literate backgrounds encounter additional difficulties. Additionally, Octaberlina et al. (2024) warn that over-reliance on AI technologies may undermine critical thinking, inhibit deep involvement, and reduce originality in writing activities. Mujahidin et al., (2024) stress that AI has to be incorporated into instructional practices that support academic integrity and encourage reflective practice in order to avoid this. In order to make sure that AI enhances rather than replaces the educational process for students yet Werdiningsih et al. (2024) also advocate for structured supervision and instructor engagement when incorporating AI into classroom settings.

The following is how the researchers formulate the problems in light of the research background: (1) How can AI be effectively utilized in the process of developing academic writing materials? (2) What AI features are suitable for integration into academic writing materials? (3) To what extent do AI-based academic writing materials improve students' academic writing skills?

Furthermore, the research is guided by three main objectives: (1) to analyse how AI can be effectively utilized in the process of developing academic writing materials, (2) to identify the AI features that are most suitable for integration

into such materials, and (3) to evaluate the extent to which AI-based academic writing materials improve students' academic writing skills.

2. Methodology

2.1 Research Design

This study used a Research and Development (R&D) design to develop, validate, and evaluate AI-based academic writing resources for EFL university students. The study's framework was the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). The ADDIE framework was selected because it provides a systematic and continuous method that ensures a connection between technology integration, user demands, and instructional goals.

2.2 Research Setting and Participants

The study was carried out in the English Education Department at Universitas PGRI Madiun during the fifth semester of the 2025 academic year. The participants consisted of 32 undergraduate students enrolled in the Academic Writing course. One teacher is both an observer and a facilitator for the course. They were selected through purposive sampling based on specific criteria: (1) they had previously completed at least one academic writing essay, (2) they demonstrated intermediate to upper-intermediate English proficiency as indicated by their prior course grades and writing performance, and (3) they had limited using AI-assisted writing tools. One instructor served as both an observer and facilitator throughout the study to ensure consistent instructional procedures. All participants were informed of the study's purpose, assured of confidentiality, and proved written informed consent before participants.

2.3 Data Types and Sources

A mixed-methods approach was employed, integrating quantitative and qualitative data to enhance validity via triangulation.

Table 1. Data Collection

Data Type	Source	Instrument	Purpose
Quantitative	Students	Pre-test and Post-test	Measuring improvements in writing proficiency
Quantitative	Students	Questionnaire	Assessing satisfaction, usefulness, motivation
Qualitative	Students	Semi-structured interviews	Exploring learning experiences and perceptions

2.4 Research Procedure

ADDIE Model could be described in the following:

1. **Analysis:** Identification of students' writing requirements and technological ability via interviews.
2. **Design** involves the formulation of learning objectives, organization of modules, and creation of prototypes.
3. **Development** involves the creation of instructional materials that integrate artificial intelligence, followed by expert validation.
4. **Implementation:** A classroom trial was conducted with experimental and control groups.
5. **Evaluation** involves the assessment of both quantitative data, such as tests and questionnaires, and qualitative data, including interviews.

2.5 Research Instrument

There were three main approaches used as research instrument namely interviews writing tests, and a questionnaire. The instrument used in the need analysis was a needs questionnaire designed to evaluate students' perceptions of their academic writing challenges and resource needs. The questionnaire also explored students' preferences for technology-enhanced features in learning materials, such as AI-assisted writing tools, easy-to-understand AI content, engaging activities, digital templates, and multimedia design. Students were asked to fill out a 20-question. This helped identify practical and tech-integrated resources to better align with students' learning objectives and experiences.

Interviews were conducted with students to explore their specific academic writing needs and technological abilities, providing a foundation for developing appropriate instructional materials. Based on the analysis, learning objectives were carefully formulated, modules were organized systematically, and instructional prototypes were created,

ensuring a coherent structure for the educational content. Then, instructional materials incorporating artificial intelligence tools were developed, then reviewed and validated by experts to ensure quality, relevance, and alignment with educational goals.

The materials were tried out in a real classroom setting involving both experimental and control groups to test their effectiveness and usability in actual teaching conditions.

3. Data Analysis

The data analysis in this study employed a mixed-methods approach to thoroughly evaluate the effectiveness of AI-based academic writing materials for EFL students.

Quantitatively, students' writing performance was measured through pre-tests and post-tests, and their perceptions were gathered via a 20-item questionnaire focused on their academic writing challenges, resource needs, and preferences for AI-assisted learning tools. The quantitative data were analyzed using t-tests in SPSS 25, comparing scores between the experimental and control groups to determine if the AI-integrated materials led to statistically significant improvements.

Qualitatively, interviews with selected students were conducted to gather in-depth insights into their specific writing needs and technological abilities. These interviews supplemented the quantitative results, providing richer understanding of how students experienced and engaged with the AI tools and instructional materials.

This comprehensive analysis combined objective performance metrics with subjective student experiences, enabling a balanced evaluation of both the impact on writing skills and the usability and acceptance of AI-enhanced learning resources in the EFL context.

4. Result

The study involved **32 undergraduate students** enrolled in an Academic Writing course. Data were obtained through four principal instruments: a writing evaluation, a questionnaire, and semi-structured interviews.

4.1 Analysis

According to the results of the needs analysis, the academic writing course needs teaching resources that are more closely matched to the curriculum of the English Education Department. According to lecturers interviewed for the course, Oshima and Hogue's Writing Academic English is frequently used. This textbook, however, was considered to be long, less useful, and not entirely in line with the learning objectives for the semester. Numerous chapters were regarded uninteresting or unrelated to the students' actual experiences in the Indonesian environment, and many chapters could not be finished in a single semester. Further information on students' opinions of the writing course and their need for extra resources was revealed by the questionnaire findings.

Table 2. Analysis of Students Perception and Needs in Writing

Item Evaluated	Percentage	Interpretation
Students who feel writing is <i>not</i> difficult	58%	Majority feel confident in writing
Students who feel writing <i>is</i> difficult	42%	A considerable portion still struggle
Students who need a writing handout	91%	Strong need for additional materials
Students who think grammar is the hardest aspect	87%	Grammar remains the biggest challenge

The table 2 shows that just over half of the students (58%) considered writing to be manageable, whereas 42% found it to be challenging. A significant majority (91%) indicated that a dedicated handout would be beneficial for enhancing their learning in the writing course. Additionally, grammar emerged as the primary area of difficulty for students, with 87% indicating it as the most challenging aspect of writing. The findings indicate a necessity for instructional materials that provide explicit grammar explanations and focused practice corresponding to the writing topics addressed in the course.

While the current materials are viewed positively, numerous students proposed enhancements for future handouts. A significant number of individuals requested additional inserted technology including AI and exercises directly related to academic-writing tasks. This is consistent with the needs analysis findings, indicating that students would gain from instructional materials that are practical, succinct, and engaging.

Table.3 Students Preferences for AI Writing Handout

The handout should provide....	N
1. Access to AI-assisted writing tools (e.g., grammar checkers, paraphrasers)	14
2. AI-integrated material is easy to understand and follow	7
3. Use of AI tools makes the learning process more engaging	5
4. Digital templates or editable worksheets	4
5. Multimedia-based activities and attractive digital design	2
Total	32

The needs analysis findings for technology-enhanced materials indicate students' strong preference for integrating digital tools and AI-assisted features into writing handout. Table 3 illustrates the categories of technology-driven support anticipated by students.

The majority of students (14 out of 32) said that the handout should include access to AI-assisted writing tools, such as grammar checkers, paraphrase tools, or automated feedback platforms. This indicates that students perceive AI as a beneficial tool for enhancing precision and lucidity in their writing.

AI-integrated materials should be simple to comprehend and follow, according to a smaller but significant group of seven students. This underscores the necessity of creating materials that effectively direct learners in utilizing AI capabilities, hence preventing confusion and reducing cognitive overload.

A separate group of five students asserted that the utilization of AI tools enhances the learning experience, indicating that the incorporation of technology can elevate motivation and active involvement in writing tasks.

Four students indicated a need for digital templates or editable worksheets that they can fill out electronically. This signifies a preference for flexible, user-friendly formats that streamline drafting and revision processes.

Ultimately, two students articulated the necessity for multimedia-oriented activities and attractive pleasing digital design, highlighting the demand for visually engaging resources such as movies, animations, or interactive components that augment understanding and enjoyment.

4.2 Design

The design phase establishes the structural, pedagogical, and technological foundations for the final product. This phase utilizes insights from the needs analysis to develop a structured instructional blueprint that addresses learners' needs. This document details the systematic organization and conceptualization of each design component.

The design process initiated with the formulation of precise learning objectives that correspond to the competencies necessary for the Academic Writing course. The objectives were formulated utilizing Bloom's Taxonomy to systematically incorporate cognitive processes, including understanding, applying, analyzing, and producing academic texts. The learning objectives guided the selection of content and activities incorporated in the book.

The subsequent step involved structuring the scope and sequence of the material. This entailed structuring topics from fundamental to advanced writing skills in a scaffolded approach. The book is organized into units that start with foundational elements, including thesis statements, paragraph structure, and coherence, and advance to more complex tasks such as essay development, paraphrasing, referencing, and complete manuscript drafting. This systematic approach facilitated the gradual and logical development of learners' writing proficiency.

A crucial component of this design phase was the integration of AI and digital tools. The material integrated AI-supported functions, including grammar checkers, paraphrasing aids, and automated feedback tools, tailored to student needs. QR codes, hyperlinks, and digital prompts were integrated into the book to facilitate learner interaction with external technological resources. This design decision enhanced accessibility and facilitated active student engagement with real-time AI feedback during the revision process.

The design process subsequently involved the development of the instructional framework, encompassing model texts, guided practice, independent tasks, revision activities, and assessment rubrics. The structure of each unit adhered to a uniform sequence: introduction of the concept, provision of examples, engagement in practice activities, implementation of AI-assisted enhancement tasks, and completion of reflective exercises. This structure ensured consistency throughout the book while accommodating various learning requirements.

The design phase prioritized visual and multimedia elements to improve clarity and engagement. The material employed color-coded guides, diagrams, sample annotations, and visually engaging layouts to enhance readability. Multimedia elements, including video tutorials and interactive examples, were integrated via QR codes to support visual

and auditory learners and to enhance content beyond the printed medium.

4.3 *Development*

Materials were generated in interactive PDF. AI functionalities were integrated via connections and APIs. The Development Phase was a crucial step in turning the intended instructional design into a comprehensive, useful collection of academic writing resources enhanced with AI-supported features. This phase built on the established structure and pedagogical principles from the Design Phase, concentrating on the creation of initial drafts, the integration of technology, the refinement of activities, and the preparation of the prototype for expert evaluation and revision.

The initial comprehensive drafts of every unit were created to start the process. The drafts were rigorously crafted to align with the previously established learning objectives, ensuring that each chapter significantly contributed to the enhancement of students' academic writing skills. The material provided explicit explanations of essential writing concepts, annotated model texts, and sequential demonstrations of writing processes. Efforts were undertaken to present the material in clear language while preserving the academic rigor suitable for undergraduate students. Each chapter was structured to incrementally enhance the preceding one, embodying the scaffolded methodology specified in the design blueprint.

This development effort was characterized by the systematic integration of AI-assisted writing tools. The materials integrated technology into the learning experience through QR codes, hyperlinks, and digital prompts, enabling students to access grammar checkers, paraphrasing tools, and automated feedback platforms, rather than treating AI as an optional add-on. The incorporation of AI aimed not only to update the handout but also to foster significant interactions between students and technology. Consequently, certain activities necessitated that learners submit their drafts to AI tools, assess the provided feedback, and implement informed revisions. Explanatory notes were incorporated to assist students in critically interpreting AI feedback, ensuring that technology acted as a complement to human judgment rather than a replacement.

The development process included AI integration and the creation of diverse learning activities to address various instructional requirements. Each unit comprised guided practice tasks, independent writing assignments, and revision activities that integrated AI support. The exercises were intended to promote critical thinking, active participation, and numerous iterations of drafting and editing. Involving learners in various stages of writing facilitated enhanced comprehension and skill reinforcement. Editable templates were developed to assist students in efficiently composing paragraphs and essays, especially for those who favored digital formats.

The focus on multimedia and visual components was another important aspect of the development phase. The material's layout was crafted to enhance readability and engagement, incorporating diagrams, flowcharts, and color-coded guides to elucidate the structure of academic texts. Multimedia supplements, including short video tutorials accessible through QR codes, were incorporated to accommodate visual and auditory learners and to offer further clarification beyond the printed material. This design decision facilitated the appeal of the material to various learning preferences while ensuring clarity was consistently upheld.

Following the development of the individual components, they were integrated into a cohesive prototype version of the handout. The prototype comprised a complete set of units, assessment rubrics aligned with IELTS descriptors, sample writings, AI-integrated tasks, and digital templates. The prototype was subsequently submitted to three expert validators with specializations in TEFL and instructional technology.

The experts assessed the content, organization, clarity, relevance of AI integration, and overall usability. The evaluation yielded an average score of 88.6%, categorizing the material as "very good." Revisions were implemented to enhance explanations, clarify instructions, streamline visuals, and improve the alignment between activities and learning outcomes based on their suggestions.

The revisions resulted in a refined, interactive, and pedagogically sound academic writing resource that combines contemporary AI tools with conventional writing instruction. The Development Phase effectively converted design concepts into a practical, engaging, and validated resource suitable for classroom implementation.

The development of prototype materials constituted the initial version of each unit. The prototypes comprised sample texts, AI-integrated assignments, editable worksheets, and sequential writing guides. These documents functioned as preliminary drafts to be assessed by specialists and improved according to their feedback. The following is the evaluation from the experts according to the design phase.

Table 4. Expert Validation Results of the Material Design

Evaluation Aspect	Expert 1 (%)	Expert 2 (%)	Average (%)	Category
Content Design	89	91	90	Very Good
Activity Design	86	88	87	Very Good
Integration of AI Tools	93	91	92	Very Good
Clarity of Instructions	85	87	86	Very Good
Visual and Layout Design	87	89	88	Very Good
Overall Score	88	89	88.6	Very Good

The AI-integrated academic writing tools were assessed by two qualified validators with expertise in instructional design and English Language Teaching (ELT). The evaluation concentrated on assessing the quality, clarity, and feasibility of the material's design prior to the full development stage. The experts evaluated various elements, such as content structure, AI tool integration, instructional alignment, visual layout, and the appropriateness of activities for undergraduate EFL learners.

Both experts employed a structured validation instrument that included criteria such as content appropriateness, material organization, clarity of instructions, example accuracy, pedagogical suitability, and technological integration. Each criterion received a rating on a four-point scale: 1 for Poor, 2 for Fair, 3 for Good, and 4 for Very Good.

The assessment results indicated a high level of concordance between the two experts. Expert 1 assigned an overall score of 88%, whereas Expert 2 evaluated the design at 89%. The average score of 88.6% categorizes the material as "Very Good," signifying that the design achieved high standards of instructional quality and technological relevance.

The assessment analysis identified the strengths namely content design 90%, both experts, the material clearly demonstrated a progression from basic to intermediate writing skills and effectively mirrored the syllabus. The activity design shows 87% that learning tasks were deemed significant, diverse, and conducive to the advancement of students' writing skills. The integration of AI Tools is at 92%, the experts observed that the integration of AI-assisted prompts, QR codes, and revision tasks is consistent with contemporary digital learning trends. The instructions clarity is 86% were deemed straightforward, though both experts suggested minor revisions to enhance the clarity of technical explanations. The visual and layout design is 88% was regarded as engaging and accessible, featuring consistent formatting across the units.

Alongside numerical scores, the experts offered constructive feedback to enhance the design. Expert 1 highlighted the necessity for clearer instructions for students regarding the interpretation of AI-generated feedback to promote responsible utilization of digital tools. Expert 2 recommended enhancing the clarity of task sequences and proposed the inclusion of additional interactive examples to facilitate autonomous learning.

5. Implementation

The created AI-integrated academic writing resources were put through a rigorous testing process in a real classroom environment during the Implementation Phase. This stage aimed to assess the materials' impact on students' writing performance and identify how well they worked when utilized by real students. The implementation occurred in the Academic Writing course, involving 32 undergraduate students divided into experimental and control groups. The experimental group utilized the newly developed materials, while the control group maintained the use of conventional instructional resources.

The implementation started with a trial session, wherein the experimental group was oriented on the utilization of the newly developed handout and its integrated AI features. In this introductory session, students received a systematic overview of the material, which encompassed navigating embedded QR codes, accessing online AI writing tools, and utilizing editable digital templates. The aim of this try-out was to confirm that students understood the material's structure and could engage effectively with the technology-enhanced elements. The instructor conducted brief demonstrations on the responsible interpretation of AI feedback, highlighting the necessity of critically evaluating AI suggestions instead of accepting them uncritically. The initial trial enabled the researcher to identify minor usability issues, including unclear instructions and technical challenges, which were resolved prior to the full classroom implementation.

The full implementation occurred over several weeks afterwards to the try-out. In the instructional sessions, students in the experimental group utilized a digital handout in a blended format, incorporating teacher-guided instruction, independent writing tasks, and AI-supported revision activities. Students composed paragraphs and essays, utilized AI tools for feedback, and afterwards revised their writing in accordance with both automated recommendations and instructor guidance. Classroom observations revealed significant engagement, with students actively utilizing AI tools to

verify grammar accuracy, enhance coherence, and refine vocabulary usage. The control group engaged in comparable writing tasks using only traditional materials and teacher feedback, facilitating a significant comparison between the groups.

Both groups took a post-test at the conclusion of the implementation period to evaluate the effectiveness of the developed materials. The post-test necessitated that students compose a 500-word academic essay on a designated topic within a controlled environment. The analytic rubric utilized in the pre-test evaluation, adapted from the IELTS Writing Band Descriptors, was employed to maintain consistency across assessments. Two independent raters assessed the essays, and inter-rater reliability was high, indicating consistent evaluation methods.

The post-test results indicated significant enhancement in the experimental group relative to the control group, particularly in coherence, organization, and grammatical accuracy. The results correspond with previous findings that AI-integrated materials facilitated student engagement in iterative drafting and revising processes, enhancing their comprehension of academic writing conventions. Students in the experimental group reported increased confidence and motivation due to the immediate feedback provided by AI tools, which complemented the teacher's guidance.

The Implementation Phase revealed that the developed academic writing material was functional, user-friendly, and effective in enhancing students' writing performance. The try-out session facilitated the effective integration of the material, and the post-test results offered empirical support for its educational efficacy. The successful implementation demonstrated that the integration of AI technology into writing instruction enhances learner engagement, supports revision processes, and contributes to measurable learning outcomes. The experimental group utilized AI-based materials for a duration of six weeks, while the control group employed conventional materials. Both groups underwent pre-test and post-test assessments.

6. Evaluation

6.1 Writing Performance Results

Table 5. Group Statistics

Pretest					
	Experimental	N	Mean	Std. Deviation	Std. Error Mean
Control	1.00	16	75.75	3.04	.76
	2.00	16	77.00	3.96	.99

The pretest scores were compared between two groups—experimental and control with each group consisting of 16 participants. The experimental group had a mean score (\bar{X}) of 75.75, while the control group's mean was 77.00. The standard deviation (SD) indicates the spread of scores around the mean: 3.04 for the experimental group and 3.96 for the control group. The standard error of the mean, 0.76 and 0.99 respectively, quantifies the precision of the mean estimate for each group.

Table 6. Independent Samples Test

		Levene's Test for Equality of Variances	
		F	Sig.
VAR00001	Equal variances assumed	0.13	0.71
	Equal variances not assumed		

This test examines the assumption of homogeneity of variance, a requirement for the valid application of parametric tests like the independent samples t-test. The test returned an F statistic of 0.13 and a significance value (p-value) of 0.71. Since $p > 0.05$, it can be said that to reject the null hypothesis of equal variances. This indicates that the two groups have statistically similar variances in their pretest scores, satisfying a key assumption for further comparison.

The close mean scores and equal variances between groups suggest comparable baseline abilities—a desirable condition for experimental research. An independent samples t-test can be conducted to assess whether the observed difference in mean scores is statistically significant.

Table 7. Group Statistics

Post Test					
	Experimental	N	Mean	Std. Deviation	Std. Error Mean
Control	1.00	16	80.06	1.43	.35
	2.00	16	82.56	2.55	.63

The post-test results indicate a measurable difference in writing performance between the two groups. The experimental group achieved a mean score of 80.06 (SD = 1.43, SEM = 0.35), while the control group attained a higher mean score of 82.56 (SD = 2.55, SEM = 0.63).

Table 8. Independent Samples Test

t-test for Equality of Means						
t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
					Lower	Upper
-3.41	30	0.002	-2.5	0.73	-3.99	-1.00
-3.41	23.61	0.002	-2.5	0.73	-4.01	-0.98

An independent samples t-test was performed to assess whether this difference was statistically significant. The t-value was -3.41 with 30 degrees of freedom, and the p-value was 0.002 ($p < 0.05$), revealing a statistically significant difference between groups. The mean difference in scores was -2.5, with a 95% confidence interval ranging from -3.99 to -1.00. Since the confidence interval does not cross zero, this further confirms the significance of the result.

These findings quantitatively demonstrate that students in the control group outperformed those in the experimental group in the post-test, and the difference is not attributable to random variation. Thus, the null hypothesis is rejected, indicating a statistically significant effect of the instructional intervention on writing achievement.

7. Questionnaire Results

Students' perceptions regarding the AI-assisted writing resources were captured through a **20-item Likert-scale questionnaire**. Descriptive analysis showed that overall student responses were positive, with average scores tending toward "agree" and "strongly agree."

Table 9. Students' Perceptions of Questionnaire

Dimension	Mean	SD	Interpretation
Perceived Usefulness of AI Feedback	4.42	0.48	Very Positive
Engagement & Motivation	4.28	0.52	Very Positive
Usability & Accessibility	4.35	0.46	Very Positive
Overall Mean	4.35	0.49	Very Positive

Across all 32 participants, the dimension with the highest mean score was **perceived usefulness of AI-generated feedback**. Students reported that automated feedback helped them identify errors more quickly and revise their essays more effectively. The dimensions of **motivation and engagement** also scored highly, indicating that AI integration increased students' interest in writing tasks. The **usability and accessibility** of the AI tools received consistently favorable ratings, suggesting that students found the system intuitive and easy to navigate. The instrument's reliability was confirmed by a Cronbach's Alpha score of **0.89**, indicating excellent internal consistency.

Table 10. Representative Students Response

Item no.	Statement	Mean
3	AI feedback helped me identify grammatical errors.	4.56
7	I feel more motivated to revise my writing using AI tools.	4.38
12	The AI tools were easy to access and use.	4.41

Interview Findings

Qualitative data were obtained from voluntary semi-structured interviews with five students from the experimental group.

Table 11. Result of Interview

Code	Example Student Statement	Theme
C1	"AI made me realize mistakes I usually ignore."	Increased Error Awareness
C2	"I felt more motivated because I could instantly see how to improve."	Motivation Through Feedback
C3	"Sometimes AI suggestions were confusing, but the teacher helped clarify them."	Balanced Teacher-AI Support
C4	"AI helped me rephrase ideas and improve flow."	Support for Coherence
C5	"I liked combining AI suggestions with my own ideas."	Hybrid Writing Strategy

Their responses highlighted that **increased error awareness** where students noted that AI-generated suggestions helped them notice previously overlooked grammatical and lexical issues. **Enhanced motivation** where the participants expressed that receiving instant feedback encouraged them to revise more frequently and submit more polished writing. **Balanced support from teacher and AI** where students emphasized that the combination of human guidance and AI assistance created a more supportive writing environment. Interviews also revealed some initial challenges, such as confusion about interpreting certain AI suggestions. However, students indicated that teacher clarification helped them overcome these difficulties.

8. Discussion

8.1 Pedagogical of AI in Academic Writing

The pedagogical frameworks that have historically directed literacy development must be carefully re-examined in the context of the incorporation of artificial intelligence into academic writing instruction. According to Flower (1994), writing is a cognitively and socially mediated activity that creates knowledge rather than just being the result of obeying rules or being grammatically perfect. Surface-level problems like grammar, syntax, or vocabulary variety are frequently the focus of AI programs like ChatGPT, Grammarly, and QuillBot. Deeper processes like idea, argumentation, synthesis, and rewriting are not always encouraged by this support, even if it might be helpful, especially for students learning English as a foreign language (EFL). Therefore, it is unclear if AI technologies complement process-based writing training, which places an emphasis on drafting, peer review, and iterative development. AI technologies may undermine the educational goal of encouraging writers' growth over time if they are just utilised as a quick fix to finish a work.

Another important concern in integrating AI into academic writing instruction is the notion of scaffolding, which refers to the deliberate help offered to learners as they learn new abilities, this concept is based on Vygotsky's (1978) Zone of Proximal Development (ZPD), which states that optimal learning happens when learners are guided to complete activities slightly beyond their current skills with the assistance of a more competent other—typically a teacher or peer. In the era of AI, this "more knowledgeable other" can include intelligent technologies that help learners in real time. When AI is intelligently integrated into instructional design, it may act as a dynamic scaffold (Bai et al., 2025; Memmert et al., 2023), providing timely prompts clarifying questions, structure ideas, and word alternatives to help students bridge the gap between rough drafts and polished academic works. For instance, Etaat (2024) noticed that students reported enhanced idea development, increased grammatical accuracy, and more comfort in beginning their writing while utilising ChatGPT to overcome first writing obstacles. Similarly, AI-powered programs like QuillBot or Grammarly may highlight not just surface faults but also provide reformulations and explanations, assisting students in identifying trends in their writing over time. According to the research by Dergaa et al. (2023), EFL learners who often utilised these tools reported considerable improvements in coherence, sentence structure, and lexical diversity, particularly when they examined and pondered on AI suggestions rather than just duplicating them.

However, the efficacy of AI as a scaffold is strongly dependent on how it is conceived and deployed in learning contexts (Gobert et al., 2024; Kim et al., 2022; Levin et al., 2025). If students are simply told to "run their paper through Grammarly" or "ask ChatGPT for ideas," the process becomes robotic with just superficial correction as a possibility for progress. According to Cale & McNulty (2024) and Mazari (2025), when educators include AI usage into reflective activities, such as asking students to defend which AI ideas they accepted or rejected, or to compare AI input to peer or teacher remarks, the scaffold becomes a metacognitive tool that promotes anatomy and deeper knowledge. This strategy not only improves students' capacity to analyse the quality of AI input, but it also develops transferable abilities such as

critical thinking and self-assessment (Kassenkhan et al., 2025; Levin et al., 2025). For example, students may be expected to produce AI logs alongside their drafts outlining how they altered their work based on AI feedback and the reasoning behind accepting or rejecting certain revisions. This openness promotes deliberate editing and turns AI from a passive editor to an active agent of inquiry.

Furthermore, scaffolding using AI must be adaptable and sensitive to individuals' particular levels of skill (Dhillon et al., 2024; George, 2023). Vogelsinger (2025) states a newbie writer may profit from sentence or model paragraphs, but a more accomplished student could utilise AI to uncover organisational flaws or holes in logic. Educators must examine differentiation in their curriculum to ensure that AI technologies are not utilised as unified solutions (Shah, 2023). Furthermore, scaffolding should be gradually reduced as learners develop competency, reflecting the educational principle of receding assistance. The idea is not to establish dependency on AI, but rather to use it as a temporary bridge that allows learners to understand writing skills and eventually use them independently. In this context, AI becomes more than a technical aid—it becomes part of a carefully organised educational strategy that respects cognitive growth, learner agency, and the long-term objective of generating self-sufficient academic writers.

8.2 *The Development of Critical Thinking and Creativity through AI-Based*

One of the most contentious issues in the debate about AI in academic writing is its influence on students' critical thinking and originality. According to Gabi (2022), academic writing is more than just accumulating material; it is the intellectual process of analysing, synthesising, assessing, and developing evidence-based arguments. These cognitive abilities are frequently developed through the cyclical processes of drafting, thinking, and revising. However, the growing usage of AI-powered writing tools may risk circumventing this intellectual labour by providing pre-made text that seems polished but lacks personalisation. When students rely on AI to construct thesis statements, propose evidence, or paraphrase academic sources, they risk outsourcing the critical thinking process itself (Aboodi, 2025; Melisa et al., 2025; Szmyd & Mitera, 2024).

This topic originates in educational psychology and writing pedagogy. Elder & Paul (2020) define critical thinking as conscious, self-regulatory judgment that results in interpretation, analysis, and assessment. Creativity, particularly in writing, entails developing new ideas, reinventing viewpoints, and devising unique solutions to rhetorical challenges. Both procedures need time, cognitive work, and the courage to deal with uncertainty. In contrast, AI offers confidence and immediacy—it creates strong writing in seconds. This may appeal to new writers or those under time constraints, but it runs the danger of reducing the intellectual depth of the writing experience. According to Anson & Straume (2022), students who rely primarily on AI-generated information processes of critical thinking, reflection, and revision, instead opting for machine-crafted fluency that seems complete but lacks genuine engagement. In the worst situations, students could mistake polished work for real learning and skip the constructive effort that results in true knowledge. Furthermore, Emerson (2024) emphasises that such dependency may diminish metacognitive awareness as students miss the ability to shape, question, or reflect on their own thoughts while the process of creation.

Under the correct circumstances, artificial intelligence may also foster creativity (Elfa & Dawood, 2023; Vinchon et al., 2023). AI's prompts, visualisations of words, and divergent sentence structure can assist learners in breaking away from strict linguistic patterns and developing narrative concepts. Some students, particularly those working in multilingual or multicultural settings, discover AI useful for rephrasing ideas in more conversational English, allowing them to articulate complicated concepts with greater confidence. This in line with the findings of Ango & Ekellem (2024), who discovered that AI-enabled platforms like ChatGPT facilitated multilingual comprehension by providing real-time nuanced explanations and adaptable language outputs, thereby bridging linguistic gaps and empowering learners to express complex ideas more fluently. The researchers also observed that AI chatbots reduced learners' cognitive burden by tailoring the complexity of replies to their competence, improving clarity, and decreasing anxiety in multilingual environments. Implementing this, Athanassopoulos et al. (2023) discovered that learners appreciated AI's capacity to reformulate their writing into clearer and more academic English, particularly when dealing with complex or discipline-specific topics. Students in multilingual situations saw AI as a linguistic bridge, utilising it to explore phrasing options, polish style, and boost confidence while writing projects. However, this promise can only be realised if educators move their evaluation focus from product to process, assessing how students arrived at their writing selections, rewrote their drafts, and made rhetorical choices with or without AI aid.

To maintain the integrity of academic writing teaching, AI must be positioned as a stimulus for deeper investigation, rather than a crutch for mechanical production. This involves not only instructional innovation, but also a rethinking of what it means to "write" in the digital era. Writing must be reframed as a kind of thought—a study of ideas rather than a

demonstration of truth. If educators' model and encourage this viewpoint, AI may be integrated in ways that complement, rather than replace, the critical cognitive qualities of academic writing.

9. AI Tools as Assistant in Academic Writing

9.1 Grammar, Paraphrasing, and Style Checkers

Grammar and style checkers are among of the most popular AI-powered tools in academic writing, helping writers find and repair grammatical problems, improve sentence structure, and improve overall readability. Grammarly uses powerful natural language processing algorithms to detect errors in punctuation, verb, word choice, and sentence structure (Apriani et al., 2025; Long, 2022). While QuillBot is best known as a paraphrase tool, it also has powerful grammar-checking skills that match specialist grammar platforms, making it a flexible choice for academic writers (Alfianofita, 2025). These tools go beyond simple spell-checkers, providing subtle feedback on tone, conciseness, and stylistic consistency (Ezzahra & Houda, 2025; Graham & Milan, 2025; Hadinejad, 2024), which is especially useful in scholarly settings where accuracy and formal register are required. By exposing faults in real time, they serve as a constant feedback system, allowing authors to focus on developing ideas while retaining linguistic precision.

One of the most significant advantages of grammar and style checkers is their ability to customise comments based on the writing environment. According to Gain et al. (2019), Grammarly improves students' grammatical correctness and overall writing quality by recognising and fixing frequent faults such as word use, punctuation, spelling, and sentence structure. In line with Dewi, (2023), the tool's automatic feedback enables students to review and select appropriate words or structures, indirectly encouraging self-learning and reflection on their writing decisions. Supporting this, Fitriana & Nurazni (2022) discovered that Grammarly's grammar checking, vocabulary development, and clarity improvement capabilities are seen as user-friendly, convenient, and adaptable making it a favoured option above free grammar checkers. Hence, according to Fitria (2021), Nurmayanti & Suryadi (2023) and Saputra & Hendriani (2025), Quillbot's benefits and efficacy in academic writing are obvious in many aspects of English language development. Students believe that its paraphrase function simplifies complicated paragraphs, helps to avoid and reduce plagiarism, and improves academic language usage, thus boosting writing clarity and formality. The grammar checker is useful for detecting and fixing structural problems in real time, thus improving accuracy and fluency. Furthermore, vocabulary selection tools assist to increase lexical resources, while summarisation features allow for the condensing of large texts without losing key meaning. Since QuillBot has both grammatical correction and paraphrase capabilities, it may help authors convey their thoughts more clearly and in a variety of ways (Fitria, 2022). Non-native English speakers, who can find it difficult to maintain grammatical precision and idioms in academic contexts, particularly benefit from this kind of focused help.

However, using grammar and style checkers in academic writing requires careful consideration of its limits and ethical implications. An over-reliance on automatic recommendations may cause students to rely more on AI than on their own editing abilities, which might hinder their long-term writing development (Avsheniuk et al., 2025; Khamis & Yusof, 2024). Grammarly and QuillBot according to Dangprasert (2025) and Thangthong et al. (2024), contain downsides in addition to benefits. Grammarly may provide incorrect suggestions for difficult or technical vocabulary, leading to overreliance and limiting students' own editing abilities, whereas the free version has limited functionality and raises privacy issues. Quillbot may include minor meaning changes during paraphrasing, generate odd phrases, and encourage reliance on automatic rewriting, with full capabilities reserved for paid customer. In order to reduce these hazards, educators should promote balanced use, utilising AI to increase productivity and provide feedback while developing students critical thinking skills, and adapting recommendations to meet academic requirements.

9.2 AI Writing Assistant

Generative AI writing assistants, such as ChatGPT, Claude, and DeepSeek, are a more advanced category of AI aids for academic writing. These platforms may generate human-like language in response to prompts, with capabilities ranging from brainstorming ideas to writing complete portions of a paper. According to Kim et al. (2025), these tools can assist students in overcoming writer's block by offering basic outlines, brainstorming support, and alternate language that encourages further development of ideas. In accordance with Tang et al. (2024) generative AI may provide structured feedback or argument flow, cohesiveness, and clarity, allowing students to edit their papers more effectively than manual revisions. Maphoto et al. (2024) states that such platforms may tailor their replies to the user's competence level,

providing basic explanations or advanced academic vocabulary as needed, which assists learners in multilingual and multicultural environments. Furthermore, Nelson et al. (2024) emphasises their potential to serve as low-cost, on-demand writing tutors, providing instant guidance and personalised learning pathways, though caution is advised due to risks of academic deception, diminished critical thinking, and overreliance on machine generated content.

Using generative AI writing aides in a guided, process-oriented manner also offer special chances to promote more involvement with the writing process (Wang & Tian, 2025). Teachers may make AI-generated literature an opportunity for metacognitive growth rather than a substitute for creative thought by encouraging students to critically assess, modify, and improve it. They can be especially useful in providing students with discipline-specific language they might not otherwise encounter, modelling academic frameworks, and providing instances of effective arguments (Khuder, 2025; Suja et al., 2024; Yan & Qianjun, 2025). However, how they are incorporated into instruction has a significant impact on how effective they are; if they are used in an unstructured or uncritical manner, they run the risk of becoming shortcuts learning stages, but if they are incorporated carefully they can help students view AI as a partner that enhances rather than replaces their intellectual work. In this sense, generative AI can develop into a valuable collaborator in the development of academic writing abilities rather than only a handy tool (Ruiz-Rojas et al., 2024).

10. Conclusion

The study aimed to develop and evaluate AI-integrated academic writing materials for EFL university students through the ADDIE Research and Development model. The needs analysis confirmed that students required concise, practical, and technology-enhanced materials aligned with their writing challenges, particularly grammar, coherence, and vocabulary. Expert validation showed that the developed materials met high standards of quality, achieving an overall score of 88.6% in the “very good” category. The implementation results demonstrated significant improvement in students’ writing performance, with the experimental group showing greater gains in coherence, grammar accuracy, and lexical quality compared with the control group. Additionally, students expressed very positive perceptions of the AI-integrated materials, emphasizing their usefulness, motivational impact, and usability. Interview results supported these findings, revealing increased error awareness, stronger motivation, and effective synergy between teacher feedback and AI-assisted support.

The findings carry several pedagogical implications. The improved writing outcomes suggest that AI can function as an effective formative feedback tool, supporting learners’ autonomy and helping them revise more accurately. The positive student perceptions highlight the motivational benefits of integrating AI tools into regular writing activities. Moreover, the findings show that AI does not replace teacher feedback; rather, it complements instruction by providing immediate, personalized suggestions that enhance the learning process. These implications suggest that AI-supported materials are not only feasible but also beneficial for use in EFL writing courses in higher education.

Despite the promising results, this study has several limitations. The sample size was relatively small and limited to one institution, which may affect the generalizability of the findings. The implementation period was also short, restricting the ability to examine long-term effects of AI-assisted materials on writing development. Additionally, the study focused primarily on general academic essays, without exploring other genres such as research papers, argumentative essays, or reports. Finally, while students demonstrated positive perceptions, some initially struggled to interpret AI-generated suggestions, indicating a need for guided training.

Based on these limitations, several suggestions for teaching practice can be offered. Instructors should integrate AI tools strategically within writing lessons, ensuring that students understand how to interpret and apply automated feedback. Materials developers are encouraged to design modular, user-friendly writing resources that combine traditional instruction with AI-enhanced tasks. Institutions should provide training for both teachers and learners on ethical and effective AI use in academic settings. Additional interactive components such as templates, examples, and multimedia content may also be included to support varied learning styles.

For future research and material development, several recommendations are proposed. Studies with larger and more diverse participant groups are needed to validate the findings across different contexts. Researchers should also examine the long-term impact of AI-integrated materials on writing proficiency and revision habits. Investigating the effectiveness of AI support in different writing genres could provide deeper insights into which aspects benefit most from technological integration. Future material development should consider discipline-specific writing needs and explore ways to incorporate referencing, citation, and research-based writing support into AI-enhanced resources. Continued refinement of the materials—especially in terms of clarity of instructions, examples, and interactive features—is recommended to further strengthen student engagement and learning outcomes.

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