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Effects of AI-assisted feedback on the essay writing performance of undergraduate English major students

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Abstract

This study investigates the effects of AI-assisted feedback on the essay writing performance of undergraduate English major students. Quasi-experimental pretest–posttest control group design was employed; the study included 72 undergraduate students from Cebu Technological University-Moalboal Campus, Philippines. Students were assigned to the experimental group (AI-assisted feedback via Dola AI) and the control group (conventional teacher-led). Writing performance was measured using a validated analytic rubric covering content, organization, vocabulary, language use, and mechanics. To identify within-group and between-group differences, data were analyzed using paired-samples and independent-samples t-tests. Results showed significant increases in essay writing performance in both groups. Nevertheless, the experimental group demonstrated significantly greater gains across all components than the control group. The independent-samples t-test also confirmed a significant difference in mean gain scores ($p < .001$), with a moderate effect size (Cohen's $d = 0.53$), indicating a meaningful impact of AI-assisted feedback. Results suggest that timely, consistently incentivized AI-generated feedback supports reformulation, leading to better writing. The study underscores the importance of teacher feedback, especially for higher-level writing practices. These findings indicate that AI-assisted feedback is most effective when teacher-guided and embedded within a systematic instructional approach. Conclusions on pedagogical integration and future work are presented.

Keywords: Academic writing, AI-assisted feedback, Automated writing evaluation, English major students, Essay writing performance, Quasi-experimental design, Second language writing, Writing instruction.

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Contents

Contribution of this paper to the literature
The study contributes to the growing body of literature with the empirical investigation of AI-assisted feedback's influence on essay writing performance among undergraduate English major students, a population underrepresented in prior research. Using a quasi-experiment, it compares AI-assisted and traditional feedback in a classroom setting. They further contribute with a calibrated analytic rubric for writing assessment and provide an explicit teacher–AI collaborative feedback model, illustrating how automated and human feedback can be integrated for further writing development in higher education.

1. Introduction

Academic writing is considered one of the most challenging skills in higher education because of its cognitive, linguistic, and organizational nature (Gustillo, 2010; Hyland, 2019; McCutchen, 2000; Schoonen et al., 2003). Among the various forms of academic writing, essay writing plays a crucial role in developing critical thinking, analytical reasoning, and the ability to synthesize information from multiple sources. Proficient writing skills allow learners to express complex ideas clearly and powerfully, which is an important requirement for academic achievement and professional communication. Despite the importance of this task, many reports suggest that university students, particularly in ESL studies, experience difficulties in composing academic essays due to problems related to grammar, cohesion, and organization (Graham, 2018; Kabigting, 2020; Ur, 1996). Likewise, Lee (2007) explained that lack of time for English major students is one reason why they are less inclined to invest in improving their writing skills and upgrading their writing capabilities. Insufficient practice and feedback are common causes of these problems. Additionally, with students limited in the number of hours per day, teachers seem unable to provide timely, effective, quality feedback to every student. Meanwhile, there is increasing interest in using artificial intelligence as an additional resource in traditional writing instruction. The use of technology in English language teaching can be regarded as a potential solution (Knox, 2020). However, empirical studies on performance enhancement through AI-assisted feedback in essay writing remain limited, especially among English major students. Therefore, this paper investigates the impact of AI-assisted feedback on the essay writing performance of undergraduate English majors by comparing students who had access to Dola AI, which offers automated feedback, with those who received conventional instruction. The subjects were first-year undergraduate English majors from Cebu Technological University-Moalboal Campus, Philippines.

Research findings: This study adds three important contributions to current literature.

First, the research provides empirical evidence about whether AI-assisted feedback helps undergraduate English major students who were not properly covered by previous research.

Second, it uses a quasi-experimental design to compare AI-assisted and conventional writing instruction, adding rigor to the methods in which existing studies have been conducted.

Lastly, it reflects on the use of AI as a supplementary tool in a teacher-centered pedagogical environment, highlighting the need for a blend of technological assistance and pedagogical instruction.

2. Objectives of the Study

The main purpose of this study is to examine the effects of AI-assisted feedback on the essay writing performance of English major students compared with conventional instruction. Specifically, this study aims to:

1. Assess the essay writing performance of the experimental and control groups in the pre-test and post-test regarding content, organization, vocabulary, language use, and mechanics.
2. Determine whether there is a statistically significant difference between pre-test and post-test scores within each group.
3. Compare the mean gain scores of the two groups to evaluate the effectiveness of AI-assisted feedback in writing instruction.

3. Literature Review

3.1. Academic Writing in Higher Education

Academic writing forms a vital part of higher education in that it allows students to express ideas, construct arguments, and demonstrate disciplinary understanding. However, academic writing is a complex task, and therefore the linguistic skills involved require more than an ability to communicate with others and are crucial to academic writing. Indeed, previous research has repeatedly demonstrated that university students, especially those who are learners of a second language, struggle to write coherent and organized texts (Kabigting, 2020; Schoonen et al., 2003). These difficulties are sometimes caused by language proficiency constraints and trouble in arranging thoughts and maintaining logical flow. Existing research identifies writing as an essential element of learning and education but raises questions and implications about how students' writing skills are taught. However, students with limited opportunities for practice and feedback can struggle to develop their writing skills. This has sparked broader interest in other instructional strategies and tools that support writing development in higher education, with technological support.

3.2. Challenges in Essay Writing Among University Students

For many students at university, essay writing remains a significant yet persistent challenge. Students' writing is often characterized by grammar, word choice, organization, or coherence (Kabigting, 2020; Ur, 1996). These issues are compounded for English as a Second Language (ESL) learners, balancing the need for language accuracy and idea development. Apart from linguistic challenges, contextual factors such as insufficient time or limited feedback compound the writing process. Too little time to revise can cause students to struggle to edit their work, whereas delayed or little feedback reduces their ability to improve (Lee, 2016). Consequently, students tend to find the writing issues recurring, negatively affecting the overall quality of their essays. These obstacles indicate a need for more

efficient, rapid feedback systems that can help students engage with the writing process. This has led to renewed research into the potential of technology, notably AI, to overcome these constraints.

3.3. Artificial Intelligence in Education

Artificial Intelligence (AI) has received increased attention in education due to its potential to enhance teaching and learning processes. AI technology is increasingly used for providing automated, adaptive, and real-time feedback to aid in student learning and performance (Holmes, Bialik, & Fadel, 2019; Knox, 2020; Zawacki-Richter, Marín, Bond, & Gouverneur, 2019). AI-based technologies have been employed in the language learning ecosystem to assist language students in diagnosing writing errors and proposing better revisions (Yang, 2022; Zawacki-Richter et al., 2019). Empirical studies also indicate that AI-assisted tools may enhance writing performance by allowing students to improve accuracy through more effective detection and correction of errors. Timely feedback promotes an ongoing revision process, which is especially important for developing skills. Furthermore, AI tools can empower learners to revise independently, as they can evaluate and adapt their work without assistance (Holmes et al., 2019; Yang, 2022). However, limitations include AI's inability to address more complex problems and concerns about this. While AI is effective in providing feedback on surface-level features, its capacity to support deeper cognitive processes remains limited. Therefore, AI should be viewed as a supplementary tool for reinforcement rather than a substitute for teachers.

3.4. AI-Assisted Writing and Student Performance

Studies have examined the effectiveness of AI-assisted writing tools to enhance student performance. Results indicate that these tools provide immediate and automated feedback, which is related to more grammatical correctness, better word use, and overall writing quality. All these tools promote revision through immediate identification and correction of errors. Despite the positives, the impact of AI on higher-order writing skills is less evident. Improvements in lower-level skills are reported repeatedly, yet the evidence is limited regarding the development of argumentation, coherence, and critical thinking (Safitri & Adani, 2024). It means that AI tools may not assist with the cognitive capacities needed for complex writing tasks properly. What's more, the success of AI-aided writing tools seems to hinge on their integration into instructional contexts. Research indicates that using AI feedback combined with teacher guidance enhances student achievement and highlights the necessity of pedagogical support in terms of technological engagement (Shi & Aryadoust, 2024).

3.5. Feedback and Writing Development

Feedback is a key component in the writing development process because it helps learners recognize their mistakes, develop their ideas, and improve their writing skills (Hyland & Hyland, 2006; Lee, 2007; Su, Tian, & Yang, 2023). Effective feedback enables students to identify areas of strong performance where they could improve and to revise their work. When feedback is given in a timely and formative manner, students can expand their ideas, organize their content, and work on the arguments they need to make (Su et al., 2023). Traditional feedback is limited by time and workload, which can postpone revision and reduce its effectiveness. AI-assisted feedback, on the other hand, is immediate and can inform students through the process of iteration. This immediacy allows students to continue learning and address writing issues in real-time. However, AI tends to focus on lower-level writing issues, as these are easier to manage, but it can sometimes leave gaps in meaning, context, and rhetorical effectiveness. This highlights the need for a balanced approach combining automated feedback with human assistance, integrating both automated and human instruction and teaching aid.

3.6. Dola AI as a Writing Support Tool

A recent emerging AI-driven writing technology in this category is Dola AI, a writing support tool designed especially for students. It reads written texts and gives automated responses, identifying problems with grammar, vocabulary, and sentence structure. Those pieces provide instant feedback to support students that could lead to better revision. Dola AI provides recommendations that encourage deeper analysis beyond surface-level weaknesses, providing clearer and better organization. It could also potentially help students create more coherent and organized essays. Concurrently, AI-enhanced tools may help students be cognizant of their writing weaknesses and their incorporation of independent revision techniques. Limited research has been conducted directly on Dola AI. The evidence mainly comes from studies researchers have done into similar AI writing tools, they say the writing is much more accurate and organized. That demonstrates the need for further empirical research on the prospective contributions of Dola AI to higher education.

3.7. Research Gap

Although research on AI-assisted writing tools is expanding, significant gaps persist.

Mainly, the research literature has focused on general ESL learners, with English major students presumed to have higher writing levels and largely overlooked.

Secondly, there has been no quasi-experimental research that has directly compared AI-assisted feedback with traditional instruction in controlled classroom settings.

Thirdly, the studies mentioned generally focus on AI as an independent tool and have little to say about the role of AI in teacher-led pedagogical approaches.

Addressing these gaps is essential to understanding how AI could support the development of writing in higher education. Therefore, the current study aimed to analyze the impact of AI-assisted feedback on undergraduate English majors' essay writing performance in a structured instructional setting.

3.8. Theoretical Background

The theoretical framework for this study is based on Sociocultural Theory and Cognitive Load Theory: both combine frameworks for exploring the impact of AI-assisted feedback-related processes in writing development.

From a sociocultural perspective, learning occurs through engagement with mediational tools and is supported by the learner's Zone of Proximal Development (ZPD) (Vygotsky, 1978).

The most recent studies show how AI-enabled feedback systems can serve as culturally mediated tools; they can support students' writing in an iterative manner, leading to improvements through successive revisions. In the present study, AI-enabled feedback serves as a mediational tool that imparts instant assistance in writing. By identifying errors and providing guidance to correct them, Dola AI helps students perform tasks they cannot do on their own. This approach is an example of scaffolding, where students are supported as they grow in their writing proficiency with direct guidance.

Cognitive Load Theory may also be applied to gain insight into the ways that AI-assisted feedback facilitates efficient learning processes. Writing is a difficult cognitive task that demands attention to several aspects at the same time, including grammar, vocabulary, organization, and the construction of ideas. With the help of AI-based feedback, the cognitive load is lessened due to the direct and instant corrections that free the learner to concentrate on a higher level of writing skills. In turn, this should help students make better use of their cognitive resources as it promotes a rise in writing ability. From both perspectives, AI-based feedback has been shown to facilitate the cognitive and social dimensions of learning through guided practice and reduce cognitive load by encouraging repeated and incremental revision of skills.

3.9. Studies on AI and Student Writing Performance

Increasingly, many research studies have reported the effects of AI-assisted writing technology on students' writing ability. More and more research efforts have examined the effect of automated feedback systems on students' writing performance. Scientists have explored how these systems help learners create more precise and coherent texts. Several papers analyze students' writing outputs before and after using AI-assisted writing aids to measure improvements in writing quality. These studies often find that students show increases in grammatical accuracy and sentence construction when receiving automatic feedback.

There are many experimental and quasi-experimental research types for learning outcomes of AI writing tools. In such research, pre-test and post-test assessments are often used to assess writing skills before and after practice with AI-assisted writing. Based on the findings of the current study, these two results demonstrated high marks of grammatical accuracy but also greater organization, coherence of ideas, and effective vocabulary usage. The feedback generated by AI also motivates students to actively revise (Shi & Aryadoust, 2024), which could help students become aware of the nature of writing errors and the quality of writing overall. These findings also present great empirical evidence for the integration of AI technologies into writing instruction.

4. Research Methodology

4.1. Research Design

The study employs a quasi-experimental pretest–posttest control group design to investigate the influence of AI-assisted feedback on essay writing performance. It allowed for comparisons of learning outcomes to be made without violating natural classroom conditions, i.e., where random assignment was not possible, between two intact groups. This was to increase internal validity, and in this regard, it was used to keep the instructional content, writing tasks, and time the same for both groups (with the only adjustment made for the inclusion of AI-assisted feedback in the experimental group).

4.2. Participants and Sampling

The participants are 72 first-year English major undergraduate students enrolled in an English Syntax course at Cebu Technological University–Moalboal Campus, Philippines. Two intact classes were selected by convenience sampling, a method commonly used in quasi-experimental educational research.

- Control group: n = 36.
- Experimental group: n = 36.

Participants were aged between 18 and 21 years. All participants had comparable academic backgrounds and prior exposure to essay writing instruction.

4.3. Intervention Fidelity

To ensure consistency of implementation, the intervention was conducted over 18 weeks following a structured protocol.

Both groups received weekly writing instruction covering.

- Idea development.
- Organization.
- Vocabulary.
- Sentence structure.
- Mechanics.

The experimental group:

- Submitted drafts to Dola AI.
- Received automated feedback aligned with rubric criteria.
- Revised essays before submission.

The control group:

- Followed the same writing tasks.
- Received teacher-led feedback only.

To ensure fidelity:

- The same instructor handled both groups.
- Instructional materials were standardized.

- Writing tasks and assessment conditions were identical.

4.4. Research Instrument

An analytic scoring rubric adapted from Al-Ghazo and Ta'amneh (2021) was used to evaluate five writing components.

- Content.
- Organization.
- Vocabulary.
- Language use.
- Mechanics.

The rubric underwent expert validation by two specialists in English language instruction to ensure content validity.

4.5. Inter-Rater Reliability

Two independent English language instructor raters scored the essays. To ensure consistent scoring, a calibration session was conducted by the raters before the evaluation. Discrepancies in scoring were resolved through discussion. To minimize bias, the raters were not informed of the group assignments. Note that Dola AI was solely a feedback tool and was not used for scoring the essays during the intervention.

4.6. Research Procedure

The study was conducted over one academic semester (18 weeks). At the beginning, both groups completed a pretest essay writing task requiring 250–500 words within 30 minutes.

During the intervention period, both groups participated in guided classroom discussions focusing on key writing components, including idea development, organization, vocabulary, sentence structure, and mechanics.

The experimental group received additional support through Dola AI. Students submitted their drafts to the platform, received automated feedback based on the rubric criteria, and revised their essays before final submission.

In contrast, the control group followed the conventional writing process, receiving teacher-led instruction without AI-assisted feedback.

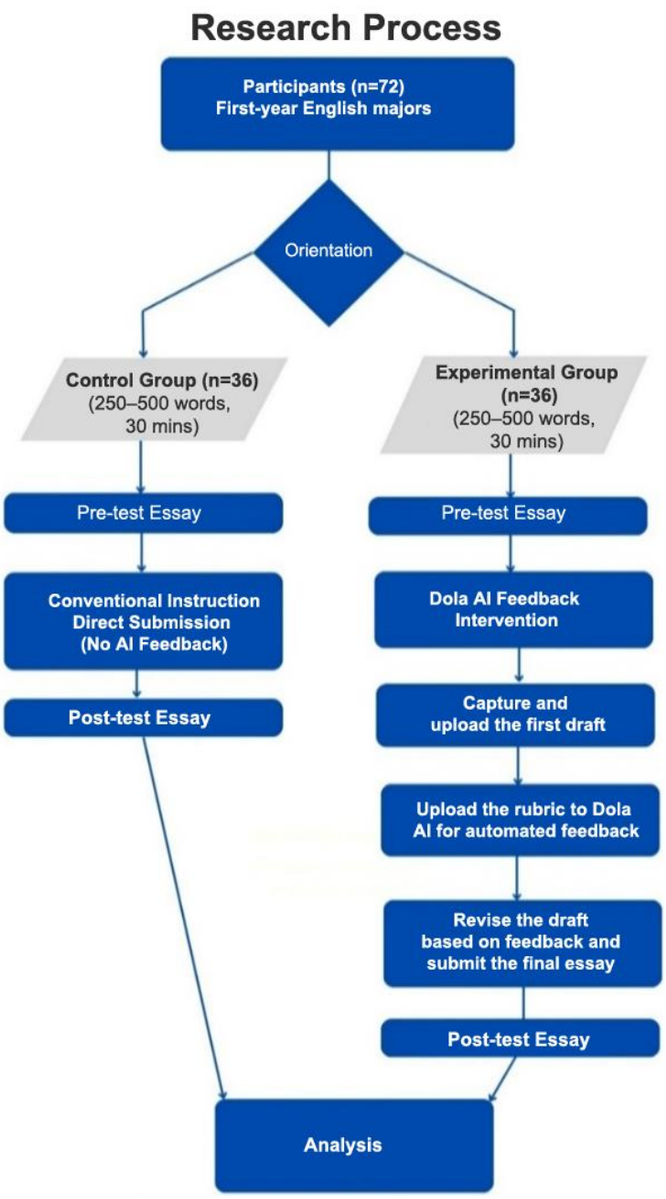

Figure 1. Research process of the study.

At the end of the intervention, both groups completed a posttest essay under the same conditions as the pretest. All essays were evaluated using the same rubric. The overall procedure of the study is illustrated in Figure 1.

5. Data Analysis, Results, and Discussion

5.1. Quantitative Data Analysis

Data were analyzed using paired-samples and independent-samples t-tests. Before performing the t-tests, the assumptions of normality, homogeneity of variance, and independence of observations were examined. No serious violations of these assumptions were found through preliminary analysis. Therefore, parametric tests were considered suitable for data analysis. Paired-samples t-tests compared differences between pre-test and post-test scores within each group, while an independent-samples t-test compared mean gain scores between the experimental and control groups. The difference in effect sizes, from Cohen's d, was also calculated to determine the magnitude of differences. Effect sizes were interpreted as small (d = 0.20), medium (d = 0.50), and large (d = 0.80).

Table 1. Pre-test and post-test essay writing performance of the control and experimental group.

Writing Criterion	Control Group				Experimental Group			
	Pre-test		Post-test		Pre-test		Post-test	
	Mean	Description	Mean	Description	Mean	Description	Mean	Description
Content	19.88	Fair	21.42	Good	20.68	Fair	24.38	Good
Organization	12.96	Fair	15.32	Good	13.76	Fair	16.60	Good
Vocabulary	12.76	Fair	14.82	Good	12.65	Fair	16.14	Good
Language Use	13.86	Fair	17.57	Good	15.22	Fair	19.83	Good
Mechanics	3.15	Fair	3.53	Fair	3.14	Fair	3.75	Fair
Composite Mean	62.61	Poor	72.65	Fair	65.46	Poor	80.69	Good

Table 1 shows the pre-test and post-test mean scores for each of the five writing components. Both groups demonstrated improvement in all criteria after the intervention. The baseline scores were relatively comparable; however, in all components, the experimental group obtained higher post-test means. This pattern also indicates better overall writing performance, especially among students who received AI-assisted feedback.

Table 2. Significant difference between pre-test and post-test results.

Group	Criteria	Test	Mean	T-Value	P-value	Interpretation
Control Group	Content	Pre-Test	19.88	-2.850	p< 0.001	Significant
		Post-Test	21.42			
	Organization	Pre-Test	12.96	-5.102	p< 0.001	Significant
		Post-Test	15.32			
	Vocabulary	Pre-Test	12.76	-4.216	p< 0.001	Significant
		Post-Test	14.82			
	Language Use	Pre-Test	13.86	-7.029	p< 0.001	Significant
		Post-Test	17.57			
	Mechanics	Pre-Test	3.15	-3.665	p< 0.001	Significant
		Post-Test	3.53			
Experimental Group	Content	Pre-Test	20.68	-7.646	p< 0.001	Significant
		Post-Test	24.38			
	Organization	Pre-Test	13.76	-8.281	p< 0.001	Significant
		Post-Test	16.60			
	Vocabulary	Pre-Test	12.65	-10.700	p< 0.001	Significant
		Post-Test	16.14			
	Language Use	Pre-Test	15.22	-11.333	p< 0.001	Significant
		Post-Test	19.83			
	Mechanics	Pre-Test	3.14	-6.840	p< 0.001	Significant
		Post-Test	3.75			

Table 2 shows the results of the paired-samples t-tests comparing pre-test and post-test scores within each group. The results indicate statistically significant improvements across all writing components for both groups ($p < 0.001$). These findings confirm that both instructional approaches contributed to measurable gains in students' writing performance.

Table 3. Mean gain results between the control and experimental groups.

Group	Mean	SD	T-Value	P-Value	Interpretation
Control Group	10.04	8.51	-2.235	p< 0.001	Significant
Experimental Group	15.24	11.04			

Table 3 presents the comparison of mean gain scores between the control and experimental groups. The experimental group obtained higher mean gains, and the difference between groups was statistically significant ($p < 0.001$). This result indicates that AI-assisted feedback contributed to greater improvement in writing performance compared to conventional instruction. The moderate effect size (Cohen's d = 0.53) further suggests a meaningful impact of the intervention.

5.2. AI-Assisted Feedback Improves Writing Performance

The results also verify that an AI-assisted feedback process enhances student writing, as this would allow students to gain automatic feedback on their grammar, sentence structure, and vocabulary to recognize mistakes they made during essay writing. This immediate feedback lightens the cognitive load and facilitates more efficient

processing of writing tasks. This supports Cognitive Load Theory and the need to minimize unneeded cognitive work to promote learning (Sweller, 2011).

Similarly, Lee (2016) found that writers who regularly utilized artificial intelligence tools increased clarity and coherence in technical writing. This sustained process of revision over the 18-week intervention affected students' writing performance. The AI-assisted feedback offered scaffolding that supported learners within their zone of proximal development to act as a "more knowledgeable other" in the writing process.

5.3. Limitations of AI in Supporting Higher-Order Writing Skills

Although AI-assisted feedback improves learning in essay writing, some results indicate its limitations in higher-order skills like argumentation and critical thinking (Holmes et al., 2019; Selwyn, 2019; Shi & Aryadoust, 2024). The capabilities of these tools are mainly restricted to surface-level mechanical errors such as grammar and syntax, which are insufficient for supporting higher-order skills like argument development and logical coherence (Safitri & Adani, 2024).

More specifically, Dola AI still lacks the capacity for rhetorical sophistication and pedagogical sensitivity, and underscores the continuing importance of human instruction (Su et al., 2023).

5.4. Optimizing Teacher-AI Collaboration

These findings emphasize the significance of teacher-AI collaboration for writing instruction. The implication is that AI cannot replace the teacher but should be perceived as a supplementary tool, particularly when the teacher must think through how to decide and provide feedback and pedagogy (Farrell, 2012). It should only be said to promote the writing process. AI can rapidly address these kinds of problems at the lower level, grammar and mechanics, say, and teachers can monitor higher-level problems, like argumentation and critical thinking. Such an approach to teacher-AI guidance, based on the collaboration of the computer, is considered a more balanced and effective feedback mechanism for enhancing students' performance in academic writing.

5.5. Discussion

The findings of this conclusion show that AI-assisted feedback is more effective in improving writing outcomes when combined with structured instructional support (Shi & Aryadoust, 2024; Su et al., 2023). It was notable that both groups performed better overall; however, as the AI feedback showed overall improvement over controls, the outcome suggests that AI-provided assistance was more beneficial for writing than traditional methods. This advantage is partly due to the numerous and near-real-time feedback that allowed students to efficiently edit and rewrite their work. An alternative explanation for these findings may be the immediacy and availability of AI-based prompts. While traditional feedback is typically delayed, AI-assisted systems provide immediate responses, showing students what is happening at each stage of writing, indicating errors, and enabling adjustments. This instant feedback promotes sustained revision and may explain the greater gains observed in the experimental group. Crucially, the feedback demonstrated that students improved their writing as they reworked each iteration incrementally, leading to higher skill scores.

From a theoretical point of view, the findings can be analyzed through the lens of Sociocultural Theory and Cognitive Load Theory. In writing, feedback from AI was very much scaffolding, structured assistance, and prompt assistance. Relying on the Zone of Proximal Development theory, feedback stimulated the student towards performing tasks that they would not have been able to complete on their own. One positive note about all of this feedback was that the automation of this feedback also minimized cognitive load on the learner, thus boosting the cognitive resources they were able to provide for higher-order writing tasks such as generating ideas, thoughts, and sentences.

Results also indicate greater gains in content, vocabulary, and language use. This means AI-supported feedback not only corrected surface errors but also helped produce clearer, less wordy ways of expressing ideas. Repeated exposure to automated feedback from the AI system may have reinforced correct patterns, allowing students to internalize language.

That will hopefully lead to more accurate, fluent answers afterward. The findings do appear to have been replicated, like previous studies, which suggest AI-based tools are allowing better performance of language production and providing feedback and rewriting through guided feedback. Yet, the mechanical improvements were still not overwhelming and remained slight compared to other elements. Unlike many mechanical skills that may take ages to attain expert mastery, this might reflect how long people take to get used to these skills in a long process to master them.

The use of AI-based feedback to prevent errors such as punctuation or spelling is just the start; however, it's easier to say that, at least in these cases, automaticity will develop long after the intervention ends. It implies that small mechanical short-term gains may not be statistically significant, even after continuous feedback has been used. That is, the results emphasize that AI-mediated feedback cannot substitute for teaching. In the experimental group, there was a far more significant increase in the level of learning, but student writing growth still required teacher guidance. AI tools functioned as complements to teaching rather than substitutes for it.

The approach was also supported by prior research that illustrated the value of a set of technological tools that complement pedagogical needs to enhance learning. Additionally, AI-assisted feedback can bridge the gap between the classroom and the outside to increase the feedback process. AI tools respond quickly and solve some of the drawbacks of classic feedback (time responsiveness and response latency). Many more of these types of interactions will give students greater ownership of their own writing and, eventually, will also create accountability over their own learning.

However, although it is encouraging that new research results can be obtained, we need to admit some limitations.

The study was conducted in a single institutional environment and included a few individuals other than English major students, so the results may not be generalizable.

Secondly, the duration of the intervention was only one academic semester, but it may not have been long enough to assess the long-term impact on higher-level writing abilities.

Thirdly, overuse of AI tools may actually inhibit independent writing without an instructor to help in such a task. These findings contribute to a growing corpus of academic studies on artificial intelligence and education.

It suggests that the development of writing can be supported with AI-assisted feedback, as long as this structure of feedback is embedded into what is being taught or learned, and does not overlap entirely with the content of instruction provided by teachers. Rather than investigate AI in isolation, we draw attention to the need for AI-assisted feedback to combine with human guidance, providing input that covers both lower-level content aspects and higher-order aspects of writing.

5.6. Proposed Pedagogical Model for Teacher-AI Feedback Collaboration

The proposed model consists of three stages: (1) AI-assisted feedback, where students receive immediate correction on grammar and language use; (2) teacher-guided feedback, focusing on higher-order writing skills such as argumentation and organization; and (3) iterative revision, where students refine their drafts by integrating feedback from both sources.

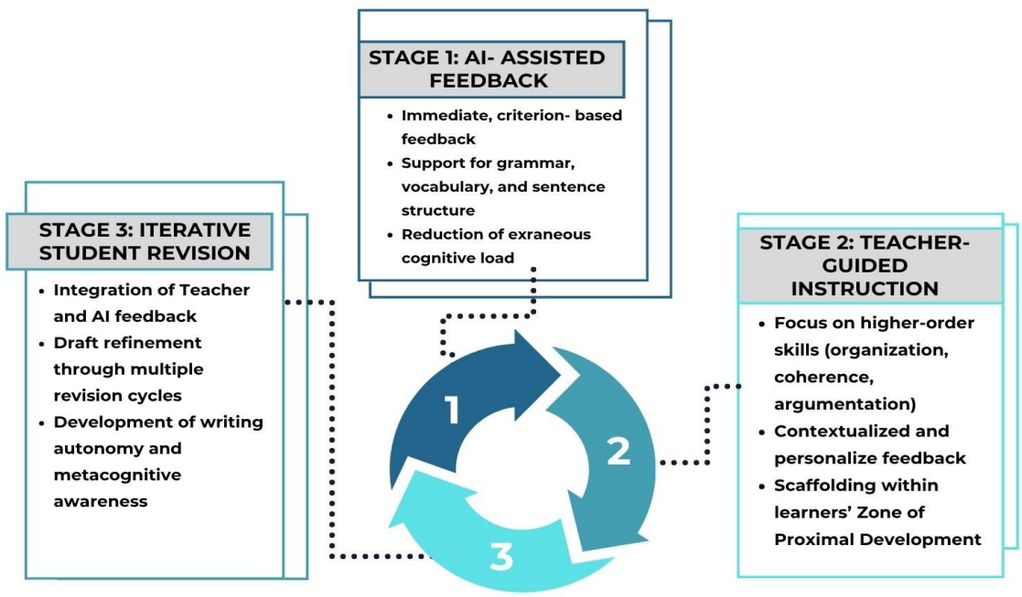

Figure 2. Proposed pedagogical model for teacher-AI feedback collaboration.

As shown in Figure 2, the proposed model follows a cyclical process in which students engage in AI-assisted feedback, teacher-guided instruction, and iterative revision. The feedback loop highlights a core fact of writing development: it is never a process that ends; learners consistently improve their work by incorporating both automated and human feedback. The model considers the complementary roles of artificial intelligence and teacher guidance in developing both lower-order and higher-order writing skills.

5.7. Implications for Pedagogy

Teachers can use AI-assisted tools to offer more efficient, timely, and structured feedback while actively reflecting on their instructional practices to improve learning outcomes (Farrell, 2012). Using AI technology can help students get faster feedback so that revision and improvement can happen more continuously in their writing tasks. Educational institutions must train teachers on the effective use of AI-supported learning tools and ensure the availability of reliable digital resources in writing classrooms. The integration of AI-assisted feedback can enhance the undergraduate writing experience, although teacher guidance remains essential in supporting higher-order writing development. Thus, a balanced approach integrating AI-assisted feedback with human instructional support is considered the most effective strategy to improve students' writing outcomes.

6. Conclusion

Artificial intelligence is gradually becoming an important tool in the education sector for teaching writing, especially writing instruction. This research also focused on the influence of AI-assisted feedback on the essay writing performance of students enrolled as undergraduate students majoring in English.

The results show that students with feedback augmented with AI report an overall improvement in their essay writing performance compared to students trained with traditional teaching methods. The results indicate that AI-assisted feedback tools may help students identify writing problems and improve their draft rewrites with more precise and structured responses instantly. This feedback encourages students to be more invested in revising and more aware of writing guidelines. However, the results also suggest that AI tools have some deficiencies, including issues related to higher-level writing strategies for supporting arguments, contextualization, and critical thinking.

Consequently, teachers play a significant role in guiding students' writing development and ensuring the quality of feedback during the instructional process. The partnership between AI-assisted responses and teachers as guides appears to be the most effective approach for improving students' writing performance. However, integrating tools such as Dola AI into writing instruction as a technology to support teacher knowledge and education can also enhance efficiency while maintaining pedagogical quality to foster meaningful learning.

Our findings suggest that AI-assisted feedback has significant effects on the essay writing ability of undergraduate English major students, as provided by a structured instructional framework.

Results show that explicit, criterion-based feedback helps in revision processes and results in gains in most components of writing. However, AI tools are limited in their capacity to support students in mastering higher-order writing skills, suggesting the role of teacher-delivered guidance remains significant.

Therefore, the optimal learning outcome for academic writing to obtain human-assisted feedback, accompanied by an appropriate hybrid approach that incorporates AI-assisted assessment, is suggested as well.

6.1. Ethical Considerations and Future Directions

Although the use of artificial intelligence in education is intrinsically beneficial, it is also associated with important ethical issues. The collection and preservation of writing records from students with the use of AI-assisted materials in the context of teaching and learning also carry a fair amount of criticism. The general use of such platforms for writing analysis presents an important debate on themes such as privacy, individual ownership of student data, and responsible use of it (Selwyn, 2019). AI tools can correct bad grammar, of course, and it is wonderful to put some order to people's language, but they do not have the ability to improve the advanced level of writing that requires human explanations and pedagogy to address. For them, if the teachers do not instruct adequately, the automated feedback is just not preparing students for critical thinking and independent writing skills (Greller & Drachsler, 2012). Further research will examine different approaches to the blending of these AI technologies with traditional writing practice in order to fulfill ethical expectations and educational usefulness. Future research may explore the lasting effects of AI-provided feedback on students' writing development and how AI tools would generalize to other writing contexts. It's critical, given AI technology is still evolving, that education be used in a manner that balances the technological inclusiveness of the current digital age with humans as the main facilitators in nurturing students in the aspect of their writing and also academic writing as a response to it.

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