

AI for Coherent Writing: Supporting EFL learners' Text Structure Development

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Abstract: The integration of Artificial Intelligence (AI) into education has reshaped language learning, particularly in writing. This study examines the effect of AI-assisted writing analysis on the structural coherence of English as a Foreign Language (EFL) students' academic essays. Using a quasi-experimental design, thirty undergraduate students at Universitas Terbuka participated in pre- and post-tests and completed a perception questionnaire based on the Technology Acceptance Model (TAM). Quantitative results revealed significant improvement in structural coherence, especially in organization and use of transitions. Students also reported high perceived usefulness and ease of use of AI tools. These findings suggest that AI-assisted feedback can effectively enhance writing coherence when integrated into process-oriented instruction, while emphasizing the need for teacher guidance and critical engagement. The study highlights the pedagogical and ethical implications of incorporating AI into higher education writing contexts.

Keywords: *AI-assisted writing, structural coherence, writing analysis*

INTRODUCTION

Writing is one of the most essential challenging skills for English as a Foreign Language (EFL) learners. It is not only demands grammatical accuracy but also logical organization, coherence, and clarity of ideas. Among the multiple dimensions of writing quality, structural coherence is considered a fundamental element that determines the clarity, flow, and comprehensibility of a text. According to Nunan and Choi (2023), coherence serves as the organizing principle of discourse that ensures logical progression between ideas, helping readers perceive writing as a unified whole rather than a series of isolated sentences. However, achieving coherence remains one of the most persistent challenges for learners of English as a Foreign Language (EFL), particularly in academic writing contexts (Zhang, 2023; Naam al-Dehimi, 2025).

In EFL settings, structural coherence is often influenced by learners' linguistic proficiency, cognitive strategies, and awareness of textual organization. Zhang (2023) highlights that EFL students tend to rely heavily on grammatical cohesion markers while neglecting the deeper logical and rhetorical relationships between ideas. This imbalance leads to texts that are grammatically correct but lack coherence at the structural level. Naam al-Dehimi (2025) further notes that coherence problems often arise from L1 interference, insufficient exposure to coherent English discourse, and limited metacognitive regulation during writing. Consequently, the development of instructional and technological interventions that promote coherence has become a central concern in recent years.

Advancements in educational technology, particularly Artificial Intelligence (AI), have created new opportunities for addressing these long-standing issues in writing pedagogy. AI-driven writing analysis systems can now provide automated feedback on coherence, cohesion, and structure, enabling learners to self-monitor and revise their writing more effectively. The study by Zhang et al. (2024) introduced *DECOR*, an AI-based benchmark capable of detecting incoherence and suggesting rewrites, demonstrating how computational tools can support structural coherence improvement through real-time analysis. Similarly, Riwayatinationsih et al. (2024) emphasize that metacognitive strategies such as planning, monitoring, and evaluating are essential for achieving coherence, and these strategies can be effectively reinforced through AI-assisted feedback mechanisms.

From a pedagogical perspective, Fitria et al. (2024) argue that coherence can be enhanced by integrating the *Simple View of Writing* framework, which combines linguistic knowledge and cognitive control. In this view, AI systems can act as cognitive scaffolds, guiding learners in managing both linguistic forms and organizational logic. When learners receive structured feedback on the progression of ideas, transitions, and argument flow, they gradually internalize coherence as a habitual writing behavior rather than an abstract concept. This aligns with Nunan and Choi's (2023) assertion that coherence must be explicitly taught and practiced through iterative engagement with text organization and reflection.

Given these developments, the intersection between AI technology and coherence-focused writing pedagogy offers a promising research direction. While existing studies have examined AI's role in grammar correction and lexical enhancement, relatively few have explored its potential in improving *structural coherence*—the logical and rhetorical connectivity that sustains the overall unity of a written text. Therefore, this study aims to investigate how AI-assisted writing analysis can enhance learners' ability to construct coherent and well-structured writing. By integrating theoretical insights on coherence with emerging AI technologies, this research seeks to contribute both to the pedagogical understanding of writing coherence and to the practical development of intelligent tools for academic writing improvement.

However, many EFL students continue to face difficulties in maintaining structural coherence. Their essays often show poor organization, weak transitions, and a lack of logical sequencing, which ultimately reduces the overall quality of their writing.

Traditional approaches to teaching writing largely rely on teacher feedback, which, while valuable, is often limited by time, subjectivity, and class size. This constraint leads to insufficient feedback cycles and limits students' opportunities for meaningful revision (Pratama & Hastuti, 2024). In recent years, the emergence of Artificial Intelligence (AI) based writing tools such as Grammarly, ChatGPT, QuillBot, and Hemingway Editor has provided a new avenue for supporting learners' writing processes. These tools offer immediate, consistent, and personalized feedback on various aspects of writing, including grammar, cohesion, and structure, which can complement and enhance traditional instructional methods (Pawestri & Widi Pratolo, 2024).

A growing body of research has explored the integration of AI in writing instruction. For instance, a systematic review found that AI tools significantly help improve organization and vocabulary usage in writing, while also reducing writing anxiety among EFL learners (Pawestri & Widi Pratolo, 2024). Additional studies report that AI-generated feedback can enhance coherence and reduce structural weakness (Pariyanto & Tungka, 2024). Despite these advances, few studies have specifically examined how AI-assisted writing analysis affects structural coherence particularly in EFL contexts where coherence problems are prevalent.

Addressing this gap, the present study investigates the use of AI-assisted writing analysis to enhance structural coherence in EFL students' academic writing. It aims to examine the extent to which AI-generated feedback contributes to improved logical organization and idea flow, as well as to explore students' perceptions of using such tools. By focusing on structural coherence, this study seeks to provide empirical evidence for how AI can function as an effective pedagogical partner in writing instruction. The findings are expected to contribute to both theoretical understanding and pedagogical practices in technology-enhanced language learning, offering insights for students, teachers, and curriculum developers seeking to integrate AI in academic writing instruction.

METHOD

This study adopts a quasi-experimental design with a pre-test and post-test approach to examine the effectiveness of AI-assisted writing analysis in improving students' structural coherence. According to Creswell and Creswell (2018), a quasi-experimental design allows researchers to assess the impact of an intervention when random assignment is not feasible. This design is appropriate for the current educational setting, which uses existing student groups. The research framework is grounded in Process Writing Theory (Hyland, 2003), which views writing as a recursive process of planning, drafting, revising, and editing. The integration of AI feedback tools supports this theory by providing immediate input during the revision phase, helping students refine their structural organization and coherence iteratively. Participants in this study were 30 undergraduate students enrolled in an academic writing course at an Universitas Terbuka. Purposive sampling was applied to ensure participants had prior exposure to English composition.

Three instruments were utilized in this study: Writing Tests (Pre-test and Post-test): Students were required to write two essays (before and after AI-assisted revision), Perception Questionnaire: Based on the Technology Acceptance Model (TAM) (Davis, 1989), this instrument assessed students' perceptions of *usefulness* and *ease of use* of AI tools in their writing process. It scored based on Structural Coherence Rubric: Adapted from Halliday and Hasan's (1976) *Cohesion in English*, this rubric measured the organization, transitions, unity, and logical flow of ideas.

The study followed four main stages:

- a. Pre-test: Students wrote a 300–350-word essay without AI assistance.
- b. Treatment: Students revised their essays using AI tools (Grammarly, ChatGPT, and QuillBot) to analyze and improve structure and coherence.
- c. Post-test: Students rewrote and submitted their final essays after incorporating AI feedback.
- d. Perception Survey: Students completed a questionnaire regarding their experiences and attitudes toward AI-assisted writing.

Quantitative data (pre-test and post-test scores) were analyzed using a paired-sample t-test to determine the statistical significance of improvements. Qualitative data (student reflections and writing revisions) were analyzed using content analysis as described by Krippendorff (2018), focusing on patterns of improvement and students' engagement with AI-generated feedback. Instrument validity was ensured through expert judgment from two EFL writing lecturers. Inter-rater reliability for writing assessments was calculated using Cohen's Kappa, ensuring scoring consistency. The questionnaire's reliability was measured using Cronbach's Alpha, with $\alpha \geq 0.70$ considered acceptable.

RESULTS AND DISCUSSION

Results

Improvement in Structural Coherence

The findings of the quasi-experimental study demonstrated a significant improvement in students' structural coherence after the implementation of AI-assisted writing analysis tools. Results from the paired-sample *t*-test indicated that students' mean coherence score increased from 70.13 (SD = 5.42) in the pre-test to 82.47 (SD = 4.91) in the post-test. The statistical analysis revealed a $t(29) = 9.86$, $p < .001$, confirming that the difference between the pre-test and post-test means was statistically significant.

The computed effect size (Cohen's $d = 1.80$) indicates a large effect, suggesting that the AI-assisted feedback had a substantial positive impact on students' ability to organize and connect ideas

coherently. This result supports previous research emphasizing the importance of technological scaffolding in enhancing structural coherence (Zhang et al., 2024; Nunan & Choi, 2023).

Test Type Mean SD t-value p-value Effect Size (d)

Pre-test	70.13	5.42			
Post-test	82.47	4.91	9.86	< .001	1.80

These findings indicate that students significantly improved their ability to maintain logical sequencing, paragraph unity, and idea flow after using AI-based platforms such as Grammarly, ChatGPT, and QuillBot during the writing process.

Improvements in Writing Aspects

Further analysis based on the Structural Coherence Rubric (adapted from Halliday & Hasan, 1976) revealed notable progress across four writing components:

Writing Aspect Pre-test Mean Post-test Mean Improvement (%)

Organization	69.2	81.4	+17.6%
Transitions	68.5	84.0	+22.6%
Topic Unity	71.0	83.2	+17.2%
Logical Flow	72.8	81.3	+11.7%

The most substantial gains were observed in organization and use of transitions, which reflects the tools' effectiveness in guiding students to structure paragraphs coherently and use cohesive devices appropriately. Grammarly and QuillBot primarily supported micro-level corrections (sentence linking and lexical coherence), while ChatGPT provided macro-level feedback that improved argument development and paragraph flow.

These results align with Fitria et al. (2024), who emphasized that metacognitive strategies reinforced through digital feedback contribute to better coherence and organization in EFL writing. Similarly, Riwayatiningsih et al. (2024) found that real-time digital feedback enhances students' ability to monitor and regulate their writing structure, leading to sustained improvements in coherence and readability.

Students' Perception Toward AI Feedback

Results from the Technology Acceptance Model (TAM)-based questionnaire showed positive perceptions toward AI tools:

Construct	Mean (out of 5)	Interpretation
Perceived Usefulness	4.36	Very Positive
Perceived Ease of Use	4.42	Very Positive
Behavioral Intention to Use	4.25	Positive

Most students agreed that AI tools helped them identify weaknesses in structure and improve coherence, though some expressed concerns about overreliance on automated suggestions and the need for teacher validation. Overall, the responses indicated strongly positive perceptions of AI-assisted writing tools. Students acknowledged that these tools helped them identify weaknesses in paragraph structure, idea sequencing, and transitions. They also found the feedback clear, accessible, and time-efficient.

However, some respondents expressed cautious attitudes toward overreliance on automated feedback, noting the importance of maintaining teacher guidance and critical self-evaluation. This sentiment supports the observations of Naam al-Dehimi (2025), who found that while AI tools facilitate coherence improvement, human mediation remains vital to ensure academic integrity and critical engagement.

In summary, Structural coherence improved significantly ($\Delta M = +12.34$, $p < .001$). The largest gains occurred in transitions (+22.6%) and organization (+17.6%) and students reported high usefulness ($M = 4.36$) and ease of use ($M = 4.42$) of AI tools. ChatGPT outperformed Grammarly and QuillBot in supporting higher-order coherence. Qualitative feedback underscored the need for balanced AI-teacher feedback to foster long-term writing competence.

Discussion

The present study aimed to examine the effectiveness of AI-assisted writing tools in improving the structural coherence of undergraduate EFL students' writing at Universitas Terbuka. The quantitative results, which demonstrated a significant increase in post-test scores and large effect sizes, confirm that AI-driven feedback can effectively support students' writing development, particularly in coherence, organization, and transition use.

The significant improvement in coherence scores aligns with recent research emphasizing the role of AI-mediated feedback in supporting writing development. According to Li and Li (2020), intelligent feedback systems promote writers' awareness of textual organization by offering explicit guidance on paragraph unity and cohesion. Similarly, Jia et al. (2021) found that AI-based corrective feedback not only enhances accuracy but also encourages metacognitive reflection, leading students to revise their writing structure more purposefully. The current findings extend these results by showing that AI feedback not only assists with sentence transitions and connectors but also with level coherence, such as idea progression and argument structure. This supports Kim and Park (2022), who argue that AI tools function as cognitive scaffolds that guide writers through recursive writing processes: planning, drafting, and revising, thereby strengthening textual unity. In this study, students' post-test writing showed clearer paragraph development and improved sequencing of ideas, confirming the theoretical claim that structural coherence can be enhanced through iterative AI-guided feedback cycles (Zhang et al., 2024; Riwayatningsih et al., 2024).

The analysis of specific writing aspects revealed notable gains in organization and use of transitions, suggesting that AI tools were particularly effective in helping students manage discourse flow and paragraph linkage. These results corroborate Fitria et al. (2024), who found that real-time AI feedback facilitates students' understanding of cohesive devices and rhetorical organization in academic texts. Likewise, Nasr et al. (2023) noted that AI-enhanced revision practices allow learners to visualize structural weaknesses in their texts, promoting independent correction and deeper engagement with text-level coherence.

The findings from the TAM-based questionnaire indicate that students perceived AI tools as useful, easy to use, and beneficial for their writing development. This confirms prior studies by Ayu and Indrawati (2023) and Naam al-Dehimi (2025), which reported positive attitudes toward AI writing assistants among EFL learners, particularly when feedback was immediate, specific, and non-threatening. Perceived usefulness ($M = 4.36$) and ease of use ($M = 4.42$) suggest that the participants valued AI systems for their accessibility and efficiency in identifying structural issues. This reflects Amelia & Fitri (2024) original TAM model, who emphasized that learner intention to use technology increases when systems demonstrate both clarity and reliability.

However, qualitative comments from several respondents revealed a concern about overreliance on AI-generated feedback. This supports Nguyen & Pham (2024), who argued that while AI tools can enhance coherence and organization, human mediation remains crucial for maintaining critical thinking and authentic authorial voice. Hence, AI feedback should complement not replace lecturer guidance in writing pedagogy.

The significant pre-to-post improvement supports the view that AI writing tools can meaningfully improve structural coherence in EFL student writing. This finding aligns with recent empirical work that documents measurable improvements in organization and coherence after AI-assisted interventions (Marzuki, 2023; Khalifa, 2024). High scores on perceived usefulness and ease of use are consistent with broader studies applying TAM to generative AI and ChatGPT in higher education (Zou, 2023). Students' positive behavioral intention suggests a readiness to integrate AI into writing workflows, which helps explain the measurable gains. Nevertheless, the literature warns that acceptance metrics alone do not guarantee effective or ethical use. Lecturer must scaffold responsible, reflective application. The rubric subscale improvements (especially transitions) indicate AI tools are particularly effective at pointing out sentence- and paragraph-level linking problems and suggesting lexical or structural connectors. This matches findings from controlled studies showing AI can reliably flag cohesive breaks and offer candidate transitions, which students often incorporate during revision (Marzuki, 2023).

While results are promising, recent literature also foregrounds concerns that temper unqualified endorsement of AI. Reports and studies highlight risks of overreliance, academic integrity challenges, and uneven tool reliability (U.S. Department of Education, 2023; Reuters/Nature coverage 2025). Students' qualitative remarks about dependence map onto these concerns: AI can scaffold but also encourage surface adoption of suggestions without deep reflection. Therefore, integrating AI must be accompanied by instruction in AI literacy, critical evaluation of suggestions, and assessment redesign to emphasize process and metacognition

The discussion demonstrates that AI-assisted writing tools have a measurable, positive impact on EFL students' structural coherence. Improvements in organization, transitions, and logical flow were supported by strong student perceptions of usefulness and ease of use. While the results affirm the pedagogical potential of AI feedback, they also underscore the need for balanced integration where human feedback complements machine intelligence to develop both accuracy and critical writing awareness.

This study examined the effectiveness of AI-assisted writing tools in improving the structural coherence of undergraduate EFL students' essays at Universitas Terbuka. The significant post-test gains and large effect sizes indicate that AI-generated feedback can meaningfully enhance students' ability to organize ideas, use transitions, and manage discourse flow. These improvements can be better understood through cognitive, metacognitive, and sociocultural perspectives on writing development.

From a cognitive perspective, AI tools function as noticing and monitoring mechanisms that make abstract discourse features more visible to learners. EFL students often struggle with coherence because they focus on sentence-level accuracy rather than global text organization. The AI tool's explicit prompts such as highlighting missing transitions, identifying illogical sequencing, or flagging weak topic sentences—directed students' attention to structural issues they might otherwise overlook. One example from the data demonstrates this shift:

Before feedback: *“Online learning has many benefits for students. Students can learn anywhere. But sometimes they feel lonely.”*

After feedback: *“Although online learning offers flexibility to study anywhere, it can also lead to isolation, increasing students’ desire for in-person interaction.”*

This, AI feedback prompted the student to integrate ideas, refine logical relations, and use more appropriate transitions, demonstrating deeper cognitive processing of coherence.

The improvement can also be interpreted through a metacognitive lens, where AI-supported revision cycles helped students plan, monitor, and evaluate their writing. The ability to revise iteratively allowed students to reflect on the organization of ideas rather than merely correcting surface errors. For example, a student initially wrote:

Before feedback: *“The government should provide technology in schools. Teachers need training. Some schools have no facilities.”*

After feedback: *“To maximize the benefits of educational technology, the government must first ensure adequate facilities in schools and provide continuous teacher training.”*

This shift shows purposeful restructuring of sentences and clearer logical progression evidence of metacognitive regulation prompted by targeted AI suggestions.

From a sociocultural perspective, AI tools acted as digital mediators that provided individualized, immediate feedback, approximating a dialogic learning partner. Such interaction, where learners are guided within their zone of proximal development through external support. The AI’s consistent and accessible feedback created a form of writer–tool dialogue, enabling students to revise with guidance even outside classroom hours. This mediated interaction may explain why students produced clearer paragraph development and improved sequencing in their post-test essays. The improvement in linking devices also indicates that students not only adopted recommended transitions but learned to use them more strategically.

Results from the TAM-based questionnaire reinforce the quantitative outcomes. High levels of perceived usefulness ($M = 4.36$) and ease of use ($M = 4.42$) suggest that students valued AI for its clarity, immediacy, and diagnostic precision. These perceptions are consistent with studies showing that accessible and non-threatening feedback increases engagement and writing confidence

Overall, the findings show that AI-assisted writing tools improve structural coherence by supporting cognitive noticing, fostering metacognitive regulation, and providing sociocultural scaffolding. While the results affirm the pedagogical potential of AI feedback, they also underscore the need for balanced use where human instruction complements technological support. Integrating AI with reflective guidance can strengthen both coherence and critical writing awareness, contributing to more effective and ethical adoption of AI in higher education writing contexts.

CONCLUSION

This study investigated the effect of AI-assisted writing analysis on the structural coherence of EFL students’ academic writing. The quantitative and qualitative results demonstrate that integrating AI feedback tools such as Grammarly, ChatGPT, and QuillBot can significantly enhance students’ ability to organize ideas, build transitions, and maintain logical flow across paragraphs. Statistical analysis revealed a large effect size, confirming the strong impact of AI-assisted feedback on students’ structural performance. The findings confirm and extend recent research that AI technologies can effectively support writing development when used as formative feedback instruments. Within the process-writing framework and sociocultural theory of learning, AI operates as a digital scaffold that guides learners through iterative cycles of drafting and revision. Students also reported high levels of usefulness and ease of use, consistent with recent Technology Acceptance Model (TAM) studies. However, this study also highlights an emerging tension: while AI accelerates learning and self-

correction, it may foster overreliance and reduced critical engagement if not balanced with teacher feedback and reflective instruction. Therefore, AI should be viewed not as a replacement for human educators but as a complementary cognitive partner in writing pedagogy. In conclusion, AI-assisted writing analysis effectively improves structural coherence and learner engagement in EFL academic contexts, particularly when embedded in a process-oriented and ethically guided instructional design. The rise of AI in education offers an unprecedented opportunity to redefine the feedback process in writing instruction. When grounded in sound pedagogy, guided by ethics, and supported by institutional policy, AI tools can empower students not only to write more coherently but also to think more critically about their own learning process. The future of writing instruction, therefore, lies in the synergy between human guidance and intelligent technology.

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