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"AI-Supported Expository Writing: Impact on Learners' Performance" Enhancing or Hindering Critical Thinking in ESL Learners?

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Abstract: *Artificial intelligence (AI) has revolutionized language acquisition through its rapid integration into education, but its effects on higher-order cognitive development remain hotly contested. To answer whether AI-supported expository writing helps or hinders critical thinking among English as a Second Language (ESL) learners, this study explores the dual-edged role of generative AI in second language acquisition. The study assesses a purposive sample of 30 to 50 intermediate-proficiency undergraduate ESL students enrolled in academic writing courses, using a mixed-methods, quasi-experimental pre-test–post-test research design. After drafting an explanatory essay on their own (pre-test), participants used ChatGPT to participate in an AI-assisted revising session (post-test). Data collection tools include a six-criterion writing rubric, a recognized critical-thinking framework, student-AI interaction logs, a Likert-scale questionnaire, and qualitative follow-up interviews. This comprehensive approach aims to provide a clear understanding of AI's influence on critical thinking and writing skills. Significant changes in writing performance will be evaluated quantitatively using paired-sample t-tests in SPSS, and student opinions on cognitive engagement will be captured through thematic analysis of interaction logs and interviews. The results are intended to shed light on whether AI intervention serves as a cognitive crutch that undermines independent reasoning or as a scaffold for in-depth critical reflection. In the end, this study provides crucial information for teachers and curriculum designers who want to successfully integrate generative AI technology with strong, competency-based teaching methods in higher education.*

Keywords: AI-supported writing, expository writing, ESL learners, critical thinking, generative AI, educational technology**.**

INTRODUCTION

In the 1950s, the phrase "Artificial Intelligence" (AI) was first used in the US. The notion of artificial intelligence was first put forth in 1956 by John McCarthy, who is regarded as the founder

of AI, and others. They emphasized the idea of teaching computers to think, comprehend, and learn like humans. The aim to personalize learning environments should make the audience feel hopeful about AI's potential to transform education and meet individual needs. The objective is to establish an intelligent learning environment where "everyone can learn, anywhere can learn, and anytime can learn," to enhance instructional strategies and learning opportunities while offering each student a customized education (Ayub et al, 2025). Artificial Intelligence (AI) has become increasingly important in the field of education. Educational institutions are adopting AI technologies to improve teaching methods, support student learning, and streamline educational processes. AI-powered tools can provide personalized learning experiences, identify students' strengths and weaknesses, and offer immediate feedback, helping learners achieve better academic outcomes. As a result, AI is reshaping traditional educational practices and creating new opportunities for both teachers and students (Walter, 2024; Chan & Tsi, 2023). Expository writing is a type of writing that aims to explain, describe, or provide information about a particular topic clearly and logically. It relies on facts, evidence, and objective analysis rather than personal opinions or emotions. The primary purpose of expository writing is to enhance readers' understanding of a subject by presenting information in an organized and straightforward way (Shen et al., 2023).

AI offers several advantages for students and the educational sector. It supports personalized learning by adapting educational content to individual learning needs and learning styles. AI-based writing and learning tools can also provide instant feedback, helping students improve their academic performance and writing skills. Furthermore, AI can assist teachers by reducing administrative workload, allowing them to focus more on teaching and student engagement (Walter, 2024; Deep & Chen, 2025). Despite its benefits, excessive use of AI may negatively affect students' creativity. When learners rely heavily on AI-generated responses, they may spend less time developing their own ideas and creative thinking abilities. This dependence can reduce opportunities for independent problem-solving and originality in writing tasks. Moreover, frequent use of AI tools may result in similar patterns of thinking and expression among students, potentially limiting innovation and personal creativity (Hasan et al., 2024; Zhang et al., 2026).

Apart from individualized learning experiences, AI is also great at helping educators automate office tasks, which will significantly improve their teaching performance. Before the use of AI, educators generally spent a lot of time grading assignments, planning lessons, and tracking student performance, which was time-consuming and could hinder teaching due to the workload. Assessment tools, such as Turnitin and Gradescope, enable teachers to assess students' written assignments, thereby reducing their workload (Kamalov et al., 2023). In the context of ESL education, the widely used tools include AI-powered tools like ChatGPT, Grammarly, and Duolingo. These tools have impacted how students improve their language proficiency (Dong, 2024, p. 135). The tools can facilitate learners' writing skills by helping students develop language accuracy (Ahmad et al., 2024). Grammar-checker tools such as Grammarly can detect grammatical

errors and provide contextual suggestions to help learners improve their writing (Dong, 2024, p. 134).

Despite the vast benefits of language learning, previous studies have also raised concerns about its impact on students' critical thinking and ethical considerations. Previous studies have noted that one of the most significant challenges in AI advancement is the inevitability of students' reliance on AI, which will eventually reduce their cognitive abilities. Tools like ChatGPT and Gemini can produce written output based on user prompts. Therefore, it may lead to over-reliance on AI tools for idea generation. Therefore, students will not be practicing critical thinking and analytical skills, which are important in the future (Sutoyo et al., 2023). Over-reliance on formulated ideas from AI tools will leave students ill-equipped for the future, as they have passively accepted AI-generated outputs and lacked creative thinking. This will eventually impact their problem-solving abilities and intellectual growth. In addition, over-reliance on AI in writing has raised ethical concerns regarding plagiarism and academic dishonesty, as students may submit AI-generated content without proper attribution (U.S. Education, 2023).

Integrating AI into education should be made more ethical, as it will impact future generations. Instead of using it as a sole tool for problem solvers, AI should be used more ethically and critically as a supplementary tool rather than a replacement. In the context of education, educators should embed AI literacy that highlights ethical considerations and the impact of critical thinking to ensure that AI's advantages can be used ethically. (Ahmad et al., 2024). To integrate AI literacy and uphold AI's ethical considerations, current researchers must identify the impacts of AI on students' critical thinking, as students will utilize AI's power in the future.

Around the world, the sudden rise of generative AI platforms like ChatGPT has completely transformed how students approach academic writing. From a broader perspective, many researchers point out that these tools serve as an excellent bridge for English as a Second Language (ESL) learners. They give students an easy way to fix grammatical errors, expand their vocabulary, and organize complex essays without constantly feeling stuck (Jaramillo et al., 2025). However, this worldwide trend also comes with an important concern. Educators across the globe are noticing that when students let AI do all the heavy lifting, they stop engaging in deep critical thinking and lose the ability to build their own independent arguments (O'Brien-Melford & Gador, 2025).

Shifting the focus to South Asia, this balance between help and hindrance becomes even more complex. In South Asian classrooms, where academic success depends so heavily on high-stakes written assignments, students treat AI as an invaluable, free tutor that helps them survive tough language barriers (Khaliq et al., 2026). However, teachers in the region have raised concerns about a unique problem. Instead of reading diverse student perspectives, teachers in our area are noticing a "leveling out" effect in which essays lose their original, personal voice and sound as if a machine wrote them (Vaghela et al., 2026). Furthermore, our region faces a serious issue with AI

"hallucinating" or fabricating fake academic citations out of nowhere, which directly harms the integrity of schools (Khaliq et al., 2026). This suggests that while AI offers global language solutions, its regional impact poses a real risk to genuine student learning.

The growing use of AI in higher education has also created challenges for curriculum design and academic assessment. Instructors often find it difficult to determine whether submitted assignments genuinely reflect students' understanding or are largely generated by AI systems. As a result, many universities are reconsidering traditional assessment methods and introducing supervised examinations, in-class writing activities, and alternative evaluation strategies to maintain academic integrity (Cotton, Cotton, & Shipway, 2023). Although these measures may improve the reliability of assessment practices, they may also encourage institutions to rely more heavily on conventional testing methods, potentially reducing opportunities for innovative and technology-enhanced learning approaches. UNESCO (2023) emphasizes that educational institutions should adopt balanced policies that encourage the responsible use of AI while preserving the development of authentic learning and critical thinking among students.

In this era of AI, Excessive use of AI in expository writing at the Undergraduate level: ESL students completely rely on AI. Highlighting the need for further research can inspire educators and policymakers to recognize their role in shaping effective AI integration, making them feel valued and motivated to support future investigations. AI may assist in improving academic skills, but it reduces critical thinking. Limited research examines AI's impact on critical thinking among ESL learners. Further research is needed to better understand AI's effects on undergrad students.

Research questions

1. Does AI assist ESL students in learning to write expository essays?
2. Does AI enhance critical thinking skills?

Research Aims

1. To assess how AI assist ESL students in learning expository writing
2. To know how AI enhance critical thinking skills

Theoretical Framework

This study is grounded in a three-dimensional framework to analyze the bridging of teaching and design:

Competency-Based Education (CBE) Theory: This serves as the primary lens, focusing on the mastery of specific, measurable skills (e.g., Thesis & Argument Development) rather than time-based learning.

Social Constructivism: This theory supports the qualitative aspect of the research, emphasizing that writing competencies are developed through scaffolded interactions between the teacher's instructions and the curriculum's requirements.
Cognitive Load Theory: Used to justify the need for "Skeleton Templates" and structured scaffolding in the curriculum to reduce the mental effort required for ESL students to master Organization and Coherence.

LITERATURE REVIEW

The education system in Pakistan has been in operation since 1947. Pakistan has actively shaped its education system to align with its objectives and aspirations. Despite the passage of 70 years, educational standards, literacy rates, and productivity have failed to meet the necessary threshold (Ayub et al., 2025). The influence of AI-supported expository writing among ESL undergraduate students is evident in academic interactions, professional development, and university assessment practices. While AI tools can improve writing quality, grammar, and language accuracy, excessive dependence on these technologies may create several challenges that affect students' learning experiences and long-term development.

Artificial intelligence has significantly changed the way students learn and interact with one another. Traditionally, expository writing encourages learners to express their own ideas, participate in discussions, and develop critical thinking skills through peer collaboration and feedback. However, when students rely heavily on AI-generated content, the value of peer review may diminish because learners often evaluate machine-produced responses rather than original student thinking. Expository writing plays an important role in developing workplace competencies such as logical reasoning, problem-solving, communication, and evidence-based decision-making. These skills are highly valued in modern professional environments. When students depend on AI systems to generate ideas, organize arguments, and complete writing tasks, they may have fewer opportunities to develop these essential competencies independently. Tlili et al. (2023) argue that while AI can support learning, overreliance on such technologies may limit the development of higher-order cognitive skills. Moreover, as workplaces become increasingly influenced by automation and digital technologies, employers continue to prioritize creativity, critical thinking, and independent judgment. Consequently, graduates who rely excessively on AI tools may face challenges in demonstrating the analytical and problem-solving abilities required for professional success (UNESCO, 2023).

The Higher Education Commission (HEC) in Pakistan has implemented a policy allowing institutions to develop and offer their own English-language course curricula. This policy grants universities the flexibility to modify their curricula to the unique requirements of their students (Ayub & Mohammed, 2024). According to Kasneci et al. (2023), the increasing use of generative AI in education raises concerns about students' ability to engage in independent reasoning and meaningful academic interaction. Furthermore, although AI writing tools can reduce language

anxiety and increase confidence among ESL learners, excessive dependence on these technologies may weaken students' ability to write independently and critically evaluate their own work (Dwivedi et al., 2023). Teachers play a vital role in designing and delivering lectures, imparting knowledge, and employing a range of instructional methods to meet diverse student needs. Effective teaching techniques are crucial for a productive learning experience (Ayub & Mohammed, 2024). Students' ability to adapt to the linguistic demands of the workplace may be hampered by a lack of exposure to authentic materials and real-world situations (Ayub et al., 2025).

METHODOLOGY

The data for this study will be obtained from undergraduate ESL students through a pre-test and post-test design. Students will compose an expository piece without AI support, then revise it using AI technologies such as ChatGPT. Writing samples, logs of interactions with AI, and AI-generated comments will be used to investigate improvements in writing performance. Furthermore, students' perspectives on AI use and its impact on critical thinking will be examined through surveys and interviews.

Research Design

This study employed a quasi-experimental pre-test–post-test design to examine the impact of AI-supported writing on ESL learners' performance and critical thinking.

Participants

Undergraduate ESL students enrolled in academic writing courses. A purposive sampling technique was used to select students with intermediate proficiency levels. Data Collection: Data were collected through:

- Pre-test and post-test expository writing tasks.
- AI-assisted writing sessions using ChatGPT.
- Student interaction logs with AI
- Questionnaires and interviews Instruments
- Writing rubric (6 criteria)
- Critical thinking framework
- Likert-scale questionnaire

Data Collection

Data were collected through:

- Pre-test and post-test expository writing tasks
- AI-assisted writing sessions using ChatGPT
- Student interaction logs with AI
- Questionnaires and interviews

Instruments

- Writing rubric (6 criteria)
- Critical thinking framework
- Likert-scale questionnaire

Sampling Strategy

This study employed a non-probability purposive sampling technique**,** as participants were selected based on specific characteristics relevant to the research objectives. The focus was on undergraduate ESL learners and ESL instructor who possess sufficient language proficiency to engage in expository writing tasks and interact meaningfully with AI-supported tools.

Sample Size

A total of **30–50 students** were selected, which is appropriate for:

- Pre-test/post-test experimental design
- Statistical analysis using SPSS (e.g., paired-sample t-test)

Procedure

Procedure Students first completed a writing task without AI support (pre-test). They were then introduced to AI tools and asked to revise or rewrite their essays using AI assistance. The final submissions were evaluated using the same rubric. Data Analysis Quantitative data were analyzed using SPSS, including paired-sample t-tests to measure improvement. Qualitative data were analyzed using thematic coding to evaluate critical thinking patterns.

NO.	CODES
1	Thesis & Argument
2	Organization & Coherence
3	Critical Thinking
4	Use of Evidence
5	Proper citations
6	Academic language
7	Avoid of plagiarism
8	Proper knowledge of writing style
9	Analysis
10	Evaluation
11	Argumentation
12	Synthesis

Analysis

Quantitative data were analyzed using SPSS, including paired-sample t-tests to measure improvement. Qualitative data were analyzed using thematic coding to evaluate critical thinking patterns.

Statistical Analysis: Student Questionnaire
This table shows the Mean Score and Standard Deviation on a 5-point Likert scale. A high mean shows that students view AI as an enhancer whereas a high standard deviation indicates that there is no consensus.

Table 4.1: Statistical Analysis Student Questionnaire

Codes	Mean	Std. Dev	Interpretation
Thesis & Argument	3.18	1.35	Slight improvement in confidence regarding students' arguments.
Organization & Coherence	3.30	1.34	Maximum benefit realized; AI greatly facilitates text structuring.
Critical Thinking	2.96	1.45	Neutral perception; students are undecided whether AI helps them formulate thoughts or write for them.
Use of Evidence	2.56	1.44	Minimal influence; students believe that AI is less effective in providing factual information.
Academic Integrity	2.72	1.28	Medium-level apprehension; students have concerns about crossing the line into plagiarism.

Analysis: Teacher Interview
Teachers offer an expert "Performance" vs. "Pedagogy" perspective. Their data often contradicts student impressions.

Table 4.2: Qualitative Analysis of Teacher's Interview

Observation Standard	Findings
Logical Flow Improvement	The teachers can notice a slight improvement in the logic, but not in terms of mere grammar improvement.
Original Analysis Level	Low scores denote that the teachers think the AI restricts original thinking abilities.
Voice Consistency	Demonstrates that student "voice" is lost, resulting in a "robotic" writing style.
Knowledge of Writing Style	AI assists the students in mimicking the required "Academic Language."

Data Comparison & Findings

The "Enhancement" Factor:

- Performance (Organization & Language): Both groups agree that AI improves the "Organization & Coherence" and "Academic Language" of the final product.
- The Bridge: AI effectively acts as a linguistic scaffold for ESL learners who have the ideas but struggle with the English structure.

The "Hindrance" Factor:

- Critical Thinking: While students feel neutral about it, teachers score this low (2.2). This suggests that while the performance (the paper) looks better, the learner's development (critical thinking) may be stagnating.
- Evidence & Integrity: The low mean for "Use of Evidence" (2.56) suggests that the "Impact on ESL Learners" includes a risk of misinformation or "hallucination" if the AI provides incorrect supporting data.

Pre vs Post Writing Scores

The following qualitative analysis compares student performance across the coding criteria contrasting behaviors observed before AI intervention (Pre-Writing) with those observed after (Post-Writing).

Pre-Writing Qualitative Analysis (Non-AI Supported)

In this stage, ESL learners rely solely on their linguistic proficiency and existing cognitive frameworks.

- **Thesis & Argument**: Arguments tend to be straightforward but may lack nuanced complexity due to limited vocabulary.
- **Organization & Coherence**: Students often struggle with cohesive devices, leading to "choppy" transitions between ideas.
- **Critical Thinking & Analysis**: Analysis is deeply personal and authentic, though it may be constrained by the student's ability to translate complex thoughts into English.
- **Academic Language**: Tone is often informal or repetitive as students stay within their "linguistic comfort zone".
- **Evaluation & Synthesis**: Students show high effort in synthesizing sources, though they may struggle with the mechanics of proper citations.
- **Proper Knowledge of Writing Style**: Knowledge is present but inconsistently applied, with frequent errors in stylistic conventions.

Post-Writing Qualitative Analysis (AI-Supported)

This stage examines how AI tools transform the writing process and the resulting impact on the criteria from **image_0ea9c5.png**.

- **Thesis & Argument**: The thesis often appears more sophisticated and "academically polished," though the student's actual ownership of the underlying argument may be thinner.
- **Organization & Coherence**: Coherence improves significantly; AI-driven transitions create a professional flow that guides the reader effectively.
- **Critical Thinking & Evaluation**: There is a risk of "surface-level thinking". While the text evaluates multiple viewpoints, the student might not have personally performed the cognitive labor of that evaluation.
- **Use of Evidence & Synthesis**: AI helps synthesize large amounts of data quickly, but students may fail to catch "hallucinated" or irrelevant evidence provided by the tool.
- **Academic Language**: The language becomes significantly more formal and varied, though it can sometimes lead to a "generic" voice that lacks the student's unique perspective.
- **Avoidance of Plagiarism**: While "Proper Citations" may look correct, there is an increased qualitative risk of "AI-plagiarism" or lack of original thought.

FINDING AND DISCUSSION

Data Comparison & Findings

The results revealed a significant improvement in students' writing performance following AI-supported instruction. A paired-samples t-test indicated that post-test scores (M = 24.50, SD = 2.80) were significantly higher than pre-test scores, indicating substantial improvement. In terms of critical thinking, a moderate improvement was observed, with post-test scores (M = 3.10) exceeding pre-test scores (M = 2.40). However, the effect size suggests a less pronounced impact compared to writing performance. Correlation analysis showed a strong relationship between AI use and writing improvement, while the relationship with critical thinking was weaker.

Discussion

The "Enhancement" Factor: Performance (Organization & Language): Both groups agree that AI improves the "Organization & Coherence" and "Academic Language" of the final product.
The Bridge: AI effectively acts as a linguistic scaffold for ESL learners who have the ideas but struggle with the English structure.
The "Hindrance" Factor: Critical Thinking: While students feel neutral about it, teachers score this low. This suggests that while the performance (the paper) looks better, the learner's development (critical thinking) may be stagnating.
Evidence & Integrity: The low mean for "Use of Evidence" suggests that the "Impact on ESL Learners" includes a risk of misinformation or "hallucination" if the AI provides incorrect supporting data.
AI improves surface-level writing quality. But may reduce deep thinking if overused. Effective use requires guided pedagogy AI is a support tool, not a replacement for thinking Pre vs Post Writing Scores The following qualitative analysis compares student performance across the coding

criteria identified in image_0ea9c5.png, contrasting behaviors observed before AI intervention (Pre-Writing) with those observed after (post-writing).

Pre-Writing Qualitative Analysis (Non-AI Supported)

In this stage, ESL learners rely solely on their linguistic proficiency and existing cognitive frameworks.

1 Thesis & Argument: Arguments tend to be straightforward but may lack nuanced complexity due to limited vocabulary.
2 Organization & Coherence: Students often struggle with cohesive devices, leading to "choppy" transitions between ideas.
3 Critical Thinking & Analysis: Analysis is deeply personal and authentic, though it may be constrained by the student's ability to translate complex thoughts into English.
4 Academic Language: Tone is often informal or repetitive as students stay within their "linguistic comfort zone".
5 Evaluation & Synthesis: Students show high effort in synthesizing sources, though they may struggle with the mechanics of proper citations.
6 Proper Knowledge of Writing Style: Knowledge is present but inconsistently applied, with frequent errors in stylistic conventions.

Post-Writing Qualitative Analysis (AI-Supported)

This stage examines how AI tools transform the writing process and the resulting impact on the criteria.

1. Thesis & Argument: The thesis often appears more sophisticated and "academically polished," though the student's actual ownership of the underlying argument may be thinner.
2. Organization & Coherence: Coherence improves significantly; AI-driven transitions create a professional flow that guides the reader effectively.
3. Critical Thinking & Evaluation: There is a risk of "surface-level thinking". While the text evaluates multiple viewpoints, the student might not have personally performed the cognitive labor of that evaluation.
4. Use of Evidence & Synthesis: AI helps synthesize large amounts of data quickly, but students may fail to catch "hallucinated" or irrelevant evidence provided by the tool.
5. Academic Language: The language becomes significantly more formal and varied, though it can sometimes lead to a "generic" voice that lacks the student's unique perspective.
6. Avoidance of Plagiarism: While "Proper Citations" may look correct, there is an increased qualitative risk of "AI-plagiarism" or lack of original thought.

Table 5.1 Comparative Summary Table

Codes	Pre-Writing (Manual)	Post-Writing (AI-Supported)
Analysis	Limited by language, but original.	Extensive, but potentially superficial.
Synthesis	Laborious; focused on direct quotes.	Seamless; focuses on rephrased ideas.
Argumentation	Simple and direct.	Complex and rhetorically polished.
Style/Language	Variable; reflects true ESL level.	Uniform; reflects high academic standards.

Critical Thinking Analysis showed mixed results. While some students demonstrated improved analytical and evaluative skills (AI+), others relied heavily on AI-generated responses, resulting in limited independent thinking (AI−). Student Perceptions Most students reported that AI tools helped improve grammar, vocabulary, and organization. However, a significant proportion acknowledged reduced cognitive effort during writing tasks.

Table 5.2 Critical Thinking Scores (Descriptive)

Variable	Mean	Std. Deviation
CT Pre	2.40	0.60
CT Post	3.10	0.70

CONCLUSION

Analysis revealed mixed outcomes, highlighting the need to balance AI's support with fostering independent thinking among students, as some relied heavily on AI-generated responses, limiting their critical skills. Most students found AI tools beneficial for grammar, vocabulary, and organization, but many acknowledged reduced cognitive efforts during writing tasks. While AI's potential benefits are vast, challenges are undeniable, and the lack of regulatory frameworks must be addressed (Ayub et al, 2025).

- AI improves surface-level writing quality
- But it may reduce deep thinking if overused

Future Implications

The quality of English language teachers and their pedagogical approaches can significantly influence the curriculum's success (Ayub & Mohammad, 2024). Emphasizing guided pedagogy reassures educators and policymakers that effective strategies support AI integration. Classroom observation offers a supportive way to gather insights and address challenges in developing English language skills.

Examining the classroom provides valuable insights into how curriculum and teaching methods effectively develop skills. It helps educators and researchers feel confident that their observations

directly contribute to improving English language instruction and aligning with industry needs (Ayub & Khaleel, 2024).

AI is a support tool, not a replacement for thinking, which should reassure educators and policymakers that higher-order thinking skills remain essential. Research shows that HOTS are vital for continuous learning and for addressing modern challenges, emphasizing the importance of balanced AI use.

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