



Sociology & Cultural Research Review (SCRR)
 Available Online: <https://scrrjournal.com>
 Print ISSN: 3007-3103 Online ISSN: 3007-3111
 Platform & Workflow by: [Open Journal Systems](https://doi.org/10.5281/zenodo.17300232)
<https://doi.org/10.5281/zenodo.17300232>



The Impact of AI Powered Writing Tools on Students' Academic Writing Performance

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ABSTRACT

The advent of Artificial Intelligence (AI) technologies has brought new resources that have a profound impact on the academic writing process. Under the IELTS Writing Test 2 rubric, this study investigated how AI-based writing software affected students' written performance on five main areas: task achievement, organization, grammar, vocabulary, and mechanics. A pretest and a posttest were administered to 35 undergraduate students who participated in the study, which used a within-subjects, repeated-measures experimental design. To learn how AI-based writing software affects written output, the subjects received training on it in between. Five factors were used to grade the essays, and statistical procedures were performed utilizing correlation, paired-sample t-test, effect size measurements, and descriptive statistics. The findings revealed a slight rise in vocabulary (mean increase from 2.22 to 2.43) and a notable improvement in grammar (mean increase from 1.14 to 1.77). However, there was no change in mechanics, organization, or task achievement. The improvement was not statistically significant at the whole-test level, according to the correlation between pretest and posttest achievement ($r = 0.317$, $p = 0.064$). According to the findings, AI-based software improves vocabulary and grammar at the surface level while having no impact on deeper-level skills like coherence, arrangement, and formatting of text. The study comes to the conclusion that while AI-based software holds potential for teaching second language writing, its effectiveness depends more on learner training, reflective practice, and instructionally integrated usage than it does on technology adoption in and of itself.

Keywords: Second Language Learning, Artificial Intelligence, Writing Accuracy, ESL Writing, AI-Powered Tools, Educational Technology.

Introduction

Background of the Study

In recent years with the advent of artificial intelligence, has brought transformative changes across various fields and disciplines worldwide, including education. (Bellman, 1978) defined AI as a broad field encompassing human thinking, creativity, problem-solving and decision-making skills in humans. AI tools. AI tools evaluate students' writing proficiency, self-confidence, and understanding of academic integrity (Malik et al., 2023).

The AI-powered platform like Chat GPT, Quillbot and Grammarly improved important elements of the writing proficiency on the students' writing performance, encouraging them

to rephrase their mistakes through their awareness and autonomy skills that the students are aware of while employing these tools without the assistance of the teacher's feedback (Parra G & Calero S, 2019) Recently, in technology-driven learning, Universities have shifted from traditional instructor-centered learning to a more learner-centered approach, observed by (Ituma, 2011).

New developments in generative AI have opened up new educational opportunities by enabling learners to get tailored and adaptable feedback. According to studies like Dawa et al. (2024) and Tang et al. (2024), university students have favorable opinions of AI and see it as a useful tool for enhancing academic writing and learning results in general. These advancements highlight the increasing importance of AI in assisting EFL students and revolutionizing conventional literacy methods. Contrary to the past perceptions of AI-powered tools as a passive means of digital delivery, now digital pedagogy serves as a means of strategic implementation of digital functions. Functions such as the integration of digital tools, mindsets, and methods in creating digitally enhanced teaching and learning processes (Tojakhmedova, 2025).

Critics found that overdependence on AI-powered tools can diminish students' natural capabilities of thinking creative ideas and their analytical capabilities. This can also foster academic dishonesty because the language models can convey misleading information, and that can be presented as factual. This aspect, called AI hallucinations, became prominent in 2022 with the rise of LLMs and ChatGPT, which can generate fabricated information leading to misinterpretation and inaccuracies (Khlaif et al., 2023).

The evolution of writing instructions has intimately made the use of digital tools more advanced and is the source of its rapid progress. (Haleem et al., 2022) emphasized that this adaptation of digital tools and their usage is the result of their integration in the educational backgrounds, resulting in the more creative and dynamic ways of learning and teaching instead of traditional pen and paper methodologies.

Problem Statement

Despite encouraging outcomes from the inclusion of AI in academic writing, its pedagogical efficacy in non-native English context, specifically in Pakistan has not yet been thoroughly examined. Additionally, while there have been encouraging findings regarding the improvement of micro-linguistic components like vocabulary and grammar, little is known about how AI affects higher-level writing skills like organization, coherence, and task completion.

According to Al Murshidi (2014), Pakistani EFL learners have been facing ongoing difficulties with academic writing because of inadequate exposure, a dearth of clear feedback, and little opportunities for actual writing practice. Even while teachers have made great strides in helping students write better, the final product does not demonstrate adequate intellectual achievement. As artificial intelligence (AI) tools become more widely available, it's critical to look into how they affect EFL learners' writing skills. Therefore, the purpose of this study is to determine whether writing tools that integrate AI advancements offer measurable improvements in writing quality and accuracy among Pakistani undergraduate students.

Research Objectives

This study's main goal is to investigate how artificial intelligence-powered writing tools affect EFL learners' writing skills. Its specific objectives are to:

- Examine how much better student writing was before and after AI-enabled tools were introduced.
- Determine which particular aspects of writing task performance, organization, grammar, lexis, and mechanics show the most progress.
- Examine how students respond to and engage with AI-informed comments in academic writing settings.

Hypotheses

The exponential increase in the development of Artificial intelligence is radically altering the technology and educational world. The greatest impact of AI is in the areas of language learning and writing. Conventional methods may have difficulty in giving personalised feedback, catering to individual needs of students, or keeping pace with the dynamic linguistic demands in professional and contemporary contexts. AI tools such as ChatGPT can function as a tool for language imitation and learning, and aid students in learning high-quality linguistic expressions (Wu, 2024).

AI-powered tools in e-learning environments not only facilitate and improve individual learning outcomes of the student. It also helps educators to gain insights about students and helps teachers improve their teaching strategies. It shows that these technologies play an important role in fostering flexible learning and more effective learning experiences in both digital and blended learning environments. (Eltahir & Babiker, 2024).

Teachers should use these AI tools complementarily rather than as a replacement for traditional teaching methods. For the learners, AI tools provide an unprecedented level of personalization and ease, giving them engagement as well, which allows them to learn at their own pace with the help of accessing diverse resources as well (Imamguluyev et al., 2024). Educators at all levels have placed significant emphasis significantly on students' writing skills and writing abilities, specifically in the context of the English language. Writing skills demand high attention and focus, because communication is expanding and it requires written communication as well. It is not limited to speaking skills alone (Md Naim et al., 2020).

Significance of the Study

AI writing instruction is of great significance in the pedagogy of academic writing. Machine learning algorithms are used by instructors to guide students in their work. This can give students personalized feedback, meeting their individual needs. These AI-powered systems have an efficient solution to meet the individualized needs of students to effectively perform writing work (Dong, 2023).

It caters to the individual needs of students, making the learning process more efficient and tailored to each learner's preferences. However, despite the benefits, there is a growing concern about the students' motivation level and overall performance in academics. There is a gap in empirical research regarding the effectiveness of AI in teaching and assessing students' learning outcomes. (Micabalo et al., 2024). (Buçınca et al., 2021) points out that students are not learning actively, but are instead in the passive mode of learning due to over-dependence on AI learning. They are not involved in critical thinking and problem-solving activities, as AI handles most of their cognitive work. For instance, students who use AI flashcards for learning and memorize the content without applying it or without

understanding it make their learning weak, and they cannot apply their knowledge in complex situations. If students keep relying on AI to the same extent, they cannot develop their essential skills effectively.

It was noted that the influence of AI tools is not only the product of technology but also comes from the pedagogical presentation of the activities and values. To integrate further pedagogical practices to facilitate learning, further research and investigation are needed in fostering literacy feedback, self-regulated study, and evaluative judgement. (Huang & te Winkel, 2022). Beyond grammar and syntax, AI-powered tools of the next generation are expected to focus on fostering critical thinking and analytical skills. It will not only assess surface-level errors, but it will also detect logical coherence, strength in evidence, and coherence used in the writings as well. By the employment of Natural language processing (NLP) and the learning algorithms, AI can provide effective feedback on clarity, conciseness of the content, and the depth used in reasoning in the writing of students. AI-based systems can strengthen the argumentation of students, giving different perspectives on topics and well-supported claims as well (Farhan).

The integration of technology in English language classrooms has the potential to fill the gap between the traditional and modern teaching methods used in writing. It has the potential to provide adaptable learning programs that can align with the needs and tech-savvy nature of new generations. (Zhi et al., 2024).

Scope of the study

Artificial intelligence AI is becoming an integral part of our daily lives. Researchers know the importance of AI in academic writing as it provides the information they need for their research work. AI helps in grammar correction, developing writing structure, and researching ideas. AI refers to computer systems that are capable of simulating human intelligence, natural language processing and speech recognition of humans (Diego & Protacio, 2025).

Employers value strong academic writing skills as it help in writing persuasive reports, helps in effective problem solving and in making coherent presentations (Hilton & Pellegrino, 2012). (Kawinkoonlasate, 2021) mentioned that the process of e-writing can also be employed in the classroom, which can be done by involving students in the writing process through proper guidance and steps. The advancement of technology can help students in their academic writing processes and give ease to explore more technological tools for writing skills. Each technological tool has its own functions that can be utilized by the students to help in their academic writing. The most popular of these tools are Quilbot, Grammarly, which provides the auto correction, feedback, and suggestions for their writing process (Zulfa et al., 2023). AI-assisted online platforms serve to generate the input and output language. Which aids language learners in their language development and accuracy. These tools available on computers and mobile devices are basically used to support the enhancement of learners' writing skills. Among all AI-powered writing tools, the most noteworthy are ChatGPT and AI-assisted chatbox, which is created by OpenAI (Barrot, 2023).

(Nazari et al., 2021) conducted an experimental study that investigates the effects of AI-powered writing tools on EFL academic writing performance. The results showed that the learners who used AI-powered writing tools in their writing outperformed those who didn't use AI-powered writing tools in their performance. It was also found that the learners who

used AI-powered tools showed high engagement in their behavior and had performed well cognitively as well as emotionally in their AI learning activities.

Research Questions

This study deals with the first research question, which is;

What is the impact of AI writing tools on academic writing performance?

What writing strengths and weaknesses are most affected by AI-powered writing tools?"

The impact and influence of AI-powered writing tools on students' academic performance are evaluated in this study. In which students use AI-powered writing tools to enhance their natural ability to write. The impact can be positive as well as negative; a positive impact on students' writing skills can be the enhancement of their writing skills. Giving students fluency in writing and improving their vocabulary and grammar in writing which will improve their syntax and structure of sentences.

A study reveals that some instructors view AI as a tool that can be used for the enhancement of learning and improving various skills, and can also reduce administrative burdens. While others also hesitate to use it due to discomfort with the new technology. This means that integration of AI into the curricula should be done carefully and accompanied by its potential benefits in education. Students should also take responsibility for their learning and should not over-rely on the tools and technology (Shofiah & Putera, 2024).

The second question is about the perceptions of students regarding AI-powered writing tools. The perceptions about the usefulness and limitations of AI-powered writing tools are essential to gain knowledge and understanding about the AI usage and its impact and influence.

Literature review

Automated Writing Evaluation (AWE) Comments' Effect on the Accuracy of English Composition

Automated Writing Evaluation (AWE) programs have become crucial for language learning since they give learners instant feedback and promote independence. It improves the writing correctness of ESL and EFL learners, according to numerous research (Stevenson & Phakiti, 2014; Li, Link, & Hegelheimer, 2015). They enable students to recognize and fix their mistakes on their own by offering thorough feedback on grammar, word choice, punctuation, and stylistics. Examples of these are Grammarly, Criterion, and My Access.

According to Bitchener and Ferris' (2012) study, learners' awareness of grammatical forms and their own editing skills are improved when they receive timely corrective feedback. Similarly, Ranalli (2018) found that by drawing learners' attention to certain linguistic forms, AWE programs foster metalinguistic awareness. This lends credence to Schmidt's (1990) Noticing Hypothesis, which holds that second language acquisition requires an awareness of linguistic form.

The effect of Automated Writing Evaluation (AWE) feedback on writing accuracy has been the subject of various empirical studies. Zhang (2020), for instance, compared instructor and AWE feedback and shown that both interventions considerably improved learners' writing accuracy, while AWE was more effective at reducing surface errors. In a similar vein, Li and Hegelheimer (2013) demonstrated that AWE feedback was primarily effective in fixing mechanical faults such as verb tenses and article usage. They did, however, highlight the need for instructor intervention to accompany automated advise so that students critically examine input rather than taking it for granted.

Writing Proficiency and Language Challenges in the Pakistani Context

By analyzing students needs and requirements in academic writing then the teachers can design the lesson plan and adopt the relevant course books to be included in the program for efficient learning, despite of a lot efforts and input of teachers to make students learn the writing accurately and efficiently unfortunately the final writing product is not as good as it has to be keeping in view the input and effort by the teachers. This is the reason that teachers find it difficult to teach their students academic writing (Al Murshidi, 2014)

Writing plays a pivotal role in communication and improves students' exposure and competency for interaction. According to the nature of the examination system in Pakistan, students show their proficiency and knowledge and worth through writing in the classroom or in examination halls. According to this study, students can fill a single letter missing in a word rather than more than two letters missing in a word, and students can use common parts of speech such as nouns and verbs in a sentence, but find difficulty in using idioms and adverbs in a sentence (Prahmana, 2017).

Previous studies have shown that integration of technology in English language teaching is of great importance in the development of basic language skills such as reading, writing and speaking. The Technological tools can make significant contributions to both students' and teachers' both in terms of the materials used for learning, the availability of material everywhere and anytime. It is costless or of low cost, contributing to effective learning. In the literature, it is also shown that technology causes some drawbacks in the teaching and learning process in a way that, in some experimental studies, there were no differences between technology and traditional methods' achievements in the learners (Gunuç & Babacan, 2018).

Nothing is obvious about how writing is changing over time. We can look everywhere around us at the ubiquity of text messaging, emails are used as the mode of communication, the highest reach for web-based information, and a source of entertainment. A study shows that the future of writing is very closely interlinked and interwoven with digital technology (Merchant, 2007).

AI Integration in Education: Enhancing Digital Learning Environments

Observations are present all around to transform the ways of teaching from old traditional methods to digital ones with technology-based instructions and materials. Students are inculcated to use digital methods for writing and improve their skills. The remark of AI will bring various computer-based capabilities in addition with the sensors to adapt human-like behaviour with functional abilities. This system aims to make human-computer interactions more robust. AI-generated tools and robots create a sense of excitement and joy among the young learners and has increased in the educational sector and is going above and beyond students (Khan & Wajahat, 2024). A study examined the impact of an AI writing tool named Word Tune on the writing skills of the students of Saudi High School. The findings revealed that this AI writing tool fostered writing skills among students. That study shows that students' post-Wordtune writing performance was better than pre-Wordtune writing performance, and the results were statistically significant (Al Mahmud, 2023).

A study shows that teachers should incorporate AI-generated writing tools as a supportive tool rather than a replacement in the classroom. AI-generated writing tools contribute to the effectiveness in the learner's writing fluency, accuracy, and complexity, reducing the anxiety,

which labels it as an effective tool for language learning and writing. However, AI integration in educational practices requires an ethical and thoughtful approach (Wang, 2024). Some attention has been paid to concerns related to AI-generated tools such as ChatGPT and its impact on students' learning. These concerns focus on the impact of ChatGPT and its ability to provide accurate answers, which will help students learn its limitations, and they will enhance and develop their critical thinking skills. A study explains that the writing tools such as ChatGPT, Quillbot, and Grammarly are the same in many ways, including their suggestions for grammar and spelling errors, style and clarity generative feedback to improve the overall quality of writing. However, some critical differences are also found between the tools in some of their features and interface. AI can help learners revolutionize their writing by producing high-quality content with less effort. AI helps generate ideas and content for the writers, builds their excitement, and helps to create engaging content (Raheem et al., 2023). Keeping in view the students' perceptions and attitudes towards AI, a study shows that students show moderate familiarity with AI generative tools, which indicates a foundational but not yet deep engagement. Perceived benefits of AI generative writing tools are viewed more positively in terms of creativity and innovation. So, these perceived benefits show us that continued AI integration should be adopted in the education system, while addressing students' concerns as well (Gasaymeh et al., 2024).

The result of a study shows that incorporation of AI enhanced tools in language education shows a promising avenue for enhancing and enriching language proficiency, tailoring learning experiences and nurturing skill development among learners. By getting personalized feedback, state of the art features, and interactive learning environments created by AI tools learners can curate their diverse learning styles and can cater instructional feedback accordingly. The transformative capacity that Artificial Intelligence holds is essential for the learners to cater the individual needs related to writing proficiency in addition it empowering students to excel in their writing endeavors (Zhao, 2024). A study says that fostering an AI generative learning environment and fostering motivation through it is crucial in creating a positive learning experience among the learners. To build intrinsic motivation, instructors should frame AI generative writing tools as a tool that empowers learners to actively engage in their writing assignments, provides them with exploration, and allows them to gain insights from the AI tools' generative feedback and instructions to enhance their writing proficiency. The development of critical thinking alongside AI proficiency is essential for the learners as well. Instructors should present AI tools as a collaborative tool rather than a substitute. This can be achieved through paper-based writing and reflective activities, while promoting ethical and responsible use of AI. The next step is creating an inclusive and interactive learning environment, which involves giving structured guidance, promoting peer collaboration and addressing equity and to ensure that all students are accessing AI meaningfully (Zhao, 2024).

Pedagogical Implications of AI in EFL Writing Instruction

Highlights how AI tools like ChatGPT can provide structured support, tailored feedback, and writing mediation to help EFL learners enhance their academic writing within their Zone of Proximal Development (ZPD). This was made clear in the final assessments that required pupils to use what they had learned in new or difficult situations. Many students who had mostly relied on AI to complete tasks were unable to relate words or phrases to what they

understood, which resulted in comments that were shallow and devoid of coherence or personal insight (Avsheniuk et al., 2025).

(Fathi & Rahimi, 2024) say that the results offer a number of practical and pedagogical ramifications for the EFL setting. For example, AI-enhanced writing classes could use the produced structured mediation and reciprocity typologies to assist EFL students in more efficiently developing their academic writing abilities

A study says that AI has the transformative potential to decolonize academic practices and acts as a catalyst for inclusive and equitable learning environments. Furthermore, a study is required. In order to encourage scholars, technologists, ethicists, and other stakeholders to participate in this important discussion, the paper urges more research and discussion in this multidisciplinary area. The objective is not limited to using AI's potential for educational not only to improve it but also to use it as a social justice tool, making sure that diversity, inclusion, and respect for all knowledge systems define academia in the future (Omodan & Marongwe, 2024). This study focuses on the research questions, such as What improvements do AI-powered tools make in coherence, grammar, and structure in student writing?

The authors of a study found that AI-augmented feedback worked best for lower-order problems like mechanical writing and grammar, but less well for higher-order challenges like argumentation and meta-analysis. This demonstrates the need for AI technologies to be integrated as an additional resource rather than as a replacement for teacher-driven feedback. A hybrid paradigm that combines instructor input with AI-generated changes, insights, and ideas is probably going to be more successful than either one alone (Nazli et al., 2025). The integration of AI-powered writing tools into academic contexts has significantly influenced students' writing performance, especially in enhancing grammatical accuracy, coherence, and overall writing proficiency. Tools such as Grammarly, Quillbot, Wordtune, and ChatGPT have demonstrated the ability to provide real-time feedback, streamline sentence structure, and foster learner engagement and motivation (Nazari et al., 2021). These tools are particularly effective for EFL and non-native speakers by offering individualized support and promoting greater autonomy in the learning process.

Despite the benefits, literature also points to important limitations. Over-reliance on AI tools can result in superficial understanding, a lack of contextual awareness, and diminished critical thinking skills. Educators have noted that students who frequently rely on AI-generated responses often struggle with originality and deeper cognitive application, particularly in open-ended or complex tasks (Avsheniuk et al., 2025). Moreover, ethical concerns such as academic dishonesty, intellectual property violations, and the authenticity of student work have been raised (Dong, 2023)

Consequently, a balanced and pedagogically sound approach is required. AI-powered tools should be integrated as supplementary aids, enhancing but not replacing teacher feedback and human-driven instruction. Educators are encouraged to combine AI mediation with instructional strategies that promote critical reflection, creativity, and writing autonomy (Ribbe & Bezanilla, 2013).

In conclusion, while AI tools present a transformative opportunity in academic writing, their use must be deliberate, ethical, and learner-centered. Future research should focus on developing best practices and guidelines for sustainable AI integration in writing pedagogy, ensuring the development of independent and proficient academic writers.

Methodology

The main aim of this study is to investigate the impact of AI-powered tools on students' academic writing performance. Moreover, this study aims to investigate the key aspects of writing that are mostly influenced by AI-powered writing tools, such as organization, mechanics, coherence, lexis, and grammar. It also aims to study the impact on time efficiency in the process of writing and focusing on the independence of students' writing capabilities.

Research Dimension

This study investigates the various aspects of the effects of AI-powered writing technologies on students' academic writing proficiency, in the case of 35 undergraduate students. The initial research dimension addresses academic writing ability quality, quantified through five most critical IELTS-based measures: task achievement, coherence and cohesion, lexical resource, grammatical range and accuracy, and mechanics. They are measurable indicators to determine the quality of writing before and after using AI tools, offering comparative insight through pretest and posttest assessments.

Another vital dimension is technological integration in education. It entails examining how AI writing software like Grammarly, Quillbot, and ChatGPT aid learners in writing, particularly in grammar correction, vocabulary enhancement, and structuring ideas. This dimension determines the practical application of AI to augment human capabilities, particularly for non-native English speakers in an EFL setting. Finally, the learning outcomes improvement dimension is at the heart of this research. Through the comparison of pretest and posttest scores, the research evaluates if AI tools are responsible for a quantifiable improvement in the academic writing of students. It also connects to educational objectives at large, including encouraging independent learning and computer literacy.

Together, these research areas provide the ability to perform a comprehensive analysis of the impact of AI-based writing tools on scholarly writing competency both from quantitative outcomes and educational factors.

Research Design

The effect of AI-based writing tools such as Quillbot, ChatGPT, etc, will be evaluated in order to analyze writing development in the students' writing. According to the five key aspects of writing, such as task achievement, coherence and cohesion, lexical resource, grammatical range and accuracy, and mechanics of writing. It must be noted that participants passed language proficiency tests in advance and were qualified to enter the early level in EFL classes. The experimental group of this study took part in the writing pretest, which was implemented without using AI-based writing tools, to evaluate the writing proficiency of the students prior to the study. A final posttest was administered to the students, which was evaluated according to the IELTS rubric, and these results were analyzed statistically.

Sampling

This study adopted a purposive sampling technique to select a group of 35 students from enrolled in an undergraduate program at GIFT University. The sampling was based on students' active enrollment in an intensive writing course, and students were willing to participate and use AI-powered tools to facilitate their writing skills. All students had comparable academic standing, and they had not received any prior AI writing training before this study. This study employed a quasi-experimental design consisting of a group pre-test and post-test study.

A similar study that resonates with this research design and approach was used by (Apriani et al., 2024) in his study, he used pretests and posttests to assess the writing outcomes of the students. This precedent study shows relevance and resonates with the methodological approach of this study.

Procedure

A similar study defined the results that showed significant improvements in the writing quality of students between the pretest and posttest. Improvements were seen in grammar accuracy, coherence, idea organization, and vocabulary use. Students developed positive revision habits by continuously interacting with an AI chatbot and self-reflecting and correcting their mistakes. When AI tools were paired with teachers' feedback and instructions, students achieved deeper learning outcomes, suggesting AI-based writing tools function as scaffolds, not a replacement for instruction (Apriani et al., 2024).

Research instruments

To assess the effectiveness or impact of AI-powered writing tools on students' academic writing performance, this study employed three primary instruments in the study. Consisting of writing performance tests, an AI usage checklist, and a writing efficacy scale. The pretest and posttest essays were taken from the students under the standardized instructions.

These essays were evaluated under the IELTS Writing Task 2 Band Descriptors, which assesses the four main criteria of the writing: 1) Task Response, which addresses how well students responded to all parts of the task; 2) Coherence and Cohesion, which reflects the sequencing and effective use of ideas and linking devices; (3) Lexical Resource, addresses the usage of vocabulary range and appropriateness of the words used; (4) Grammatical Range and Accuracy, assesses grammatical features and accuracy of the sentences. (5) Mechanics includes the technical aspects of writing, such as punctuation, spelling, and capitalization. This rubric scores from 0 to 4 for each aspect of writing, giving a total of 20 points.

A third instrument used in this study was the Writing Self-Efficacy Scale, this instrument was adapted from Bandura's self-efficacy theory, and this was administered to measure students' self-confidence and their writing abilities perceptions about themselves. A 10-item Likert scale survey was used in this study, which included statements such as "I can develop logical arguments in academic writing" and "AI tools improve my writing confidence," rated from 1 (Strongly Disagree) to 5 (Strongly Agree). This instrument also aligns with the previous studies, such as (Waris et al., 2025) Applied self-efficacy scales and examined the performance of the tasks to study the impact of the usage of Grammarly and Duolingo on the academic writing of the students. Similarly, (Shi et al., 2025) Employed a correlation study between AI literacy, self-regulation, and academic writing.

Data collection

This study employed a quasi-experimental one-group pretest–posttest design to study the impact of AI-powered tools on academic writing performance. The IELTS Task 2 Writing Rubric was used to assess four key dimensions: Task Response, Coherence and Cohesion, Lexical Resource, and Grammatical Range and mechanics. (Altuntaş, 2021) Conducted similar research using automated writing evaluation tools with scoring pretests and posttests, which assess grammar and coherence of the writing.

In phase 2 of the data collecting period, which was continued for a 2-16-week duration, students were allowed to use AI-powered writing tools such as Grammarly, Quilbot, and

ChatGPT. Students documented their weekly AI usage report, which captured the frequency of their use, the purpose of their use, and perceived value. This activity allowed researchers to correlate usage habits with performance outcomes. In correlation with this study, (Creighton et al., 2025) Employed digital tools that reflected checklists in a pre- and post-test study, and this was to measure students' awareness and autonomy in digital academic practices.

(Pellas, 2023) examined changes in narrative structure and self-efficacy using similar pre/post writing tests and a validated self-efficacy scale after AI integration in higher education.

Data analysis

The mean scores and standard deviations for each criterion were computed, and a paired sample t-test were performed to determine whether the outcomes of posttests were significantly different or not. The writing Self-Efficacy Scale responses by students were similarly analyzed by using mean comparison through a paired t-test to assess students' confidence level achieved during the period of four months of AI tool use. Additionally, correlation analysis was conducted to explore the relationship between writing performance gains of the students and perceived self-efficacy. These procedures were supported by multiple peer-reviewed studies, for example, using pre/post-testing and paired t-tests to measure ChatGPT's impact on Chinese EFL undergraduates' writing and self-efficacy, indicating a significant improvement in both performance and confidence ($p < 0.01$). Similarly, reported significant gains in writing scores ($t = 4.87, p < 0.001$) after students used tools for story generation and reflection. Automated AI-generated tools increased self-efficacy and confidence, reduced anxiety, as explored through the same analysis technique.

Results

The results were analysed based on the IELTS Level 2's five aspects. The main focus of this study was based on the following main points which are; 1) how students performed in the writing Pretest and students performed in the writing Posttests. 2) to check whether the AI-powered writing tools impact the efficiency of the students' writing or not. 3) Which aspects among the five aspects, which are task fulfillment, organization, grammar, lexis, and mechanics, were affected more or less in the writing of the students upon the usage of AI writing tools? A paired sample T-test was conducted for this study to test the hypothesis of this study, which was supported by descriptive statistics, correlation coefficients, effect size calculations such as (Cohen's d and Hedges' g), and confidence intervals for this study.

Writing Proficiency Pretest

To analyse the main objectives of this study, a pretest of essay writing was conducted among the undergraduate students to ensure that the students were homogeneous in their writing skills. The topic was selected and given to them to write an essay on. The students were asked to write an essay between 200 to 250 words in the time limit of 45 minutes. The tests were written using pen and paper. The essays were scored based upon the five aspects, which are adapted from the IELTS Task 2 writing rubric. Each aspect was scored between points 0 to 4 giving a total of 20 points for each essay.

The scores of the writing pretests ranged from 7 to 14 giving a mean score of 11.26.

Posttest of this study

The students were asked to write essays-without using AI powered writing tools, and were asked to write between 200 to 250 words in the time period of 45 minutes about the assigned topic. The tests were written in pen and paper form.

The Analysis of Five Key Aspects of Writing in Pretests

A pretest was administered to the students at the start of the study, in which the students were instructed to write words ranging from 200 to 250 in the time period of 45 minutes. As discussed earlier, the essays were analysed according to the five aspects of writing. The five aspects in writing were 1) Task Fulfillment, 2) Organization, 3) Grammar, 4) Lexis, and 5) Mechanics. Each of these five aspects was scored from 0 to 4. In pretests, the scores given according to the five aspects are as shown in the table below.

Table 1: Key five aspects of writings

Key aspects of writing	1 Task Fulfillment	2 Organization	3 Grammar	4 Lexis	5 Mechanics
0.1,2,3,4					
Participant 1	3	3	1	3	2
Participant 2	3	3	1	2	2
Participant 3	3	3	1	3	2
Participant 4	3	3	1	3	2
Participant 5	2	3	1	3	3
Participant 6	2	4	2	4	3
Participant 7	3	3	2	3	3
Participant 9	2	2	1	2	2
Participant10	3	3	1	2	2
Participant13	3	3	2	2	3
Participant 14	2	3	1	2	3
Participant 16	3	3	1	3	3
Participant 17	3	3	1	2	3
Participant 18	3	3	1	2	3
Participant 21	3	2	0	1	2
Participant 22	3	3	0	1	2
Participant 23	3	3	1	2	2
Participant 24	2	2	0	1	2
Participant 25	2	3	0	1	2
Participant 26	2	3	0	1	2
Participant 28	3	3	1	2	2
Participant 29	3	2	0	2	2
Participant 31	3	3	1	2	2
Participant32	3	3	1	2	2
Participant 34	3	3	2	2	2
Participant 35	3	3	1	3	2

From the above data, the average mean score for each aspect is as follows;

Table 2: Table of Mean Scores of Pretests

Writing Aspect	Mean Score
Task Fulfillment	2.73
Organization	2.86
Grammar	1.14
Lexis	2.22
Mechanics	2.38

These mean scores of pretests give a clear picture that the strongest area of students is Organization (2.86) and the weakest area is Grammar (1.14).

Now the interpretation of each writing aspect of the pretest is also done to gain insight into the students pretest writing proficiency.

Task Fulfillment

Students showed a good performance in task fulfillment, giving an average score of 2.73. This shows that the students were able to understand the topic well and wrote the essay according to the appropriate length and good formatting

Organization

The aspect of organization emerged as the strongest among all five aspects of writing pretests giving a mean score of 2.86. Most of the students in this aspect also scored 3, giving us the information that their ideas were logically sequenced and coherent. The basic use of transitional phrases and paragraph structures and the usage of cohesive devices, is mostly evident in the writing of students.

Grammar

The weakest aspect among the five aspects of essay writing is grammar analysed in pretests. The average mean score of grammar is 1.14. The weakest aspect of grammar shows various challenges in the accuracy of written language, particularly in the construction of sentences, tense consistency, article usage, and verb agreement. Multiple students in this aspect achieved 0 or 1 scores, showing that these grammatical errors are inferred with clarity and meaning.

Lexis

Vocabulary usage or, lexis, scored moderately, giving an average mean score of 2.22. These moderate-level scores of lexis indicate that the students have a basic to intermediate level of vocabulary, which is only used to express general ideas, but it lacks the precision and diversity of vocabulary expected at the higher levels of writing..

Mechanics

The rank of mechanics ranks slightly above lexis, giving an average mean of 2.38 but is below organization and task fulfillment. Mechanics focuses on the spelling, punctuation and capitalization in the writings. In the analysis of these pretests, students seem to have a basic grasp of punctuation rules and spelling, but the inconsistencies in this aspect are frequent. Many students in this aspect scored 2 and 3, which indicates minor errors in mechanics, but students scored 1, indicating more systematic errors, which can hinder the readability.

The Analysis of Five Key Aspects of Writing in Posttests

The posttests of the undergraduate students were also analysed according to the five aspects of writing: 1) Task Fulfillment, 2) Organization, 3) Grammar, 4) Lexis and 5) Mechanics. The following table under review demonstrates the results of posttests of the students.

Table 3: Five aspects of writing in Posttests

Key aspects of writing	1 Task Fulfillment	2 Organization	3 Grammar	4 Lexis	5 Mechanics
0.1,2,3,4					
Participant 1	2	3	2	3	2
Participant 3	3	2	2	3	2
Participant 4	3	2	2	3	2
Participant 5	2	2	2	3	2
Participant 6	3	3	2	3	3
Participant 7	2	2	1	2	2
Participant 8	2	2	2	3	2
Participant 9	2	2	2	2	2
Participant 10	2	2	1	2	2
Participant 11	3	2	2	3	2
Participant 12	3	3	2	3	3
Participant 13	3	2	1	2	2
Participant 14	2	2	1	2	2
Participant 15.	0	2	1	2	2
Participant 16	3	3	2	3	2
Participant 17	3	2	2	2	2
Participant 18	3	2	2	2	3
Participant 19	3	2	1	2	2
Participant 20	3	2	2	2	3
Participant 21	3	3	2	3	3
Participant 22	2	3	2	3	3
Participant 23	3	3	2	3	3
Participant 24	3	2	2	2	2
Participant 25	3	3	2	2	2
Participant 26	3	3	2	2	2
Participant 27	3	3	2	2	2
Participant 28	3	3	2	2	3
Participant 29	3	2	1	2	2
Participant 30	3	4	3	3	4
Participant 31	3	2	1	2	2
Participant 32	3	3	2	2	3
Participant 33	4	3	2	4	3
Participant 34	2	3	2	2	3
Participant 35	3	3	2	2	2

Each student was scored within the score range from 0 to 4 for aspects of writing, giving a total of 20 scores for each essay. The average mean score for each aspect of writing for the posttests of the study are as follows;

Table 4: Mean Scores of Posttests

Writing Aspect	Mean Score
Task Fulfillment	2.69
Organization	2.49
Grammar	1.77
Lexis	2.43
Mechanics	2.37

Task Fulfillment

The first aspect of the writing tasks is task fulfillment. The same as the pretests result posttests also have the task fulfillment aspect strong of the five aspects. With a mean score of 2.69, this value of mean in task fulfillment identifies students' capabilities to understand the task given, and gives relevant responses and meets the basic expectations regarding format and length of the essay.

Organization

The second component of this writing is the organization of the essay. Organization is the second-highest scored aspect in the posttest of essay writing taken from the undergraduate students. The average mean score of the organization in posttests is 2.49. This mean score suggests that the students have a basic understanding of how to structure the ideas and paragraphs. The students are using some logical sequencing and transitions in their writings. The logical sequencing and transitions are not consistent and effective as in most cases observed.

Students having high scores in this aspect have generally used logical sequencing; they have used clear topic sentences and have used cohesive devices such as "however," "in addition," or "therefore" in their writings. However, the students with low scores in this aspect of writing have used abrupt transitions, lacked structured paragraphs, and presented their ideas in a disorganized fashion.

Grammar

The aspect of grammar in posttest also has the lowest score as in pretests. The average mean of grammar in this aspect is 1.77. A mean score of 1.77 implies that the students struggled with the sentence construction, and have ambiguity in verb tenses, subject verb agreement. They also lacked proficiency in other core grammatical features. The weak grammar issue can hinder the overall comprehension of the writing

Lexis

The fourth aspect of the writing refers to the vocabulary use or lexis. The average mean score of lexis in the posttests of this study is 2.43. This average mean score study generally hints towards the moderate lexical control among the students performing the posttests. This indicates that students generally can express their ideas with basic vocabulary but they lacked precision and variation across the language.

Mechanics

The last aspect of the writing is mechanics. Mechanics includes the spelling of the words, punctuation and capitalization. Mechanics in the posttests showed the average mean score of 2.37. The mean score of 2.37 reflects the partial competence of the students in their writing. This means that the students are aware of the basic rules of writing, but they apply the rules inconsistently in their writings.

The analysis of the writing scores in the posttests showed a clear trend. Students know how to develop ideas and structure the content, fulfilling the length requirement but lack basic competency in grammar, lexis, and mechanics. Whereas task fulfillment and organization are the strengths of the writings, the aspect of grammar is a developmental priority. The results of this posttest highlight where the students stand and can help students gain insights about their strengths and weaknesses and provide a clear path forward.

Table 5: Pretest and Posttest Mean Scores of Task fulfillment

Pretest Scores Mean	Posttest Score Mean	Difference
2.73	2.69	-0.04

Task fulfillment is the students' ability to address the topic, meet the required length and stay on the content. The posttests showed a minor decline from 2.73 to 2.69. The change is very minimal; it suggests that the students became less focused on the task prompts and were slightly inconsistent in adhering to the task demands in posttests.

Table 6

Pretest Mean Score	Posttests Mean Score	Difference
2.86	2.49	-0.37

Pretest and Posttests Mean Scores of Organization

The decrease in organization is noticeable which fell from 2.86 to 2.49. This regression in the organization of posttests suggests that the students struggled with the coherent structures, structuring of the paragraphs, and logical transitions in the posttests more than the pretests.

Table 7: Pretest and Posttest Mean Scores of Grammar

Pretest Mean Scores	Posttests Mean Scores	Difference
1.14	1.77	+0.63

Students improved in the grammar area, giving a rise in mean scores from 1.14 to 1.77. This increase in scores suggests that the students benefited from instruction about the targeted grammar. The practice between the two assessment time periods also proved to be beneficial for the students.

Table 8: Pretest and Posttest Scores of Lexis

Pretest Mean Scores	Posttest Mean Scores	Difference
2.22	2.43	+0.21

The fourth aspect of the writing lexis showed a modest improvement. This indicates that the students are developing a better range of vocabulary and using varied lexical terms in the posttests as compared to the pretests.

Table 9: Pretests and Posttests of Mechanics

Pretest Mean Scores	Posttest Mean Scores	Difference
2.38	2.37	-0.01

Mechanics showed a negligible difference between the pretests and posttests. This means that the students retained their stability in punctuation, spelling, and capitalization. While this is a relatively strong area, there is still room for improvement, and this can be achieved by editing and proofreading strategies.

Table 10: *Table of Pretests and Posttest Total Scores*

Participants	Pretest	Posttests
Participant 1	12	12
Participant 2	11	10
Participant 3	12	12
Participant 4	12	12
Participant 5	12	11
Participant 6	15	14
Participant 7	14	9
Participant 8	12	11
Participant 9	9	10
Participant 10	11	9
Participant 11	13	12
Participant 12	14	14
Participant 13	13	10
Participant 14	11	9
Participant 15	8	7
Participant 16	13	13
Participant 17	12	11
Participant 18	12	12
Participant 19	12	10
Participant 20	11	12
Participant 21	8	14
Participant 22	9	13
Participant 23	11	14
Participant 24	7	11
Participant 25	8	12
Participant 26	8	12
Participant 27	11	12
Participant 28	11	13
Participant 29	9	10
Participant 30	15	17
Participant 31	11	10
Participant 32	11	13
Participant 33	12	16
Participant 34	12	12
Participant 35	12	12

Descriptive Statistics

Descriptive statistics were first computed for the two paired variables. The mean score for the pretest was 11.26 giving a standard deviation of 1.99. while the mean score for posttests

was 11.74 with a standard deviation of 2.02. Based on the sample size which is $N = 35$. Both the variables had the standard error of mean (SEM) of 0.34.

Paired Samples Correlation

Before testing the mean differences of the two samples, the correlation between the two samples were also examined. The Pearson correlation coefficient (r) was calculated to be 0.317, with a p value of 0.064. This indicates a moderate positive correlation between the pretests and posttests. This indicates that the students who showed higher scores at the first measurement also tended to score slightly higher at the second measurement. However, the correlation between the two studies was not statistically significant. As the p -value exceeded the conventional threshold which was 0.05.

Paired-Samples t-Test

Paired sample t-test, which is the core analysis of this study, was then conducted to test whether the mean difference between the two samples is statistically significant or not. The results of the paired sample t-tests show, the mean difference is -0.486, giving a t value of -1.226, and the degrees of freedom (df) is 34, and the Significance (2-tailed) is 0.229. The negative sign in the mean difference indicates that the mean value of pretests (11.26) is smaller than the mean value of posttests (11.74). However, the p -value of 0.229 indicates that the difference is not statistically significant because it is not at the level of 0.05, or the p -value is greater than the critical value of 0.05. Therefore, the null hypothesis cannot be rejected because there is no difference between the means.

Effect Size Analysis

Effect size metrics were computed in order to complement the t-test results. Effect sizes provide a standardized measure of the magnitude which is of observed differences. This mainly has importance when the statistical significance is not achieved, which can be due to a small sample size or when the statistical value is low. Two effect sizes measured were: Cohen's d : -0.207 and Hedges' g : -0.205. The confidence intervals for both effect size measures are: 95% Confidence Interval for Cohen's d : [-0.541, 0.129] and 95% Confidence Interval for Hedges' g : [-0.535, 0.128].

Both of the effect sizes fall within the small range. Cohen (1988) defined that 0.2 is considered small, 0.5 is medium, and 0.8 is large. The possibility of no effect at all cannot be ruled out because both of the confidence intervals include zero. The negative values for the effect sizes, which are Cohen's d and Hedges' g , are negative. The negative value of these effect sizes is due to the coding of the variables, i.e, one as pretests and the second as posttests.

The small magnitude and the non-significant nature of these effect sizes reinforce the outcome that any observed improvement is not practically meaningful and is minimal. It also suggests that the impact of the intervention was not strong enough to produce a detectable or reliable shift in the samples analysed.

To summarize the analytical findings, there was a slight difference in the mean scores from pretests to posttests (11.26 to 11.74), which gives the mean difference of 0.486. In a paired sample test, the p value was not statistically significant, giving a value of $p = 0.229$, which is greater than the critical value of 0.05. The correlation of paired scores was moderate, giving the value ($r = 0.317$), but it is not statistically significant ($p = 0.064$). Effect size measures Cohen's $d = -0.207$; Hedges' $g = -0.205$) were both small and gave non-significant results. In total, the results do not provide a meaningful change in scores between the two

measurements. This study consisted of an experimental study; the findings of this study didn't support the hypothesis that the intervention or the experimental manipulation led to significant improvements in the students' writings.

This study was designed within the subject. The paired sample t-test used in this study was the appropriate test for data analysis. The lack of statistically significant data can be due to several factors. It can be due to sample size; the small sample size of 35 students may lack the power to detect small to moderate effects. It can be due to a lack of intervention efficacy, because the results demonstrated that the intervention implemented had a minimal effect on the outcome. It suggests that the time period or the duration was sufficient to create a noticeable change.

Fatemeh Etaat (2024) presents a comprehensive investigation on how the AI- AI-assisted writing tools assist in the writing of English as a foreign language learners. In this study, 36 sessions were conducted by Iranian EFL learners. The study compared an experimental group in which students use AI-assisted writing tools such as Wordtune and InstaText for their writing home assignments, with a control group consisting of students who used pen and paper for writing their writing assignments. Writing proficiency in this study was assessed using pretests, six periodic writing tests and posttest.

In comparison, In this study, paired sample t-tests examined the mean difference between two related conditions. The pretest and posttest data were taken from the same group of participants. The number of participants was 35. The mean from pretests to posttests slightly increased from 11.26 (pretests) to 11.74 (posttests), which is a modest improvement. However, the statistical analysis revealed that the difference was not significant, because the p value was 0.229 which is above the conventional threshold of 0.05. The correlation between the paired scores was moderate, giving a value of ($r = 0.317$), but not statistically significant ($p = 0.064$). The effect size (Cohen's $d = -0.207$) was small and negative, which depicted a minimal impact of the intervention. The result suggests that there was a numerical increase in the performance. But the change was not strong enough to be considered meaningful and significant to a specific positive outcome.

Conclusion

The main aim of this study was to investigate the impact of AI-powered tools on whether they have a significant change in the writings of the students. This study mainly investigated the five components of writing: task fulfillment, organization, grammar, lexis, and mechanics, which are based on the IELTS Writing Task 2 rubric.

This study was based on the within-subjects which means it contains a repeated-measures experimental design. The 35 undergraduate students wrote two tests. One was the pretest and the second was the posttest. The pretest was taken before the intervention, and the posttest was taken after the intervention. AI-powered tools were introduced during the time period between pretest and posttest. AI-powered writing tools were allowed or integrated into their study to analyse their impact or effectiveness on the students' writings. AI-powered writing tools were used by the students to revise and refine their writings. Essays were assessed according to the five key dimensions of writing. Both tests were then subjected to statistical testing using descriptive statistics, correlation, paired-sample t-tests, and effect size calculations.

To conclude, the key findings of this study, the calculations, and the statistical analysis of are discussed below;

The area of grammar showed the most noticeable change or improvement after the intervention, giving a mean increase from 1.14 to 1.77. The improvement in this aspect suggests that the students benefited from the tool-mediated grammar correction from AI-powered writing tools.

The lexis or the grammar also increased from the mean score of 2.22 to 2.43. This slight improvement in the lexis suggests the varied vocabulary and word choice development in the students, which is assisted by AI-powered writing tools that suggest synonyms and style adjustments. The aspect of task fulfillment showed a small decline from pretest to posttest. Giving a mean score from 2.86 to 2.49. Though it is the strongest aspect from the five aspects. The minimal drop in the mean might suggest the cognitive overload or distraction caused by the new tool use. Rather than the actual decline in the comprehension of the prompt.

The most significant decline was seen in the aspect of organization. The mean decreased from 2.86 to 2.49. It suggests that despite the help of AI-powered writing tools in the micro-level aspects like grammar and vocabulary, students faced difficulties in maintaining the overall logical flow of the content, along with paragraph unity.

The aspect of mechanics showed no significant changes and remained almost unchanged. It shows that the students had a stable awareness of punctuation, spelling, and capitalization. But it also showed no measurable improvement due to the intervention.

The correlation between pretests and posttest scores was measured. The correlation between the two scores was moderate ($r = 0.317$) but not statistically significant ($p = 0.064$). This implies that the students who performed well initially in the pretests tended to maintain a similar performance in the posttests. The changes seen were not consistent.

The interpretation of these results demonstrated that while AI-powered tools slightly enhanced the micro-linguistic areas like grammar and lexis, there were no significant improvements in the overall performance in writing of the students in the given intervention framework.

The slight observable improvements in grammar and lexis indicate that these tools are well-suited for surface-level improvements. But they are less effective for the higher-order writing skills, such as content development and organization of paragraphs.

The stagnation in aspects such as task fulfillment and organization suggests that they might have struggled with the longer texts. They were unable to apply the AI-generated suggestions cohesively in their writings. The difficulty faced by students in improving their writing with the help of AI-generated tools might be due to cognitive overload. Inadequate knowledge or training on how to interpret and use AI feedback, or limited metacognitive skills required to integrate content effectively.

This study did not show any statistically significant improvements in the overall writing scores by following the use of AI-powered writing tools, but it showed minimal improvements in the aspects of grammar and vocabulary enhancement. The findings reveal that AI has the potential, but its effect is modest, context-based, and is dependent on how it is used. The minor gains in the writings of the students suggest that educational technology is not a comprehensive solution. But the effective change in writing requires learner reflection,

intentional instruction, and it improves with scaffolded practice. AI tools should be considered as part of educational institutions; they should not be considered as a replacement for them. The research contributes to the growing empirical data, which is helpful towards the growing conversation around AI in education, particularly in the context of second language education.

It then highlights the need for the development of more pedagogically integrated and more learner-centric AI implementations, which are grounded in educational theory and classroom realities. In a world that is shaped by artificial intelligence, it is important to not only adopt the emerging tools but also adapt pedagogical frameworks in their learning. It is to leverage learners' full potential while the human element of learning remains central.

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