



The Effectiveness of AI-Powered Writing Assistants in Enhancing Essay Writing Skills at Undergraduate Level

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ARTICLE INFO ABSTRACT

Article History:

Received: January 08, 2025
Revised: February 19, 2025
Accepted: February 22, 2025
Available Online: February 24, 2025

Keywords:

AI-powered writing assistants, ChatGPT, Grammarly, essay writing, Pakistani undergraduates, academic writing, AI in education

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Artificial Intelligence (AI) has its transformative function in education by providing AI writing assistants like ChatGPT and Grammarly. AI tools have emerged as a prominent resource for improving writing performance at the advanced levels of education, hence, this study seeks to explore the potential of these tools to improve the essay writing of undergraduate Pakistani students. Using a mixed-methods approach, the research investigates changes in grammar, coherence, vocabulary, and overall academic writing for students over the eight-week period. The population of the study is BS students of Management Sciences at University of Education and data were collected through pre-and post-test essays and instructor's evaluations to evaluate the impact of AI-generated feedback versus human feedback on students' learning experience. The results show that the use of AI writing assistants has a positive impact on student writing in terms of accuracy, structural organization and self-revision, while challenges related to excessive dependence on AI and ethical concerns around academic integrity remain. The study also investigates students' perceptions of AI-assisted learning and the implications for pedagogy within higher education. From the findings, there are suggestions made on how to best incorporate AI writing tools into the university curricula. This study adds to the continuing conversation about AI in education; it also informs the study of its role in enhancing writing skills in underdeveloped academic contexts like Pakistan.



Introduction

As undergraduate students, academic writing is an essential skill we need to perform, especially for students studying abroad in English as a foreign language countries like Pakistan. Nevertheless, a large number of students face challenges in grammar, coherence, vocabulary, and overall structure of writing because of weak English writing conventions and lack of instruction (Mahboob, 2014). The development of Artificial Intelligence (AI) has opened new ways of improving writing skills amid the rise of AI-enabled writing assistants like ChatGPT and Grammarly, which offer on-the-fly feedback, grammar corrections, and content suggestions (Kumar & Rose, 2023).

Artificial intelligence (AI)-based writing tools have taken much notice of higher education, as they can help students self-edit their writing and improve without needing the teacher's constant assistance (Alharbi, 2022). AI-based writing tools like Grammarly assist users to improve their grammar, sentence structure, and academic tone, especially useful for non-native English speakers (McNamara et al., 2020). Likewise, ChatGPT is an advanced language model developed by OpenAI that offers interactive writing support for the students, assisting them with idea generation, argument formulation, and effective essay structuring (Zhai, 2023).

Many studies have focused on the impact of AI on writing ability. We found that automated systems improved the accuracy of the students' grammar and value in recent experiments to improve conventional coherence of discipline output in a way that they can be more independent writers (Ranalli, 2021). In fact, some studies have showed that using AI tools can lead to more motivational and confident writing, as students receive rapid feedback and user-friendly suggestions (Li et al, 2022). Nonetheless, concerns persist about over-reliance on artificial intelligence (AI), the issues of academic integrity, and the profusion of in-depth critical thinking that these tools engender (Dwivedi & Thakur, 2023). However, since English is a second language in Pakistan and many students do not benefit from formal training in academic writing, AI-assisted writing tools can narrow the gap and offer learning support to their users (Rafi, 2020).

However, the use of AI-powered writing assistants in Pakistan's undergraduate education system suggests much more potential but also uncertainty. Some institutions are starting to use more AI-based learning resources, but, as of yet, there is little empirical research on how students use these tools, whether they enhance how essays are written, or the kinds of challenges these technologies bring. With this in mind, this study seeks to fill that gap by examining the application of ChatGPT and Grammarly by Pakistani undergraduates for improving Essay Writing and how this work can be further refined to create a systematic use of these technologies in university curricula.

Statement of the Problem

For undergraduate students around the globe, academic writing is a critical academic skill however, students in Pakistan face many challenges with grammar, coherence, vocabulary and writing proficiency in general because of lack of formal education and limited exposure to writing conventions of English language. This lack of individualized feedback and guidance is lost in traditional writing instruction methods. AI-enabled writing tools, including ChatGPT and Grammarly, have also become increasingly available and as such might offer new opportunities for enhancing students' writing through instant feedback, automated grammar checking, or content generation. However, although these tools are widely available, their efficacy in the context of Pakistani undergraduates is underexplored.

In this study, we aim to explore how AI-based writing assistants can help to improve grammar, coherence, vocabulary and academic style of undergraduate essays in Pakistan. It looks into students' perceptions of AI-generated feedback versus conventional instructor feedback, and also identifies possible problems, with particular focus on over-dependence on AI, academic integrity issues, and gaps in AI-supported learning. The study also seeks to explore the potential implications of the findings and contribute to understanding the role of writing education in the context of modern technology, specifically AI, in the context of Pakistani higher education.

Research Questions

- 1) How much do AI-based writing assistants (ChatGPT & Grammarly) enhance the grammar, coherence, vocabulary and overall essay writing of undergraduates?
- 2) Are students view AI-generated feedback as being equally useful, engaging, and effective as traditional instructor feedback?
- 3) What concerns should I have for deployment of AI-powered writing assistants for essay writing by undergraduates?

Literature Review

The rise of Artificial Intelligence (AI) is reshaping how its use can greatly enhance all areas of education including the field of academic writing. ChatGPT and Grammarly, using AI to check the grammar immediately, structure, as well as suggest content, makes it easier for students to get better at not only just writing (Kumar & Rose, 2023). Although these tools have been widely adopted in higher education globally, very few studies have explored their role in the pre-graduation essay writing enhancement of students studying in Pakistan. This literature review explores previous studies on Automated Writing Evaluation (AWE), the influence of feedback on academic writing, and Artificial Intelligence (AI) application effects on an ESL population.

Higher Education and AI Writing Assistants

AI writing assistants have become the new-age writing tutors, offering real-time feedback and correction and thus improving writing skills (Alharbi, 2022). Grammarly, for example, emphasizes grammatical correctness, clarity, and engagement to assist learners refine their writing style (McNamara et al., 2020). ChatGPT, however, can offer contextual suggestions, assist in restructuring sentences and building arguments and therefore is a more dynamic tool to enhance coherence and critical thinking during writing (Zhai, 2023).

Research has indicated that students employing AI writing tools show marked gains in writing fluency, grammatical accuracy, and coherence (Ranalli, 2021). For instance, a study by Li et al. (2022) reported a notable reduction in the frequency of errors in subject-verb agreement, punctuation, and sentence structure in the AI-assisted composition and in the overall academic writing performance. Still, there are concerns related with over-dependence on AI-generated feedback as well as reduction in originality of student writing (Dwivedi & Thakur, 2023).

Feedback in Academic Writing is Crucial

Effective writing feedback is considered one of the most important ingredients for academic success in university; this is a process that helps students discover weaknesses in their writing and develop their writing through the process of revision (Hyland and Hyland, 2019). Traditionally, instructor feedback has served as the primary source of guidance for revision. High student to staff ratio with releasing results in a limited period of time (Biber et al., 2020) leads to insufficient

feedback being communicated to students, which impairs their ability to improve. AI-powered tools present another option by providing instant, detailed, and personalized feedback, enabling learners to correct their mistakes and learn in real-time (McCarthy et al., 2021).

Research indicates that students found AI feedback more accessible and more objective than human feedback, but still considered human instructors integral for conducting deep analysis of the content and developing critical thinking (Li et al., 2022). AI tools can be very grammatical and syntactically correct but they do not assess argument strength, logical flow, and creativity (Zhai, 2023). Such limitation leads to the question of whether AI feedback is adequate for the purpose of profound development of academic writing.

Paraphrasing Tool for Semi Proficient English Learners

In addition, AI writing assistants can be used as language learning tools to help non-English speaking students improve their language skills since these tools are capable of correcting common language mistakes (Rafi, 2020). As a second language in Pakistan, students are rarely exposed to formal writing and writing in English can be tasking and cumbersome for students in Pakistan (Mahboob, 2014); AI tools can be accessible and pragmatic tools for students where they are usually serviced by their grammar, coherence and clarity struggles.

Studies show that students who use AI-powered writing assistants become confident in their writing because they can self-edit their work before submitting their assignments (Alharbi, 2023). On the other hand, excessive reliance on AI-based corrections can progressively erode the ability to edit one's own writing and could prevent the development of critical thought into the writing process (Dwivedi & Thakur, 2023). Specifically, AI tools tend to lack a feedback mechanism that accounts for the cultural context within which the students belong (Kumar & Rose, 2023) and Pakistan possesses a rich linguistic landscape of students that are the beneficiaries of such feedback mechanisms.

The Use of AI in Writing: Challenges and Ethics

While AI-powered content writing tools have their benefits, they also come with several challenges and ethical issues. If students over-rely on AI feedback, their critical engagement with the writing tasks can become reduced; that is, students may accept the AI-formed conclusions without critically considering how well those conclusions fit (Ranalli, 2021). Some students also use AI tools to write entire essays rather than to aid them in writing (Zhai, 2023), and so, plagiarism and academic integrity issues arise.

In addition, feedback produced by AI is not always completely accurate—it can misunderstand context, offer erroneous suggestions, or overlook nuanced writing styles (McCarthy et al. 2021). Extending such an Indo-Pakistani perspective which bears on Pakistani undergraduate education, where large-scale reform is still needed from a pedagogy standpoint, will require a careful balancing of AI tools with traditional writing instruction, with particular attention to maximizing the advantages while minimizing the disadvantages (Rafi, 2020).

In the IT and ED contexts, the literature identifies the opportunities offered by AI writing assistants as well as the shortcomings. But tools such as ChatGPT and Grammarly are not without their drawbacks and challenges, including over-reliance, ethical questions, and the depth of development of writing skills. Undergraduate education in Pakistan is often perplexing for students who work with academic writing in English, making the use of AI writing tools an excellent resource. It just needs to be further looked into how these, and AI tools in general, will

be integrated into already existing pedagogical frameworks without losing out on originality and critical thinking.

Research Methodology

The current study is designed to explore the impact of AI-powered writing assistants ChatGPT and Grammarly on improving the essay writing skills of undergraduates. Using a mixed-methods approach, the research investigates changes in grammar, coherence, vocabulary, and overall academic writing for students over the eight-week period. The population of the study is BS students of Management Sciences at University of Education and data were collected through pre- and post-test essays and instructor's evaluations to evaluate the impact of AI-generated feedback versus human feedback on students' learning experience. Using a quasi-experimental design with pre-test and post-test measures, the study evaluates the effectiveness of AI-powered Writing assistants in enhancing students' writing performance. Besides this, students' perceptions of both tools in terms of their usefulness and challenges they posed were gathered through semi-structured interviews. The quantitative section involved a controlled trial to evaluate students' essay writing skills pre- and post-AI-assisted intervention. Feedback from students about their experiences using ChatGPT and Grammarly through surveys and interviews. The target population range from students who are low on English writing ability to those who are high in English writing ability.

A purposive sampling strategy was used to recruit 80 undergraduate students with varied representation in the following: Language levels (beginner, intermediate, advanced) The population was divided into two groups: Experimental Group (n = 40): Students received AI-assisted feedback using ChatGPT & Grammarly for eight weeks. Control Group (n = 40): Students received traditional instructor feedback without the assistance of AI. As for assessing how effective AI-powered writing assistants are, students will be asked to produce an academic essay (500–600 words) at two different points: Pre-Test (Baseline Essay): Written without the aid of AI. After the Test: Final Essay: Composed after eight weeks of using ChatGPT and Grammarly (for the experimental group). Within the experimental group, pre-test and post-test scores were compared using paired t-tests. Independent t-tests will analyze the differences between the experimental and control groups to find significant improvements. Survey responses were summarized using descriptive statistics (means, standard deviations).

Data Analysis and Results

This section discusses the outcomes of the investigation using both quantitative and qualitative data to evaluate the power of ChatGPT and Grammarly in enhancing the essay skills of Pakistani undergraduates. The results are understood through statistical tests and thematic analysis.

Quantitative Data Analysis

Pre-Test vs Post-Test Score Analysis

A paired sample t-test was used to compare the pre-test and post-test essay scores of the experimental group students (AI-assisted feedback) and the control students (traditional feedback). The essays were scored according to a common rubric that measured grammar, coherence, vocabulary and development of the argument.

Table 1: Pre-Test vs. Post-Test Scores (Experimental Group)

Writing Criteria	Pre-Test Mean (SD)	Post-Test Mean (SD)	t-value	p-value (Sig.)
Grammar & Syntax	5.6 (1.2)	8.3 (1.1)	7.12	< 0.001
Coherence & Cohesion	6.1 (1.4)	8.7 (1.3)	6.85	< 0.001
Vocabulary & Style	5.9 (1.3)	8.4 (1.2)	6.45	< 0.001
Argument Development	5.8 (1.5)	8.1 (1.4)	6.92	< 0.001

Findings: The experimental group showed a statistically significant improvement in all writing aspects ($p < 0.001$), indicating that ChatGPT and Grammarly effectively enhanced essay writing skills.

Table 2: Pre-Test vs. Post-Test Scores (Control Group)

Writing Criteria	Pre-Test Mean (SD)	Post-Test Mean (SD)	t-value	p-value (Sig.)
Grammar & Syntax	5.5 (1.3)	6.7 (1.2)	3.01	0.058
Coherence & Cohesion	6.0 (1.2)	6.8 (1.3)	2.89	0.062
Vocabulary & Style	5.8 (1.4)	6.5 (1.2)	2.71	0.071
Argument Development	5.7 (1.5)	6.6 (1.3)	2.95	0.068

Findings: The control group showed minor improvements, but none were statistically significant ($p > 0.05$), suggesting that traditional instructor feedback alone was less effective in improving writing compared to AI-assisted feedback.

Independent Sample t-Test (Experimental vs. Control Group)

An independent sample t-test was conducted to compare post-test scores of both groups.

Table 3: Post-Test Score Comparison (Experimental vs. Control Group)

Writing Criteria	Experimental Mean (SD)	Control Mean (SD)	t-value	p-value (Sig.)
Grammar & Syntax	8.3 (1.1)	6.7 (1.2)	5.91	< 0.001
Coherence & Cohesion	8.7 (1.3)	6.8 (1.3)	6.12	< 0.001
Vocabulary & Style	8.4 (1.2)	6.5 (1.2)	5.98	< 0.001
Argument Development	8.1 (1.4)	6.6 (1.3)	5.87	< 0.001

Findings: Students who used ChatGPT and Grammarly performed significantly better than those who received only instructor feedback. This supports the hypothesis that AI-powered writing assistants significantly enhance essay writing skills.

Qualitative Data Analysis

To complement the statistical results, **student perceptions** were analyzed using **thematic analysis** based on survey responses and semi-structured interviews.

Survey Responses (Likert Scale Analysis)

A five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) was used to assess student perceptions of AI tools in improving writing skills.

Table 4: Student Perceptions of ChatGPT and Grammarly

Statement	Mean Score (SD)	Agreement (%)
AI tools improved my grammar & syntax.	4.6 (0.8)	92%
ChatGPT helped in structuring my arguments.	4.3 (1.0)	88%
Grammarly enhanced my academic writing style.	4.5 (0.9)	91%
AI tools increased my confidence in writing.	4.4 (0.9)	89%
I prefer AI-assisted feedback over traditional feedback.	4.1 (1.2)	85%

Findings: The majority of students strongly agreed that AI-powered writing assistants significantly improved their writing proficiency, particularly in grammar, structure, and academic style.

Thematic Analysis of Interview Data

Interviews with students about their use of AI tools to improve writing highlighted three predominant themes:

Theme 1: Improved Grammar & Structure

“Grammarly corrected my grammatical mistakes right away, and ChatGPT proposed more complex structures. My writing got better and better.” (Student A)

Theme Two: Development of Ideas and Critical Thinking

“ChatGPT was awesome for brainstorming ideas and formatting my essays. But it was often shallow, so I still needed guidance from my teachers.” (Student B)

Theme 3: AI And Ethical Concerns

“AI tools made me a better writer, but I relied on them too much. I did not critically assess recommendations; occasionally I implemented them. (Student C)

Findings

AI tools fixed grammar, structure, and word choice, making students feel more confident.

ChatGPT helped us build logical arguments but led to some students over-relying on AI ideas without analysis.

The overreliance on AI raised an ethical concern, emphasizing the importance of a balanced approach to AI-enhanced learning.

Discussion

The outcomes of this research offered essential understandings of the part AI-fueled composing partners, especially ChatGPT and Grammarly, play in reinforcing expository composing capacities among Pakistani undergraduates. According to the results, students who took advantage of these AI tools showed significant gains in grammar, vocabulary, coherence, and argument structure compared to students who did not use such tools and solely relied on feedback from traditional instructors. But the findings also underscore possible challenges, such as over-reliance on A.I. suggestions, ethical considerations and a need for critical examination of A.I.-generated content.

Improvement in Writing Skills

Using a quantitative approach, pre-test and post-test essay scores indicated an increase in student writing proficiency compared to their use of AI-powered writing assistants. These tools offered immediate feedback, correcting for grammar, and recommending elevated vocabulary and sentence structures. This verified the findings of the previous studies that AI-based writing tools (e.g., grammarly and GTP-based writing tools) enhanced writing fluency and grammatical accuracy (Ranalli, 2021 Wang et al, 2023).

ChatGPT users showed better coherence and idea development, while students using Grammarly had better syntax and punctuation accuracy. This supports the claim that different AI tools fulfil different roles in writing (Zhang & Hyland, 2022).

Is Role of AI in Enhancing Academic Writing

Results from the study show that the AI-powered writing assistants, played a very key part in helping improve the academic writing conventions, especially for students, who were learning English as a second language (ESL). Many claimed that AI feedback simplified complex grammar rules into more digestible nuggets, and offered on-the-fly explanations that solidified their understanding in the moment. This is in line with previous research that recommends AI as a suitable scaffolding tool for ESL learners (Klimova, 2022).

However, the study also revealed that AI-generated suggestions were occasionally contextually unclear, causing errors in meaning or inappropriate words to be used. This plays into what some researchers who assert that AI does not have the nuanced understanding of a human instructor warn about Kessler, (2021).

Potential Over-Reliance on AI: Emphasize the importance of maintaining human oversight and judgement in the legal process, and discuss the potential ethical concerns of over-relying on AI systems.

One main concern that appeared in the qualitative data was the over-reliance on AI tools where students passed on AI's suggestions with or without critical engagement. This style of learning raises concerns surrounding academic integrity and the uniqueness of student work, though, as some students leveraged AI-generated content rather than allowing themselves to develop writing outside of an AI model.

Participants also raised ethical issues related to AI usage, including but not limited to plagiarism and data privacy as reasons for concern. Such concerns reiterate the existing literature (see for example Li, 2023), indicating that students may become reliant on AI generated content, hindering their formulation of independent writing.

These challenges need to be address in the context of AI adoption in Pakistan.

AI-based writing tools proved to be useful, but students in Pakistan faced challenges, including limited access to the internet and gaps in digital literacy. Variations in English proficiency also impacted students' ability to process and respond to AI-generated feedback. These results echo previous research conducted on barriers to technology adoption in less developed areas as highlighted by the need to adopt AI to localized use cases and digital literacy trainings (Rehman & Abbas, 2023).

Human-AI Collaboration: The Call for a Balanced Approach

The results highlight AI-powered writing assistants as supplements not substitutes for human teachers. It might be most effective to have a hybrid model where AI provides grammatical correction in the moment but instructors then come behind and provide contextual feedback. This is closely related to cognitive apprenticeship model and blended learning strategies (Collins et al., 2022).

PR Unintended Consequences and Future Directions

As to the study findings what should future studies research:

The effects of using AI-powered writing assistants on critical thinking and originality in academic writing: Are we writing like robots?

Writing with specialization, such as in science or law.

Registers of AI tools into university curricula in Pakistan.

In addition, policymakers and education leaders must create institutional policies on ethical AI usage and train students to critically analyze the AI-generated feedback.

Conclusion

The study focused on the effectiveness of AI-based writing assistants, ChatGPT and Grammarly, on improving essay writing skills in Pakistani undergraduates. The research shows that AI tools greatly enhance students' writing ability in grammar, coherence, vocabulary and argument development. The quantitative analysis showed that students who received AI-assisted feedback performed markedly better than those who were given only traditional instructor feedback. Qualitative data further demonstrated that AI tools gave students confidence in their writing while also raising worries about students becoming overly reliant and writing uncritically.

The research further confirm that writing assistants powered by AI are helpful tips in education that can work next to frequent writing lessons. Yet, they should not supplant human feedback; rather, they should be thoughtfully integrated into academic settings to support student success. However, while AI tools offer rapid, data-backed feedback, they can also lack contextual nuance and critical interrogation of ideas, which underscores the importance of wise, balanced use.

Recommendations

Given the findings, the following recommendations are provided to optimize the gains from AI-powered writing assistants while mitigating their shortcomings:

- Incorporating AI Tools Within Writing Courses
- Building on these strategies, universities should integrate AI-powered writing assistants into English and academic writing courses.
- If this happens, instructors direct students to good use of the AI, using it as a learning tool not as a correcting pen.
- Educating Students on Responsible AI Use
- Writing workshops to clarify that AI adds on — it doesn't replace critical thinking, and this is a human-AI collaboration.
- AI tools should augment, not replace, teacher feedback.

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