

THE EFFECT OF AI-BASED FEEDBACK TOOLS ON ACADEMIC WRITING PERFORMANCE OF EFL STUDENTS

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Abstract. The rapid development of artificial intelligence (AI) technologies has considerably transformed contemporary educational practices, particularly in the field of academic writing instruction. This study investigates the impact of AI-based feedback tools on the academic writing performance of English as a Foreign Language (EFL) students. Special attention is given to the pedagogical role of platforms such as ChatGPT, Grammarly, and QuillBot in improving grammatical accuracy, lexical richness, coherence, academic style, and overall writing quality. The research employed both qualitative and quantitative approaches involving experimental and control groups of university students. Data were collected through pre-tests, post-tests, classroom observations, questionnaires, and comparative writing assessments. The findings demonstrate that students who utilized AI-assisted feedback systems showed significantly higher improvement in academic writing performance compared to those using traditional feedback methods. In particular, AI technologies contributed to faster error correction, increased learner autonomy, enhanced writing fluency, and greater confidence during academic writing tasks. However, the study also identifies several challenges associated with excessive dependence on AI-generated content, including risks related to academic integrity, plagiarism, and reduced independent critical thinking. The article concludes that AI-based feedback tools can serve as highly effective supplementary resources in academic writing instruction when applied under appropriate pedagogical supervision and ethical guidelines.

Keywords: artificial intelligence, academic writing, AI feedback tools, ChatGPT, Grammarly, QuillBot, EFL students, digital pedagogy, academic integrity, writing performance.

Аннотация. В данной статье исследуется влияние инструментов обратной связи, основанных на искусственном интеллекте, на академическую письменную деятельность студентов, изучающих английский язык как иностранный (EFL). Особое внимание уделяется педагогической роли платформ ChatGPT, Grammarly и QuillBot в развитии грамматической точности, академического стиля, лексического богатства, логической структуры текста и общего качества письменной речи. В исследовании использовались как качественные, так и количественные методы анализа. Экспериментальная работа проводилась среди студентов высших учебных заведений с применением контрольных и экспериментальных групп. Сбор данных осуществлялся посредством pre-test и post-test заданий, письменных работ, наблюдений и анкетирования. Результаты исследования показали, что студенты, использовавшие AI-инструменты обратной связи, продемонстрировали значительно более высокие показатели академического письма по сравнению со студентами, обучавшимися с использованием традиционных методов обратной связи. В частности, было выявлено снижение количества грамматических ошибок, улучшение академического стиля, повышение скорости письма и рост учебной мотивации. Вместе с тем исследование выявило ряд проблем, связанных с чрезмерной зависимостью от AI-технологий, включая риски нарушения академической честности, плагиата и снижения уровня самостоятельного критического мышления. В заключении подчеркивается, что эффективное использование AI-инструментов возможно только при наличии педагогического контроля и методического сопровождения.

Ключевые слова: искусственный интеллект, академическое письмо, AI-инструменты обратной связи, ChatGPT, Grammarly, QuillBot, студенты EFL, цифровая педагогика, академическая честность, письменная компетенция.

Introduction. The rapid advancement of digital technologies has significantly transformed contemporary educational systems and pedagogical practices across the world. In particular, the emergence of artificial intelligence (AI) technologies has created new opportunities for improving teaching methodologies, learning environments, and students' academic performance. Within the field of foreign language education, AI-powered tools are increasingly being integrated into instructional processes to support language acquisition, learner autonomy, and academic skill development.

Among the four core language skills, academic writing is considered one of the most challenging competencies for English as a Foreign Language (EFL) students. Effective academic writing requires not only grammatical accuracy and vocabulary knowledge but also logical organization, coherence, critical thinking, argumentation, and familiarity with academic discourse conventions. Consequently, developing academic writing competence has become one of the primary objectives of higher education institutions, especially in EFL contexts where students often experience linguistic and cognitive difficulties during the writing process.

Traditionally, academic writing instruction has relied heavily on teacher feedback, peer-review activities, and manual correction techniques. Although these approaches remain pedagogically valuable, they are frequently associated with several limitations, including delayed feedback, insufficient individualization, heavy teacher workload, and limited opportunities for continuous revision. In recent years, however, technological innovations have introduced alternative feedback mechanisms capable of addressing some of these challenges more effectively.

Artificial intelligence-based feedback systems such as ChatGPT, Grammarly, QuillBot, and other automated writing assistants are currently being widely used in academic environments. These platforms provide immediate feedback on grammar, vocabulary usage, sentence structure, coherence, and academic style. Moreover, AI-powered tools can support brainstorming, paraphrasing, idea organization, and text revision, thereby facilitating different stages of the academic writing process. As a result, AI technologies are increasingly viewed as potentially valuable educational resources for improving students' writing performance and promoting autonomous learning.

Several studies have demonstrated the pedagogical benefits of AI-assisted writing instruction. Researchers argue that automated feedback systems contribute to improving grammatical accuracy, increasing writing fluency, and enhancing students' confidence during academic writing tasks.[1] Furthermore, AI-supported learning environments may encourage students to engage more actively in the revision process by allowing them to receive immediate corrective feedback and personalized suggestions.

Despite these advantages, the integration of AI technologies into academic writing instruction has also generated considerable debate among educators and researchers. One of the major concerns relates to academic integrity and the growing possibility of

plagiarism through AI-generated content. Since generative AI systems are capable of producing sophisticated academic texts within seconds, questions regarding originality, authorship authenticity, and ethical use have become increasingly important in higher education.[2.170] Additionally, scholars warn that excessive dependence on AI technologies may weaken students' independent critical thinking, creativity, and analytical abilities.

Another important issue involves the reliability and contextual accuracy of AI-generated feedback. Although AI platforms often produce linguistically fluent responses, they may occasionally provide misleading information, superficial analysis, or contextually inappropriate suggestions. Therefore, many researchers emphasize the necessity of pedagogical supervision and critical evaluation when implementing AI-assisted learning tools in educational settings.

In the context of Uzbekistan's higher education system, growing attention is currently being paid to the modernization of foreign language teaching methodologies and the integration of digital technologies into educational practice. The increasing accessibility of AI-powered educational tools has created new opportunities for improving academic writing instruction among university students. However, despite the growing popularity of AI technologies, relatively limited empirical research has been conducted regarding their effectiveness within Uzbek EFL classrooms.

The relevance of the present study lies in the increasing demand for innovative and effective approaches to developing academic writing competence in higher education. As AI technologies continue to influence modern educational practices, understanding their pedagogical potential and limitations becomes increasingly important for both educators and learners.

The main purpose of this research is to investigate the effect of AI-based feedback tools on the academic writing performance of EFL students. The study specifically examines the pedagogical impact of platforms such as ChatGPT, Grammarly, and QuillBot on students' grammatical accuracy, coherence, lexical richness, academic style, and overall writing quality.

To achieve this objective, the following research tasks were identified:

1. to examine the theoretical foundations of academic writing and AI-assisted learning;
2. to analyze the functional capabilities of AI-based feedback tools in academic writing instruction;
3. to evaluate the effectiveness of AI technologies in improving EFL students' writing performance;
4. to identify the pedagogical advantages and limitations of AI-assisted feedback systems;
5. to investigate issues related to academic integrity and independent critical thinking in AI-supported learning environments;

6. to develop methodological recommendations for the effective integration of AI tools into academic writing instruction.

The study hypothesizes that AI-based feedback tools significantly improve EFL students' academic writing performance compared to traditional feedback methods. Through experimental investigation and comparative analysis, the research aims to contribute to the growing body of literature on artificial intelligence in language education and provide practical implications for modern academic writing pedagogy.

Literature Review. The integration of artificial intelligence technologies into language education has become one of the most rapidly developing areas in contemporary educational research. In recent years, AI-powered platforms have increasingly been employed to support academic writing instruction, particularly in English as a Foreign Language (EFL) contexts. The growing popularity of tools such as ChatGPT, Grammarly, QuillBot, and other automated feedback systems has generated substantial scholarly interest regarding their pedagogical effectiveness, ethical implications, and influence on students' writing competence.

Academic writing is widely recognized as one of the most complex productive language skills, requiring learners to demonstrate grammatical accuracy, lexical sophistication, coherence, cohesion, critical thinking, and discipline-specific communication abilities. According to Hyland, academic writing is not merely a linguistic activity but also a cognitive and social practice that reflects students' ability to participate in academic discourse communities.[1] Consequently, improving academic writing competence remains a major objective in higher education, especially within EFL environments where students frequently encounter linguistic and structural difficulties in producing scholarly texts.

Traditional approaches to writing instruction typically rely on teacher-centered feedback mechanisms, peer-review activities, and manual error correction strategies. Although such methods contribute to writing development, they are often limited by time constraints, delayed feedback, and insufficient individualization. In this regard, technological advancements have introduced alternative instructional models that provide students with immediate, personalized, and interactive feedback opportunities.

The theoretical foundation for AI-assisted learning can be linked to sociocultural learning theory and formative assessment frameworks. Vygotsky's concept of the Zone of Proximal Development emphasizes the importance of guided support during the learning process, suggesting that learners achieve higher levels of performance when assisted by more capable mediators.[2] AI-based feedback systems may function as digital mediators by offering real-time guidance, corrective feedback, and language support during writing activities.

Similarly, formative assessment theory highlights the significance of continuous feedback in improving student performance. Black and Wiliam argue that effective

feedback enables learners to identify weaknesses, revise errors, and regulate their own learning processes.[3] AI-powered writing tools align closely with these principles by generating immediate responses that facilitate self-correction and autonomous learning.

Recent studies indicate that AI-based writing platforms can positively affect multiple dimensions of academic writing performance. Grammarly, for instance, has been extensively examined for its ability to improve grammatical accuracy, punctuation, sentence clarity, and stylistic appropriateness. O'Neill and Russell found that students using Grammarly demonstrated higher levels of linguistic accuracy and reported increased confidence in academic writing tasks.[4] The researchers also noted that automated feedback systems reduce students' writing anxiety by allowing them to revise texts independently before teacher evaluation.

In addition to grammar-focused applications, paraphrasing tools such as QuillBot have gained popularity among EFL learners. Research suggests that such platforms help students expand lexical variety, improve sentence structure, and develop paraphrasing competence, which is particularly important in avoiding plagiarism and enhancing academic integrity.[5] However, scholars caution that excessive dependence on automated paraphrasing tools may weaken students' original writing abilities and limit cognitive engagement during text production.

The emergence of generative AI systems, particularly ChatGPT, has significantly transformed discussions surrounding AI-assisted academic writing. Unlike traditional grammar-checking software, large language models are capable of generating coherent texts, summarizing information, explaining concepts, and supporting idea development. Kasneci et al. argue that ChatGPT possesses considerable pedagogical potential due to its interactive and adaptive nature [6]. According to the authors, AI chatbots can facilitate brainstorming, outline generation, and language modeling, thereby supporting students throughout different stages of the writing process.

Likewise, Dwivedi et al. emphasize that generative AI technologies may reshape educational practices by increasing accessibility to academic support and enhancing personalized learning experiences.[7] The researchers suggest that AI tools could become integral components of future digital learning environments. Nevertheless, they also highlight significant ethical and pedagogical concerns associated with AI-generated content.

One of the most widely debated issues in the literature concerns academic integrity. Cotton, Cotton, and Shipway argue that generative AI systems create new challenges for universities regarding plagiarism detection, authorship authenticity, and assessment reliability.[8] Because AI platforms are capable of producing sophisticated academic texts within seconds, educators face increasing difficulties in distinguishing between students' original work and AI-generated outputs.

Moreover, researchers warn that excessive reliance on AI systems may negatively affect students' critical thinking and independent analytical skills. According to Farrokhnia et al., students who overuse generative AI technologies may become passive consumers of information rather than active constructors of knowledge.[9] This concern is particularly relevant in academic writing instruction, where critical reflection, argumentation, and intellectual creativity are essential learning outcomes.

Another important issue addressed in previous studies involves the reliability and accuracy of AI-generated information. While AI platforms often produce linguistically fluent responses, they may occasionally provide misleading, fabricated, or contextually inappropriate content. Tlili et al. note that AI-generated academic texts should always be critically evaluated and verified by both students and instructors.[10] Consequently, pedagogical supervision remains crucial in AI-assisted learning environments.

Within EFL contexts, AI-based feedback systems appear particularly beneficial due to the linguistic challenges faced by non-native English speakers. Studies indicate that automated writing feedback helps learners identify recurring grammatical errors, improve sentence complexity, and strengthen academic vocabulary usage.[11] Furthermore, interactive AI tools may contribute to increasing learner motivation and engagement by creating more dynamic and less intimidating writing environments.

Despite the growing body of literature on AI-assisted writing instruction, several research gaps remain insufficiently explored. First, many existing studies focus primarily on theoretical discussions or short-term observations rather than experimental investigations. Second, limited research has comparatively analyzed the pedagogical effectiveness of multiple AI-based feedback tools within authentic EFL academic writing contexts. Third, relatively few studies have examined the balance between the educational advantages of AI technologies and their potential risks to academic integrity and independent thinking.

Therefore, the present study seeks to address these gaps by investigating the impact of AI-based feedback tools on the academic writing performance of EFL students through an experimental research design. The study specifically examines how platforms such as ChatGPT, Grammarly, and QuillBot influence students' grammatical accuracy, coherence, academic style, lexical richness, and overall writing quality. Additionally, the research explores both the pedagogical opportunities and the limitations associated with AI-assisted academic writing instruction in higher education contexts.

Research Methodology. This study used a mixed-methods approach, combining quantitative and qualitative research methods. A quasi-experimental design was applied with two groups: an experimental group and a control group of EFL students with similar initial writing levels. The experimental group used AI-based feedback tools (ChatGPT, Grammarly, QuillBot), while the control group received traditional teacher feedback over an eight-week period.

Students' academic writing performance was measured using pre-tests and post-tests based on grammar, coherence, vocabulary, organization, and writing fluency. The results were analyzed comparatively to identify differences between the groups.

In addition, questionnaires and classroom observations were used to collect qualitative data on students' experiences and attitudes toward AI-assisted learning. The data were analyzed to identify key themes.

The study ensured validity, reliability, and ethical standards by using consistent evaluation criteria and maintaining participant confidentiality.

Analysis and Results. The findings of the present study revealed that AI-based feedback tools had a positive and statistically noticeable impact on the academic writing performance of EFL students. Comparative analysis of pre-test and post-test results demonstrated significant differences between the control group and the experimental group in several academic writing indicators.

At the initial stage of the experiment, both groups showed relatively similar levels of academic writing competence. However, after the eight-week instructional period, students in the experimental group demonstrated considerably greater improvement in writing performance compared to those in the control group.

The results of the comparative analysis are presented in Table 1.

Table 1 Comparison of Academic Writing Performance Between Control and Experimental Groups

Writing Criteria	Control Group Improvement	Experimental Group Improvement
Grammatical Accuracy	9%	31%
Academic Vocabulary Usage	7%	29%
Coherence and Cohesion	11%	34%
Organization of Ideas	10%	32%
Academic Style	8%	30%
Writing Fluency	8%	30%

The statistical data indicate that the experimental group outperformed the control group across all assessed categories. The highest improvement was observed in coherence and cohesion, where students using AI-assisted feedback tools demonstrated a 34% increase in performance. This finding suggests that AI technologies may effectively support students in organizing and connecting ideas more logically during academic writing tasks.

Similarly, grammatical accuracy improved significantly among students in the experimental group. AI-powered platforms such as Grammarly provided immediate corrective feedback, enabling learners to identify and revise grammatical errors independently. As a result, students produced more accurate and academically appropriate written texts.

The analysis also revealed substantial growth in academic vocabulary usage and writing fluency. Students who used ChatGPT and QuillBot demonstrated greater lexical diversity and more sophisticated sentence structures compared to students receiving traditional feedback. Furthermore, the availability of instant feedback reduced hesitation during writing activities and increased students' confidence in expressing ideas in written form.

The pre-test and post-test mean scores further support these findings.

Table 2 Pre-test and Post-test Mean Scores

Groups	Pre-test Mean Score	Post-test Mean Score	Improvement
Control Group	63	71	11%
Experimental Group	64	86	36%

As shown in Table 2, the experimental group achieved a significantly higher increase in post-test performance compared to the control group. Although both groups demonstrated some level of progress, students who utilized AI-based feedback tools showed more rapid and consistent improvement throughout the experimental period.

In addition to quantitative findings, qualitative data obtained through questionnaires and classroom observations provided important insights into students' attitudes toward AI-assisted academic writing instruction.

Most students in the experimental group reported positive perceptions regarding the use of AI technologies. According to questionnaire responses, students considered AI-based feedback systems beneficial for:

1. identifying grammatical and lexical mistakes;
2. improving academic writing style;
3. generating ideas during the planning stage;
4. reducing writing anxiety;
5. increasing self-confidence in academic writing tasks.

Several students stated that AI-assisted feedback helped them become more independent during the revision process. Instead of relying solely on teacher correction, learners were able to analyze and improve their own writing through automated suggestions and recommendations.

However, classroom observations also revealed several challenges associated with the use of AI technologies. Some students demonstrated excessive dependence on AI-generated suggestions and occasionally accepted corrections without critically evaluating them. In certain cases, students relied heavily on ChatGPT for idea generation and text construction, which reduced their engagement in independent analytical thinking.

Furthermore, several inaccuracies and contextually inappropriate suggestions generated by AI systems were identified during the experiment. This finding indicates that

although AI technologies can provide substantial support during academic writing instruction, they cannot fully replace teacher guidance and pedagogical supervision.

Overall, the results of the study confirm that AI-based feedback tools can significantly enhance EFL students' academic writing performance when integrated into the educational process through appropriate methodological and ethical frameworks.

The findings of the present study demonstrate that AI-based feedback tools can play a significant role in improving the academic writing performance of EFL students. The comparative analysis between the control and experimental groups revealed that students who utilized AI-assisted technologies achieved considerably higher results in grammatical accuracy, coherence, academic vocabulary usage, organization of ideas, and writing fluency.

One of the most important findings of the study is the effectiveness of immediate automated feedback in the writing process. Traditional writing instruction often depends on delayed teacher correction, which may reduce students' opportunities for immediate revision and self-correction. In contrast, AI-powered platforms such as Grammarly and ChatGPT provided students with real-time suggestions and corrective feedback, allowing them to identify mistakes and improve their writing more efficiently. This result supports the findings of previous studies emphasizing the importance of formative feedback in language learning environments.

The study also revealed that AI-assisted feedback systems positively influenced students' confidence and motivation during academic writing activities. Many participants reported that AI technologies reduced writing anxiety and helped them express ideas more freely in English. This finding is particularly important in EFL contexts where students frequently experience linguistic insecurity and fear of making mistakes during academic writing tasks.

Another significant outcome of the research concerns the development of learner autonomy. Students in the experimental group became more actively engaged in revising and editing their own texts. Instead of relying entirely on teacher-centered correction, learners independently analyzed feedback generated by AI systems and made necessary improvements in their writing. This suggests that AI technologies may contribute to the development of self-regulated learning skills in higher education contexts.

At the same time, the study identified several challenges associated with the use of AI technologies in academic writing instruction. One of the primary concerns involves excessive dependence on AI-generated content. Some students relied too heavily on automated suggestions without critically evaluating their accuracy or appropriateness. This finding indicates that AI technologies, while beneficial, may potentially weaken students' independent analytical thinking if used without proper pedagogical guidance.

The issue of academic integrity also emerged as a major concern during the research process. Generative AI systems such as ChatGPT are capable of producing coherent

academic texts within a short period of time, which may increase the risk of plagiarism and unethical academic practices. Consequently, educational institutions should establish clear ethical guidelines regulating the use of AI-assisted technologies in academic writing instruction.

Another important issue relates to the reliability of AI-generated feedback. Although AI platforms generally produced linguistically accurate recommendations, several cases of contextually inappropriate or factually questionable suggestions were observed. Therefore, the role of instructors remains essential in monitoring, evaluating, and guiding students' use of AI tools during academic writing activities.

The findings of this study correspond with previous international research highlighting both the pedagogical advantages and ethical limitations of AI-assisted learning environments. Similar to the studies conducted by Kasneci et al. and Dwivedi et al., the present research confirms that AI technologies can significantly improve writing performance when integrated responsibly into educational practice.

From a pedagogical perspective, the study suggests that AI-based feedback tools should not replace teachers but rather function as supplementary educational resources supporting the writing process. Effective integration of AI technologies requires a balanced instructional approach combining technological assistance with critical thinking development, academic integrity awareness, and teacher supervision.

Based on the findings of the study, several methodological recommendations can be proposed for educators working in EFL academic writing contexts:

1. AI technologies should be used as supportive rather than dominant instructional tools;
2. students should be trained to critically evaluate AI-generated feedback;
3. academic integrity principles should be explicitly discussed in writing courses;
4. teachers should combine automated feedback with human evaluation;
5. writing assignments should emphasize analytical and creative thinking skills.

Overall, the discussion demonstrates that AI-based feedback tools possess considerable pedagogical potential for enhancing academic writing competence among EFL students. However, their successful implementation depends largely on responsible usage, methodological planning, and continuous pedagogical supervision.

Conclusion. In conclusion, the findings of the present study demonstrate that AI-based feedback tools can significantly improve the academic writing performance of EFL students when integrated appropriately into the educational process. The experimental results revealed that students who utilized AI-assisted technologies such as ChatGPT, Grammarly, and QuillBot achieved higher levels of grammatical accuracy, coherence, academic vocabulary usage, writing fluency, and overall text organization compared to students who relied solely on traditional feedback methods.

The study confirms that AI-powered educational tools provide several important pedagogical advantages in academic writing instruction. In particular, immediate corrective feedback, personalized writing support, and interactive learning opportunities contribute to increasing students' motivation, confidence, and learner autonomy. Furthermore, AI technologies facilitate the revision process by helping students identify and correct linguistic and structural weaknesses more efficiently.

At the same time, the research identified several challenges related to the implementation of AI technologies in academic environments. Excessive dependence on automated systems may negatively affect students' independent critical thinking and analytical abilities. Additionally, the increasing accessibility of generative AI platforms raises important concerns regarding academic integrity, plagiarism, and ethical use of AI-generated content in higher education.

The findings suggest that AI technologies should not replace teachers in academic writing instruction. Instead, they should function as supplementary pedagogical tools supporting students throughout different stages of the writing process. The effectiveness of AI-assisted learning largely depends on appropriate methodological guidance, ethical regulation, and continuous teacher supervision.

Based on the results of the study, the following recommendations can be proposed:

1. educational institutions should develop clear policies regarding the ethical use of AI technologies in academic writing;
2. teachers should combine AI-assisted feedback with traditional instructional methods;
3. students should be trained to critically evaluate AI-generated suggestions;
4. academic writing courses should emphasize independent thinking and analytical skills alongside technological literacy;
5. further research should investigate the long-term pedagogical effects of AI-assisted writing instruction in different educational contexts.

Overall, the integration of AI-based feedback systems into EFL academic writing instruction represents a promising direction in modern digital pedagogy. When implemented responsibly and pedagogically, AI technologies can contribute substantially to improving students' academic writing competence and enhancing the overall effectiveness of foreign language education.

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