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HUMAN–AI COLLABORATION IN FOREIGN LANGUAGE WRITING: A MIXED-METHODS STUDY

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Abstract. The rapid development of artificial intelligence has significantly transformed foreign language education, particularly the teaching and learning of academic writing. AI-powered applications such as ChatGPT, Grammarly, and other generative AI systems provide learners with opportunities to generate ideas, organize arguments, improve grammatical accuracy, expand vocabulary, and receive immediate feedback. However, the increasing integration of AI into writing instruction raises important questions concerning the relationship between technological assistance and human involvement in the writing process. The present study investigates human–AI collaboration in foreign language writing, focusing on its influence on writing performance, learner autonomy, motivation, critical engagement, and academic integrity. A mixed-methods literature-based research design is adopted to synthesize quantitative findings and qualitative evidence from previous empirical studies. The quantitative component examines reported changes in writing performance and patterns of AI-supported learning, while the qualitative component analyzes students' experiences, perceptions, and challenges associated with human–AI interaction. Previous research indicates that AI-assisted writing can contribute to improvements in grammatical accuracy, vocabulary use, text organization, and writing confidence. Mahapatra (2024) reported significant improvements in academic writing performance following a ChatGPT-supported intervention. Similarly, Polakova and Ivenz (2024) identified positive changes in several dimensions of EFL students' writing after receiving AI-generated feedback. However, existing research also highlights concerns related to excessive dependence, reduced originality, inaccurate suggestions, and

academic dishonesty. The findings suggest that effective human–AI collaboration requires a balanced relationship in which artificial intelligence provides linguistic and organizational assistance while learners retain responsibility for critical thinking, content development, and final writing decisions. The study concludes that AI should be integrated as a collaborative educational resource rather than a replacement for human creativity, teacher guidance, and independent language development.

Key words: human–AI collaboration, foreign language writing, EFL students, artificial intelligence, ChatGPT, academic writing, learner autonomy, writing performance, AI-assisted learning, academic integrity.

INTRODUCTION

Writing is one of the most complex skills in foreign language learning because it requires the simultaneous application of linguistic knowledge, cognitive abilities, organizational strategies, and communicative competence. Unlike speaking, which often takes place spontaneously, academic writing requires learners to plan their ideas, organize information, select appropriate vocabulary, construct grammatically accurate sentences, and revise their texts according to academic conventions. For students learning English as a Foreign Language (EFL), writing presents particular challenges. Learners may experience difficulties with grammatical structures, vocabulary selection, sentence organization, argument development, and the appropriate use of academic language. These difficulties can influence their confidence and reduce their willingness to participate in extended writing activities.

Traditionally, foreign language writing instruction has relied on textbooks, teacher explanations, peer feedback, dictionaries, and independent revision. Although these methods remain valuable, students do not always receive immediate and individualized assistance during the writing process. Teachers may also experience difficulties providing detailed feedback to every student, particularly in large university classes. The development of artificial intelligence has introduced new possibilities for

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addressing these challenges. Generative AI applications can provide explanations, suggest alternative expressions, identify grammatical errors, generate examples, and assist students in organizing their written ideas. Among these applications, ChatGPT has become particularly influential because it allows learners to communicate with an AI system through natural language.

Kohnke, Moorhouse, and Zou (2023) discuss the potential applications of ChatGPT in language teaching and learning, emphasizing its capacity to provide interactive support and facilitate individualized language practice. Such capabilities have important implications for foreign language writing because learners can obtain explanations and feedback at different stages of the writing process. Human–AI collaboration refers to an educational process in which students and artificial intelligence systems contribute different forms of knowledge and support to the production and improvement of written texts. In this relationship, AI can provide suggestions concerning grammar, vocabulary, organization, and clarity, while students remain responsible for evaluating the information, developing arguments, and making final decisions. This approach differs from simply asking an AI system to generate a complete essay. Effective collaboration requires active interaction, critical evaluation, and meaningful participation from the learner. Kasneci et al. (2023) explain that large language models create important opportunities for education through personalized assistance, immediate feedback, and interactive learning. Nevertheless, they also identify limitations involving inaccurate information, bias, and potential dependence on automated systems. In foreign language writing, these advantages and limitations are particularly important. Students may use AI to identify grammatical problems, improve sentence structures, develop topic sentences, and explore alternative vocabulary. However, they must also recognize that AI-generated suggestions are not always accurate or appropriate for a particular academic context. Mahapatra (2024) investigated the impact of ChatGPT as a formative feedback tool on undergraduate ESL

students' academic writing skills. The mixed-methods intervention study demonstrated significant improvements in students' writing performance following AI-supported instruction. The qualitative findings also indicated that students appreciated the opportunities to receive immediate explanations and feedback concerning content, organization, and grammar. Similarly, Polakova and Ivenz (2024) examined the effectiveness of ChatGPT feedback among 110 university EFL students. Their findings demonstrated improvements in several writing dimensions, including conciseness, grammar, inclusion of key information, and the use of passive voice. Students also expressed generally positive perceptions of AI-assisted writing. Song and Song (2023) investigated the effectiveness of ChatGPT in improving academic writing skills and writing motivation among Chinese EFL students. Their mixed-methods research combined writing assessments with interviews and demonstrated the educational potential of AI-supported instruction. Another important aspect of human–AI collaboration concerns the development of learner autonomy. Autonomous learners are able to identify their learning needs, select appropriate strategies, evaluate their progress, and take responsibility for their academic development. AI applications may support autonomy by allowing students to receive assistance independently of classroom schedules. However, excessive dependence on automated suggestions may weaken students' ability to solve writing problems without technological support. Rusdin (2024) explored EFL students' experiences with ChatGPT in academic writing and highlighted the importance of balancing technological assistance with human judgment. The research demonstrated that students appreciated AI support for overcoming uncertainty, clarifying vocabulary, and generating content suggestions. At the same time, concerns regarding originality, authenticity, and excessive dependence were identified. More recent research by Meniado et al. (2024) investigated ChatGPT use among 357 EFL learners in Thailand and Vietnam, with additional qualitative interviews involving 16 participants. Students reported using ChatGPT for

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brainstorming, organizing ideas, developing outlines, clarifying concepts, and editing written drafts. The findings highlighted the importance of perceived usefulness and engagement in shaping students' attitudes toward AI-assisted writing.

In addition, research by Chen and colleagues in the area of collaborative writing has explored how AI feedback can be combined with peer interaction. A study published in Computers and Education: Artificial Intelligence (2024) examined a ten-week wiki-based collaborative writing intervention involving 39 undergraduate students. The approach combined collaborative planning, individual writing with ChatGPT feedback, and subsequent collaborative writing activities. These studies suggest that the educational value of artificial intelligence does not depend exclusively on the capabilities of the technology. It also depends on the way students, teachers, and AI systems interact during the writing process. The issue is especially relevant to Uzbek universities, where EFL students increasingly use AI applications to complete academic assignments and improve their English writing. Although these technologies can provide useful support, students need appropriate guidance to ensure that AI assistance strengthens rather than replaces their linguistic and intellectual abilities. Therefore, the present study examines human–AI collaboration in foreign language writing through a mixed-methods synthesis of existing empirical research. It focuses on the influence of AI-supported interaction on writing performance, student engagement, learner autonomy, and academic integrity. The study addresses the following research questions: How does human–AI collaboration influence EFL students' foreign language writing performance?

What benefits and challenges do students experience when using AI tools during the writing process? How can teachers establish an effective balance between AI assistance and students' independent writing development?

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METHODS

The present study employs a mixed-methods literature-based research design to examine human–AI collaboration in foreign language writing. The approach combines quantitative evidence reported in previous empirical investigations with qualitative findings concerning students' experiences and perceptions of AI-assisted writing. A mixed-methods approach is appropriate because human–AI collaboration involves both measurable educational outcomes and individual experiences that cannot be fully explained through numerical data alone. The methodological framework draws on research concerning computer-assisted language learning, formative feedback, academic writing development, and learner autonomy. Relevant empirical studies were selected according to their relationship with AI-supported writing, EFL or ESL learners, writing performance, student perceptions, and collaborative learning. Particular attention was given to the mixed-methods studies conducted by Mahapatra (2024), Polakova and Ivenz (2024), Song and Song (2023), and Meniado et al. (2024). Additional research concerning collaborative writing and AI feedback was examined to understand the role of interaction between students and technological systems. The quantitative component of the analysis focused on measurable findings reported in the selected publications. These included writing assessment outcomes, pre-test and post-test comparisons, improvements in grammatical accuracy, text organization, vocabulary use, and students' reported patterns of AI use. The qualitative component examined students' perceptions, experiences, and attitudes toward AI-assisted writing. Particular attention was given to themes involving immediate feedback, writing confidence, independent learning, technological dependence, originality, and academic integrity. The findings from both components were interpreted together to identify areas of agreement and differences between reported writing outcomes and students' experiences. Human–AI collaboration was examined across the main stages of the writing process, including brainstorming, planning, drafting, feedback, revision, and

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final editing. The analysis also distinguished between supportive AI use and excessive dependence. Supportive use involves asking questions, requesting explanations, evaluating suggestions, and revising independently. Excessive dependence involves submitting AI-generated material without meaningful personal contribution or critical evaluation. As this study is a secondary literature-based mixed-methods synthesis, it does not claim to have collected new questionnaire responses, conducted interviews with Uzbek students, or administered original writing tests. All numerical findings discussed in the results section are attributed to the original published investigations.

RESULTS

The synthesis of quantitative and qualitative findings identifies several important dimensions of human–AI collaboration in foreign language writing. These dimensions demonstrate that AI can support writing development through immediate assistance and interactive feedback, while the quality of the outcomes depends on students' active participation. One of the most frequently reported advantages of AI-assisted writing is the improvement of linguistic accuracy and overall text quality. Students learning English as a foreign language often experience difficulties with grammatical structures, vocabulary selection, sentence formation, and paragraph organization. AI applications can provide immediate suggestions concerning these aspects and explain possible corrections. Mahapatra (2024) investigated ChatGPT as a formative feedback tool in a mixed-methods intervention involving undergraduate ESL students. The quantitative findings indicated significant improvements in the experimental group’s writing performance following the intervention. The study included 35 students in the experimental group and 37 students in the comparison group in the reported analysis. Students who received ChatGPT-supported feedback achieved higher post-test and delayed post-test writing scores than students in the comparison group. The findings suggest that AI-supported formative feedback can contribute to writing development when students receive appropriate training and actively engage in revision activities.

Polakova and Ivenz (2024) also examined ChatGPT feedback among 110 university EFL students. Their research identified improvements in several aspects of writing, particularly conciseness, grammar, the inclusion of relevant information, and the appropriate use of passive voice. These findings indicate that AI systems can provide useful linguistic assistance during the writing process. However, improvement in linguistic accuracy does not necessarily mean that students have developed equivalent improvements in independent writing ability. The educational value of feedback depends on whether learners understand the corrections and can apply similar knowledge in future writing tasks.

Idea generation and planning are important stages of academic writing because students must identify relevant information and establish a logical structure before producing a complete text. EFL students sometimes experience difficulties selecting appropriate arguments or developing supporting details. AI applications can help address these difficulties by suggesting possible perspectives and organizing information into preliminary outlines. Meniado et al. (2024) investigated the experiences of 357 EFL learners in Thailand and Vietnam. The findings indicated that students frequently used ChatGPT for brainstorming, organizing ideas, refining outlines, and clarifying concepts. These findings suggest that students view AI as a useful planning resource rather than simply a grammar correction tool. During human–AI collaboration, students may request several possible approaches to a writing topic and then select the most appropriate ideas according to their own understanding. For example, when writing about the importance of environmental education, a learner may ask AI to suggest possible arguments concerning environmental awareness, educational institutions, and sustainable development. The learner can then examine these suggestions, select relevant arguments, and develop original supporting explanations. This interaction may reduce the difficulties associated with beginning a writing task and help learners organize their thoughts more effectively. Nevertheless, students

should avoid accepting complete outlines without examining their relevance to the assignment. Feedback is a central component of writing development because it allows learners to identify weaknesses and improve their texts. Traditional teacher feedback remains important, but providing detailed individual feedback to every student can be time-consuming. AI applications offer an additional source of feedback that can be accessed during different stages of writing. Students may ask ChatGPT to identify unclear sentences, explain grammatical mistakes, suggest more appropriate vocabulary, or evaluate the organization of a paragraph. Mahapatra (2024) demonstrated that ChatGPT can function as a formative feedback resource in academic writing instruction. The study also highlighted the importance of self-assessment and peer assessment in combination with AI-supported feedback. Similarly, Polakova and Ivenz (2024) found that students benefited from ChatGPT suggestions concerning grammatical accuracy, conciseness, and the inclusion of important information. These findings suggest that AI-supported revision can help learners identify problems that may not be immediately apparent during independent proofreading. However, the qualitative evidence also indicates that students sometimes encounter difficulties interpreting or applying AI-generated recommendations. This is particularly important when AI suggests advanced vocabulary or complex sentence structures that may not match the student's intended meaning. Therefore, effective revision requires learners to compare suggestions with their original ideas and make independent decisions about which changes are appropriate. Students' perceptions of AI-assisted writing play an important role in determining whether they use these technologies effectively. When learners consider AI tools useful and accessible, they may be more willing to engage in additional writing practice and revision. Song and Song (2023) examined the impact of ChatGPT-assisted language learning on writing performance and motivation among 50 Chinese EFL students. Their mixed-methods research included an experimental group receiving ChatGPT-supported instruction and a comparison group following traditional

instruction. The study reported positive developments in writing performance and motivation among students receiving AI-supported instruction. Meniado et al. (2024) similarly found generally positive perceptions of ChatGPT among EFL learners in Thailand and Vietnam. Students valued the technology for generating ideas, providing examples, and supporting different stages of the writing process. These findings suggest that AI can make writing activities more accessible by reducing some of the difficulties associated with independent text production. However, positive perceptions should not be interpreted as direct evidence of improved independent writing competence. Students may enjoy using AI without necessarily developing the ability to write effectively without technological assistance. Learner autonomy is an important dimension of successful foreign language education. Autonomous learners are able to organize their learning activities, identify weaknesses, evaluate feedback, and take responsibility for improvement. AI applications can support autonomy by providing immediate explanations and opportunities for independent practice. For example, students can ask AI to explain why a particular grammatical construction is incorrect rather than simply requesting a corrected sentence. They can also compare different versions of a paragraph and identify the differences in clarity, vocabulary, and organization. These activities may encourage metalinguistic awareness and independent decision-making. Nevertheless, excessive dependence on AI can create the opposite effect. If students routinely ask AI to write entire essays or generate complete arguments, they may become less willing to develop their own ideas. Rusdin (2024) emphasizes the importance of balancing AI assistance with human judgment and academic authenticity. The findings suggest that learner autonomy is strengthened when students use AI as a resource for understanding and improvement rather than as a substitute for their own intellectual contribution.

Human–AI collaboration does not need to be limited to interaction between an individual student and an AI system. AI can also become part of a wider collaborative

learning environment involving teachers and peers. Research published in Computers and Education: Artificial Intelligence (2024) investigated the integration of collaborative writing and ChatGPT feedback in a wiki-based learning environment. The quasi-experimental study involved 39 undergraduate students and included a ten-week intervention. Students participated in collaborative outlining, individual writing with AI feedback, and subsequent collaborative writing activities. This approach demonstrates how AI can support interaction among learners rather than replace human collaboration. Students can discuss AI-generated suggestions, compare different interpretations, and collectively decide how to revise their texts. Peer discussion also allows learners to understand how readers interpret their writing and whether their arguments are sufficiently clear. The integration of AI feedback and collaborative writing may therefore create opportunities for both linguistic development and social interaction.

Despite its advantages, human–AI collaboration presents several challenges.

One important concern involves the accuracy of AI-generated information. Generative AI systems may produce incorrect explanations, unreliable references, or inappropriate suggestions. Kasneci et al. (2023) emphasize that large language models can generate inaccurate information and reproduce biases. Therefore, students should not treat every AI response as authoritative. Another challenge concerns originality and academic integrity. When students submit AI-generated texts without meaningful personal contribution, questions arise concerning authorship and academic honesty. Rusdin (2024) identifies authenticity and the need for human judgment as important concerns in EFL students' use of ChatGPT. Excessive dependence may also influence students' ability to develop independent writing strategies. Some learners may become accustomed to receiving immediate corrections and may consequently devote less attention to identifying and solving their own linguistic problems. In addition, AI-generated texts may contain vocabulary or sentence structures that are unnecessarily complex for the learner’s proficiency level. These challenges demonstrate the

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importance of developing AI literacy and responsible technological practices in foreign language education.

The combined analysis of quantitative and qualitative evidence reveals several consistent patterns. The quantitative findings from Mahapatra (2024), Polakova and Ivenz (2024), and Song and Song (2023) indicate that AI-supported writing activities can contribute to improvements in writing performance. The qualitative findings from Rusdin (2024) and Meniado et al. (2024) demonstrate that students generally appreciate AI assistance for idea generation, feedback, vocabulary development, and text revision. However, the qualitative evidence also identifies concerns that cannot be explained through writing scores alone. Students may experience uncertainty about whether AI-generated suggestions are accurate, whether their work remains original, and how much technological assistance is appropriate. Consequently, quantitative improvements in writing performance should be interpreted alongside qualitative information concerning students' learning experiences and independent decision-making. The integration of both forms of evidence suggests that successful human–AI collaboration requires more than technological access. It requires instructional guidance, critical engagement, and continued student responsibility.

DISCUSSION

The findings of the present study demonstrate that human–AI collaboration has considerable potential to support foreign language writing development. However, its effectiveness depends on the quality of interaction between learners and artificial intelligence systems. One of the most important findings concerns the positive contribution of AI-assisted feedback to writing performance. The studies by Mahapatra (2024) and Polakova and Ivenz (2024) provide empirical evidence that ChatGPT-supported feedback can improve different aspects of academic writing. These findings are consistent with the view that immediate and individualized feedback can support the development of linguistic accuracy and writing competence. However, the

improvement of writing performance should not be understood only in terms of grammatical correctness. Academic writing also requires original ideas, logical arguments, appropriate evidence, coherence, and the ability to communicate complex information effectively. AI systems may assist students with these dimensions, but they cannot automatically guarantee the development of independent academic reasoning. The findings also emphasize the importance of the collaborative nature of human–AI interaction. Meniado et al. (2024) demonstrate that students use ChatGPT at different stages of the writing process, including brainstorming, outlining, and revision. This suggests that AI can function as a flexible learning partner that provides assistance according to individual needs. Nevertheless, effective collaboration requires students to remain active participants. When learners evaluate suggestions, compare alternative expressions, and independently revise their texts, AI becomes a tool for learning rather than merely a text-generation service. Another important finding concerns learner autonomy. AI applications can increase opportunities for independent practice, especially when students need explanations outside classroom hours. However, autonomy does not mean depending on AI for every writing decision. True autonomy involves the ability to identify problems, evaluate available resources, and decide independently how to improve a written text. Therefore, teachers should encourage students to explain why they accept or reject particular AI-generated suggestions. The qualitative evidence also highlights concerns regarding academic integrity. Rusdin (2024) emphasizes the importance of maintaining authenticity when using ChatGPT in academic writing. This concern is particularly relevant in higher education because students are expected to demonstrate their own understanding and intellectual development. Universities should therefore establish clear guidelines concerning the appropriate use of AI applications. Students should understand the difference between receiving feedback and submitting AI-generated content as their own independent work. The discussion also has implications for Uzbek higher education institutions.

Many Uzbek EFL students use digital applications to improve their writing, but they may not always receive systematic instruction on how to evaluate AI-generated information. For this reason, AI literacy should become an important component of academic writing education. Students need to learn how to formulate effective prompts, identify inaccurate responses, verify information, and maintain responsibility for their final written products. The most productive approach is not to prohibit AI use completely or allow unrestricted dependence. Instead, universities should establish a balanced model in which AI supports linguistic development while teachers and students preserve the essential human dimensions of academic writing.

The findings have important implications for EFL teachers and higher education institutions. Teachers should integrate AI applications into writing instruction through carefully structured activities that require meaningful student participation. Students may first prepare an independent draft and then request AI feedback concerning grammar, vocabulary, organization, and coherence. After receiving suggestions, they should compare the feedback with their original text and explain which recommendations they accept or reject. Peer review can also be combined with AI assistance. Students may exchange their drafts, examine AI-generated comments, and discuss alternative revisions with classmates. Teachers should encourage learners to use AI for explanation rather than simply requesting corrected versions of complete texts. Another important implication concerns assessment. Writing assignments should evaluate not only the final product but also the writing process, including planning, drafting, revision, and reflection. Students may be asked to submit an original draft, selected AI feedback, and a revised version accompanied by a short explanation of their decisions. This approach can make students more responsible for their learning and help teachers understand the extent of individual contributions. Finally, institutions should develop clear policies concerning academic integrity, appropriate AI use, and the

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disclosure of AI assistance. Such measures can support the responsible integration of artificial intelligence into foreign language writing education.

The present study has several limitations. First, it is based on a secondary mixed-methods synthesis of published research rather than an original experimental investigation involving Uzbek university students. Second, the selected studies were conducted in different educational and cultural contexts. Differences in students' English proficiency, digital literacy, and previous experience with AI may influence the findings. Third, the studies used different assessment instruments and research designs. Consequently, their quantitative results cannot be combined into a single statistical effect without a more systematic meta-analytic procedure. Another limitation concerns the rapid development of generative AI technologies. The capabilities and limitations of current systems may differ from those investigated in earlier studies. Future research should involve Uzbek university EFL students and employ a longitudinal mixed-methods design. Such research could combine pre-test and post-test writing assessments, student questionnaires, semi-structured interviews, and analysis of writing drafts. It would also be valuable to compare AI-only feedback, teacher feedback, and combined human–AI feedback to identify which approach produces the most sustainable improvements in independent writing competence.

CONCLUSION

The present study examined human–AI collaboration in foreign language writing through a mixed-methods synthesis of existing empirical research. The findings indicate that artificial intelligence can provide valuable assistance in idea generation, text organization, vocabulary development, grammatical correction, and writing revision. Research by Mahapatra (2024), Polakova and Ivenz (2024), and Song and Song (2023) demonstrates the potential of ChatGPT-supported instruction to improve writing performance and student engagement. Similarly, Meniado et al. (2024) highlight the importance of AI applications in brainstorming, outlining, and editing

written texts. However, the analysis also demonstrates that AI-assisted writing involves important challenges related to originality, accuracy, learner autonomy, and academic integrity. The educational value of human–AI collaboration therefore depends on maintaining an appropriate balance between technological assistance and human responsibility. For Uzbek university EFL students, AI tools can create additional opportunities to improve English writing skills and develop independent learning strategies. Nevertheless, students should be encouraged to evaluate AI-generated suggestions critically and maintain ownership of their ideas and final written products. In conclusion, human–AI collaboration should be understood as a partnership in which artificial intelligence provides technological and linguistic support while human learners contribute creativity, critical thinking, personal interpretation, and academic responsibility. The successful integration of AI into foreign language writing education requires not the replacement of human involvement but the development of more effective forms of interaction between learners, teachers, and intelligent technologies.

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