

The Impact of AI-Based Tools(e.g., ChatGPT) on the Fluency in Writing among the students of the English Department at the University of Tikrit

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تأثير الأدوات القائمة على الذكاء الاصطناعي مثل (ChatGPT) على طلاقة الكتابة لدى طلاب قسم اللغة الإنجليزية

في جامعة تكريت

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Abstract

The objective of this study was to examine how the use of ChatGPT can enhance writing fluency and writing motivation in English language students of the University of Tikrit. The design was a quasi-experiment that involved 60 students (an experimental group utilizing ChatGPT and a control group receiving conventional teaching) in eight weeks. The findings revealed that the experimental group obtained a significant advantage over the control group in all the fluency indicators (speed, corrected rate, etc.). Motivation to write also improved significantly, particularly in self-efficacy and lessened writing anxiety with immediate tool feedback being the key to the improvement. The research paper finds that ChatGPT is an efficient tool within an EFL setting and proposes its gradual introduction with proper training. **Keywords:** ChatGPT, writing fluency, writing motivation, writing anxiety, University of Tikrit

المخلص

هدفت هذه الدراسة إلى فحص كيف يمكن أن يعزز استخدام ChatGPT طلاقة الكتابة والدافع نحو الكتابة لدى طلاب اللغة الإنجليزية في جامعة تكريت. اتبعت الدراسة تصميمًا شبه تجريبي شمل 60 طالبًا (مجموعة تجريبية استخدمت ChatGPT، ومجموعة ضابطة تلقت تعليمًا تقليديًا) على مدى ثمانية أسابيع. أظهرت النتائج تفوق المجموعة التجريبية بشكل ملحوظ على المجموعة الضابطة في جميع مؤشرات الطلاقة (السرعة، المعدل المصحح، إلخ). كما تحسّن الدافع نحو الكتابة بشكل ملحوظ، لا سيما في الكفاءة الذاتية وتقليل قلق الكتابة، وكانت التغذية الراجعة الفورية من الأداة هي المفتاح لذلك التحسّن. تستنتج الورقة البحثية أن ChatGPT أداة فعّالة في بيئة تعليم اللغة الإنجليزية كلغة أجنبية، وتقرّح إدخاله تدريجيًا مع توفير التدريب المناسب. **الكلمات المفتاحية:** ChatGPT، طلاقة الكتابة، الدافع نحو الكتابة، قلق الكتابة، جامعة تكريت

1. Introduction

1.1 Research Problem

Academic writing is a highly demanding skill that can be very challenging to the English as a Foreign Language (EFL) students because it involves the ability to coordinate accuracy in grammar, lexical variety, logical structure, and text cohesion, the elements that form the writing fluency (Furat Almutairi, 2025). The weakness of this fluency is observed in students of the English Department at the University of Tikrit, which can be explained by the absence of immediate feedback, the use of conventional teaching techniques, and high anxiety about writing, which suppresses motivation to study (Song and Song, 2023). Although there are sophisticated artificial intelligence technologies, like ChatGPT, which have emerged, the research on their effect on writing fluency as an independent construct is limited, and there is no such research available on the Iraqi setting. Thus, the following research question is to be answered in this study: Does the use of ChatGPT enhance academic writing fluency and writing motivation in students of the University of Tikrit? Based on this broad question, the following sub-questions are as follows:

1. Do experimental group (ChatGPT) and control group (traditional instruction) differ statistically in three indicators of fluency (Words Per Minute, corrected fluency and function word percentage)?
2. Do the two groups differ significantly in terms of writing motivation (intrinsic motivation, extrinsic motivation, self-efficacy and writing anxiety)?
3. What is the effect size of ChatGPT; writing fluency and writing motivation?

1.2 Significance of the Study

The paper offers a theoretical framework that integrates language learning theories (Vygotsky, 1978; Sweller, 2011) with artificial intelligence applications and accentuates the notion of writing fluency which has not been studied in detail. In practice, it provides empirical data on how ChatGPT can be more effective in enhancing fluency (measured through WPM, corrected fluency and function word percentage) and reducing writing anxiety, which is useful to faculty members at the University of Tikrit in building their teaching approaches. The research is also among the first scientific efforts in this regard, and its results can be applied by the appropriate authorities when developing policies on the application of artificial intelligence in education.

1.3 study Objectives.

The study aims to:

- Compare academic writing fluency (measured by three quantitative measures: WPM, corrected fluency, and function word percentage) between the experimental (ChatGPT) and the control (traditional instruction) group.
- Compare the writing motivation (intrinsic motivation, extrinsic motivation, self-efficacy, writing anxiety) of the two groups.
- Compare the results of the motivation questionnaire of the experimental group after the test in order to determine which aspects were the most influenced (confidence, enjoyment, reduction of fear of errors).

1.4 Study Methodology.

The research design was a quasi-experimental (two groups that were equal and pre-test/post-test measures) research. The sample was made up of 60 3-year students of the English Department at the University of Tikrit, who were randomly divided into an experimental (n=30) and a control (n=30) group based on the method of learning: ChatGPT or traditional. Two tools were employed:

1. A writing fluency test (two argumentative essays, one during pre-test and one during post-test), where the results were analysed based on three quantitative measures; Words Per Minute (WPM), corrected fluency (total words divided by spelling errors and time) and function word percentage. These indicators have been calculated by two scores, with the inter-rater reliability (ICC) of 0.94 in WPM and 0.91 in corrected fluency.
2. Writing motivation questionnaire (WMQ) which has 18 questions in four dimensions (intrinsic motivation, extrinsic motivation, self-efficacy, and writing anxiety), and Cronbachs alpha of reliability of 0.87.

The intervention was administered after the pre-test, in a period of eight weeks and the post-test was conducted. The analysis of data was performed in SPSS (descriptive statistics, paired t-test, ANCOVA, MANOVA, and effect sizes by Cohen d and partial eta squared).

2. Theoretical Framework

2.1 Vygotsky and Zone of Proximal Development.

Vygotsky (1978) is regarded as the father of sociocultural theory that stresses that learning is based principally on social interaction and cooperation with more knowledgeable individuals. Vygotsky believes that the cultural development is initially manifested at the social level (among people) and then internalised at the individual level. The key idea of this theory is the notion of the so-called Zone of Proximal Development (ZPD) that is considered one of the most important concepts in the context of supported learning. The Zone of Proximal Development refers to the gap between an independent level of performance (what a learner can do independently) and potential level of performance (what a learner can achieve with the support and help of a more competent individual, be it a teacher, a peer, or an educational device) (Vygotsky, 1978). Learning best happens in this zone where scaffolding is available- temporary help that allows the learner to accomplish a task that they are not yet able to. The tools may be considered as virtual peers or digital scaffolds that widen the Zone of Proximal Development of the learner, especially when referring to artificial intelligence tools like ChatGPT. ChatGPT offers instant feedback, tips on how to phrase the text better, grammatical corrections, and academic writing templates, thus enabling the learner to write more complex texts than it would otherwise be able to independently (Furat Almutairi, 2025). The tool is used as though the learner is engaging with an educated peer or a teacher and gradually learns the linguistic and organisational skills that the tool offers and utilises these skills on their own in later writing. This generalization of the idea of the more knowledgeable other to artificial

intelligence is a modern extension of the sociocultural theory, which is why it is a suitable model to consider the development of writing with the help of ChatGPT.

2.2 Cognitive Load

Cognitive load theory is another valuable cognitive concept of how artificial intelligence tools can support the learning process, created by Sweller (2011). The theory presupposes that human working memory is a limited capacity since it is capable of processing a limited amount of information elements at a given time. When a learner is exposed to a complex task that involves a combination of numerous factors that need to be processed at the same time, they can experience cognitive overload that prevents learning and limits its effectiveness (Furat Almutairi, 2025).

The theory identifies three different types of cognitive load (Sweller, 2011):

- Intrinsic load: It is caused by the difficulty and complexity of the educational material itself. This kind of load is not avoidable because it is concerned with the content.
- Extraneous load: This is due to the manner in which the educational content is delivered, or distracting factors or ineffective activities in the learning environment. A good instructional design can help diminish this type.
- Germane load: This is associated with the mental processes that result in deep learning, the development of mental representations and knowledge organisation. This is what we want to load because it helps in the attainment of learning. Academic writing can pose a high intrinsic cognitive load among English as a Foreign Language (EFL) learners as it involves the concomitant regulation of several dimensions. These dimensions are further divided into lower-order concerns, which include grammatical correctness, spelling, proper choice of vocabulary and higher-order concerns, which includes organisation of ideas, development of arguments and attainment of coherence and cohesion in the writing. ChatGPT can assist in alleviating these cognitive difficulties through the elimination of extraneous cognitive load; some lower-order processes, like proposing grammatical corrections or rephrasing weak statements, are automated by ChatGPT, thus leaving the limited cognitive resources of working memory free and allowing the learner to focus their attention and effort on higher-order skills (Furat Almutairi, 2025; Khampusaen

2.3 Technological Pedagogical Content Knowledge (TPACK)

To explain the multifaceted forms of knowledge that teachers require in order to effectively and meaningfully integrate technology into their teaching practices, Mishra and Koehler (2006) have created the TPACK framework. The framework is composed of three primary knowledge types, three contacts between them, and a middle contact which unites them all (Mishra & Koehler, 2006):

1. Technological Knowledge (TK): Have knowledge about the use of technological tools, their capabilities and restrictions and adaptability to new developments in technology.
2. Pedagogical Knowledge (PK): Knowledge about the theories, methods, and strategies of teaching and learning, classroom management, learner assessment and planning of educational activities.
3. Content Knowledge (CK): The knowledge of the topic under instruction, in this case the profound knowledge of English grammar, English academic texts and features of good academic writing.

The core of the TPACK model is the overlaps between these three categories of knowledge, the most significant of which is the core overlap (TPACK), which is the combination of technological, pedagogical and content knowledge. The capability to deliver specific content with specific technology pedagogically soundly to improve learning is the intersection (Furat Almutairi, 2025).

When it comes to teaching writing with the help of ChatGPT, the teacher must not just understand how to use the tool (technological knowledge). They should also be aware of the correct pedagogical techniques of using the tool in the classroom, e.g. when it should be used, how to construct writing activities that incorporate it and how one can evaluate texts written with its help (pedagogical knowledge). They must also have a profound comprehension of the writing skills they would like to acquire (content knowledge). TPACK framework shows that the real success of the artificial intelligence in education does not lie in the tool, but rather in the way it is incorporated into the thought-through, well-considered, and integrated pedagogic environment (Van, 2025).

2.4 Self-Managed Learning and Involvement.

Besides the above frameworks, the concept of self-regulated learning is directly connected with the knowledge of the effects of artificial intelligence tools on the development of writing. According to Zimmerman (2002) self-regulated learning refers to the process where learners engage systematically in the process of activating and maintaining their cognition, motivation, and behaviours in the attainment of their educational objectives. When using AI-assisted writing, learners stop being externally controlled (with the assistance of the teacher or

the tool) and start being self-controlling writers. The AI tool is a facilitator, where it directs the learners on the effective writing strategies and allows them to accomplish tasks without the teacher's assistance.

Moreover, the engagement concept is an important aspect of learning. Engagement can be described as the active involvement of the learner in the learning environment, including behavioural aspects (to exert effort and persistence), cognitive aspects (a deep learning strategies), and feelings (positive attitudes towards learning) (Fredricks, Filsecker, and Lawson, 2016). Engagement assumes a different dimension when it comes to AI-assisted instruction because the tools used are interactive. The writing process, as well as the ability to seek instant feedback and continuously improve skills, can be developed in real time with the assistance of such tools as ChatGPT.

2.5 Feedback in writing teaching.

In language learning, feedback is critical to improving the performance and motivation of writing. The feedback can be described as information given to the learner regarding the aspects of his or her performance, to help close the gap between the actual and desired performance (Bakla, 2020; Liu, Yu, and Liu, 2022; Zhang and Zou, 2023). In conventional methods, the most effective writing teaching has been based on teacher feedback, which provides insight on what can be improved. Likewise, in AI-assisted learning, the instant feedback features of applications like ChatGPT can give learners consistent feedback and recommendations to improve their writing abilities. The following features define AI-assisted feedback: immediacy (immediately after writing), personalisation (optimised to the needs of the individual learner), and consistency (not subject to human factors like fatigue or bias).

2.6 Writing Fluency: Idea and Elements.

Writing fluency is a multidimensional theoretical concept, which describes the capacity of the writer to create written texts with ease, speed and clarity, with little interruption, hesitation or conscious effort in the mechanical process of writing. Writing fluency refers to the capacity to write coherent, structured, and contextually relevant academic texts with minimal cognitive load (Furat Almutairi, 2025, p. 2). The difference between writing fluency and writing proficiency should be made: the latter refers to the general quality of the text in the form of the richness of ideas and depth of analysis, whereas the former is concerned with the procedural component of writing: the fluency of the movement of words (Johnson, 2021; Nation, 2009).

Writing fluency consists of several main components (Khampusaen, 2024; Van, 2025; Furat Almutairi, 2025):

- **Syntactic Variety:** The writer can also apply different sentence structures (similar: simple, complex, compound, etc.) instead of using the same syntactic pattern. Syntactic variety is the reflection of the depth of linguistic knowledge and can help to make the text less monotonous.
- **Lexical Diversity:** The author uses a large variety of words that is suitable to the context of the academic paper and does not repeat the same words in the text. The lexical diversity is connected to the skill of the writer to convey specific subtleties of meaning (Johnson, 2021).
- **Grammatical Accuracy:** Correct application of the rules of the English grammatical structure and the proper use of tense, syntax, prepositions and the structure of the sentence.
- **Coherence and Cohesion:** Coherence is the capacity of the writer to organize the ideas in a coherent and connected flow in a way that the reader can easily follow the ideas. Cohesion is connected to the linguistic tools that unite sentences and paragraphs (e.g., conjunctions (however, therefore, in addition)) and allusion (this, these, it) (Khampusaen, 2024). According to Wolfersberger (2007), writing fluency does not necessarily mean the speed, but the ratio between automaticity and communicative quality. The writer who is fluent will be able to produce text without being continuously interrupted to look up words or work on grammar, thus dedicating more brainpower to high-level issues (Furat Almutairi, 2025). Writing fluency is a highly significant target in the EFL learning context, as it is the key between a basic and a high-level linguistic knowledge (Nation, 2009).

2.7 Language Education and Artificial Intelligence and its Tools.

Artificial intelligence is a system that incorporates intelligent programmes that work alongside humans to execute different tasks (Aldosari, 2020). In learning institutions, AI can make intelligent choices in a manner that human decisions are made (Akerkar, 2014). Researchers in applied linguistics have realised the opportunities offered by AI in both the teaching and learning of languages, with a view to improving the way language is taught and how learners learn languages (Luckin et al., 2016; Zhang and Zou, 2020; Nazari et al., 2021; Sun et al., 2021). Online platforms with AI can be implemented to obtain the required language input and output, helping language learners in their linguistic growth. The use of AI in language education has evolved over the last decades. The first AI systems were small in scale and mostly provided rule-based grammar

correction applications and automatic drill practices. These early applications worked under a predetermined code of rules to use language and were not very interactive (Nagata, 1993). As the natural language processing (NLP) and machine learning technologies evolved, more advanced functions started being implemented into AI based systems. Halfway generation tools like intelligent tutoring systems could adjust to performance of specific learners based on the analysis of errors and providing differentiated feedback (Heift & Schulze, 2007). These systems were a transition to learner-focused training and personalisation based on data. The last few years have seen the rise of a new type of generative AI tools, the most well-known of which is ChatGPT. In contrast to previous tools, ChatGPT is able to produce coherent, contextually relevant text on-the-fly, allowing dynamic and interactive learning experiences. The learners will be able to have a realistic conversation, get a comprehensive explanation and collaboratively write with the AI, faking peer interaction and teacher criticism (Godwin-Jones, 2023). These models provide ample scaffolding opportunities in the context of writing instruction among EFL learners, enabling them to brainstorm, revise their sentence structures, make better lexical choices, and get instant feedback on their coherence and argumentation.

2.8 ChatGPT: Features and Characteristics.

ChatGPT is an OpenAI large language model (LLM) and is a generative AI model that can be effectively applied in different language learning courses to improve writing skills among learners (Barrot, 2023). ChatGPT has the specific feature to comprehend natural language and create human-like text, creating words and grammatically correct constructions to help it create coherent and cohesive texts. This tool perceives human inquiries and answers them in a suitable manner. ChatGPT is conditioned to work with large volumes of textual information and respond to questions and queries in a natural language, produce sensible and context-specific texts, and give recommendations on how to improve sentences, rephrase and correct grammatical and lexical mistakes (Khampusaen, 2024). ChatGPT is an assistive tool that helps in writing instruction by offering instant feedback on the organisation of the text, coherence, and linguistic accuracy; proposing linguistic variants to enhance the style and vocabulary; and aiding brainstorming and idea generation. ChatGPT is a 24/7 personal writing tutor that provides alternative ideas to correct ungrammatical sentences and enhance overall writing skills. Nevertheless, challenges related to the use of ChatGPT exist. A possible obstacle to this issue is the possibility of constantly relying on AI text that may undermine the writing skills of learners. Moreover, generated text can be used without relevant consideration of reviews and editing, and it can result in matters of plagiarism that must be tackled (Khampusaen, 2024). Additionally, the recommendations by ChatGPT might not be contextually accurate or need critical consideration to find out when the AI can be trusted or when changes are necessary. ChatGPT also has the risk of providing false or untrue information (hallucinations), and users should have content verification skills (Furat Almutairi, 2025).

2.9 EFL Academic Writing Problems.

The development of academic writing competence among EFL students is a complex and interrelated issue. These issues are divided into four broad areas: linguistic, cognitive-organisational, affective and cultural (Furat Almutairi, 2025).

2.9.1 Linguistic Challenges

Such challenges include the problems with the very language system, and they are commonly the initial obstacles faced by students. The studies indicate that EFL students have a problem with differentiating between informal and academic language, using collocations correctly, and using terminology that is specific to a particular discipline (Coxhead, 2011). Research has shown that EFL authors are more likely to commit some common mistakes in simple grammar principles like subject-verb agreement, proper article usage and sequence of tenses in complex sentences (Silva, 1993). They also have problems with proper word choice where lexical materials are limited leading to poor articulation and accuracy of their arguments (Coxhead, 2011). Also, EFL students are more likely to shun complex sentences and use simple constructions in the sentence structure and this influences the perceived academic maturity of their writing (Silva, 1993). Such linguistic difficulties hamper fluency since the learner wastes time and mental energy in finding the right word/ wording or right structure instead of getting a clear flow of ideas (Furat Almutairi, 2025).

2.9.2 Organisational and Cognitive Problems.

Academic writing involves highly developed organisational and cognitive skills that transcend the mere linguistic knowledge. The most prominent of these issues include: developing a clear and specific thesis statement stating the key point of the text; structuring paragraphs in a logically consistent way, i.e., having a topic sentence and supporting evidence in every paragraph; building a logical argument, i.e. making claims, and refuting opposing views (Khampusaen, 2024). These are among the areas that EFL learners find challenging

because they are not familiar with the conventions of English academic writing as rhetoric, which can be very different in relation to their native tongues (Kaplan, 1966; Hinkel, 2004). According to Furat Almutairi (2025, p. 2) learners might not be capable of organizing their thoughts logically, as they are not familiar with rhetorical patterns, genre norms, and cultural standards of how to argue.

2.9.3 Affective Challenges

Emotional and psychological aspects are important and influential in learning to write. Writing anxiety is a feeling of stress, fear and anxiety that is related to writing, and it is typical of EFL learners (Horwitz, 2001). This anxiety can be physically manifested (fast heartbeat, sweaty palms) or mentally (distraction, frustration, etc.). This is further aggravated by low self-confidence and fear of negative evaluation. The anxiety about writing is a vicious circle, as the learner avoids writing practice because of anxiety and avoidance, which restricts the chances of improvement, leading to low confidence and further anxiety. Such emotional obstacles may influence motivation and cause avoidance behaviours or over-dependence on ready-made structures.

2.9.4 Cultural and Discourse-Level Problems.

Difficulties go as far as cultural differences in thinking patterns and rhetorical organisation. Literature suggests that there are cultural differences in thinking and discourse patterns (Kaplan, 1966). Western scholarly culture is inclined towards valuing individual voice (clarity of personal opinion, assertiveness), direct argumentation (presenting claims clearly and backed by evidence), and critical thinking (evaluation and analysis of ideas). Other cultures on the contrary might prefer more subtle or indirect methods of making arguments, and might view the open expression of personal opinion as disrespectful or immodest (Ballard and Clanchy, 1997). Such variations may cause the learner to write what he or she thinks is required, and what the Western scholars desire, which has an adverse impact on grading of the texts. Moreover, EFL students usually do not have adequate knowledge of citation formats (e.g., APA or MLA) and the moral aspects of using sources, which puts them at risk of committing inadvertent plagiarism (Furat Almutairi, 2025; Khampusaen, 2024).

2.10 Theoretical Interrelationship between ChatGPT and these Challenges.

Relying on the theoretical frameworks provided (Vygotsky, cognitive load, TPACK, self-regulated learning, and feedback) and the knowledge of the various problems EFL learners experience, it is possible to develop a conceptual relationship between ChatGPT and these problems. This correlation gives the rationale why this tool can be used to improve writing fluency. ChatGPT can be seen as a mediational tool or more knowledgeable virtual peer that broadens the Zone of Proximal Development of the learner, according to Vygotsky. ChatGPT assists the learner in doing writing tasks that are beyond their independent abilities through the provision of the immediate feedback, linguistic models, and improvement suggestions. It is expected that with practice, the learner will eventually internalise these skills and be able to use them on his or her own, resulting in permanent enhancement of fluency. Cognitive load: ChatGPT decreases lower-order extraneous cognitive load through automation of lower-order mechanical processes (including correcting grammatical and spelling errors or suggesting alternative phrasing). This unloading of cognitive load enables the working memory to utilise the limited resources it has to deal with more important matters, like organising thoughts and forming arguments, which are central to writing fluency and quality (Furat Almutairi, 2025). According to TPACK: The success of implementing ChatGPT in the writing lesson will be determined by whether the teacher has the integrative knowledge (TPACK) that allows them to use the tool effectively and in a pedagogically appropriate way. The educator should construct writing tasks that meaningful incorporate the tool, teach students to critically and ethically use it, and evaluate learning results in a manner that demonstrates a responsible use of AI (Van, 2025). Regarding the lens of affective issues: The AI-supported writing experience creates a low-stakes space in which the learners can train writing and get feedback with no fear of negative evaluation or an unfavorable assessment, as there is no immediate negative form of judgment by the teacher or the students. This will help decrease the anxiety of writing and boost self-confidence which will push one to practice more and improve. According to the feedback and self-regulated learning perspective: ChatGPT gives learners instant, individualised and unlimited feedback which enables learners to determine their strengths and weaknesses when writing. Learners become self-regulated writers through collaborative writing with AI in place of external regulation (Zimmerman, 2002). These theoretical connections are the framework that allows to formulate testable hypotheses on what effect ChatGPT has on the fluency in writing by EFL learners. These assumptions will be tested with the help of the methodology presented in the practical part of this work.

3. Research Methodology

3.1 Research Design

The research was based on the quasi-experimental study design with two equal groups (experimental and control) and pre- and post-tests. The proposed design focuses on investigating how the use of ChatGPT can influence the fluency and motivation of writing English as a Foreign Language (EFL) students in the University of Tikrit.

3.2 Participants

This sample was a population of 60 third-year students undertaking courses under the English Language Department, College of Education, Humanities, University of Tikrit, in the first semester of the 20252026 academic year. They were randomly grouped into two experimental (n=30) and control (n=30) groups.

Table (1) shows the demographic features of the respondents of both groups.

Table (1): Demographic Characteristics of the participants.

Variable	Category	Experimental (n=30)	Group Control (n=30)	Group
Gender	Male	10(%٣٣,٣)	12(%٤٠)	
	Female	20(%٦٦,٧)	18(%٦٠)	
Age (years)	Mean ± SD	21.4٠,٨ ±	21.3٠,٩ ±	
English language level	Mean ± SD	67.3٥,٢ ±	68.1٤,٩ ±	

The distribution of the participants by gender, age and their proficiency in English language in terms of their past writing course average is presented in Table (1). These characteristics are similar in the two groups, which implies the preliminary appropriateness of comparisons.

3.3 Research Instruments

3.3.1 Writing Fluency Test (Pre-test and post-test)

Two equal tests were used to measure writing fluency; one during the pre-test and another during the post-test. Online Learning vs. Traditional Learning was the pre-test topic and The Impact of Social Media on Academic Achievement was the post-test one. All participants were requested to compose a short essay on the topic given to them in 15 minutes without any outside assistance.

Three indicators of quantitative fluency were used in the study:

Words Per Minute (WPM): Total words/15.

- Corrected Fluency: (Total words - blatant spelling errors) / 15.
- Function Word Percentage: Number of function words (prepositions, conjunctions, articles) / total words x 100. Two independent raters calculated these indicators in each essay. WPM and corrected fluency had a high reliability (inter-rater agreement coefficient) of 0.94 and 0.91 respectively.

3.3.2 Writing Motivation Questionnaire (WMQ)

Writing Motivation Questionnaire (WMQ) was designed as the primary tool of assessing motivation of students to academic writing. The final questionnaire was comprised of 18 items that were spread out into four major dimensions as illustrated in Table (2). Everything was rated using a five-point Likert scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree.

Table (2): Writing Motivation Questionnaire (WMQ) Items by Dimension.

St. No.	Dimension Name	Item (Statement)
1	Intrinsic Motivation	I really like to write essays in English.
2	Intrinsic Motivation	I write in English since I get a sense of accomplishment and fulfillment when I write.
3	Intrinsic Motivation	When I am writing about something that I am interested in, I feel excited and would like to keep on writing.
4	Intrinsic Motivation	I enjoy it when I write in English and get prompt feedback.
5	Intrinsic Motivation	Writing in English is now a fun thing to do courtesy of the digital assistive technology.
6	Extrinsic Motivation	I work hard in writing since I aspire to achieve good grades.
7	Extrinsic Motivation	I write better when I believe that my writing will be assessed by the teacher.
8	Extrinsic Motivation	I plan to work on my writing so that my peers and professors will appreciate my writing.

9	Extrinsic Motivation	I require good grades in writing to enhance my GPA.
10	Self-efficacy	I believe I can arrange the paragraphs in my essay logically.
11	Self-efficacy	I think I will be able to write a full argumentative essay without any assistance.
12	Self-efficacy	I am able to use the right vocabulary when writing an academic essay.
13	Self-efficacy	I can write without having to pause so much when I get instant feedback.
14	Self-efficacy	I believe I can write a full essay within given time limit.
15	Writing Anxiety (reverse-scored)	When I am told to write an academic essay I become tense and confused.
16	Writing Anxiety (reverse-scored)	I fear that I might commit grammatical errors when writing in audience.
17	Writing Anxiety (reverse-scored)	I get anxious and stressed when I write in English.
18	Writing Anxiety (reverse-scored)	I have fears when I attempt to write without editing

Note: Items (15, 16, 17, 18) pertaining to writing anxiety were reverse-scored, i.e. a large score on this dimension reflects a small level of anxiety. The maximum score of the questionnaire is between 18 and 90 with 90 indicating maximum writing motivation and minimum writing anxiety.

Psychometric Properties of the Questionnaire:

- **Content Validity:** 6 measurement, evaluation and educational psychology experts were shown the questionnaire. The average rate of agreement was 89 and 3 items were removed according to their feedback.
- **Reliability:** Cronbach alpha coefficient was based on pre-test data (n=60). The coefficients were: Intrinsic motivation (0.83), Extrinsic motivation (0.79), Self-efficacy (0.86), Writing anxiety (0.81) and the overall questionnaire (0.87). These values refer to good internal consistency.

3.4 Study Procedures

The research was carried out over 8 weeks (October to December 2025): two sessions a week (90 minutes each).
Control Group: Adhered to standard teaching according to an academic textbook and pre-written essay templates, receiving feedback after 3-5 days.

Experimental Group: The members of this group were trained to use ChatGPT to enhance writing fluency. The intervention entailed the writing of short paragraphs, getting an immediate response by ChatGPT on the idea flow and minimizing pauses, and finally, the handwriting of the paragraph. Mechanisms were put in place, so that the students were not totally dependent on ChatGPT.

Measurements: Writing fluency test and motivation questionnaire were performed as a pre-test (week 1) and post-test (week 8) to both groups.

3.5 Data Analysis

Data analysis was done using SPSS version 29. The analysis involved descriptive statistics (means, standard deviations), paired-samples t-tests to compare the pre-test and post-test scores in each group, analysis of covariance (ANCOVA) to compare the two groups on the post-test scores but controlling by pre-test scores, and multivariate analysis of variance (MANOVA) to compare the four motivation dimensions collectively. Cohen d, and partial eta squared (η^2) were used as effect sizes. The level of significance was determined as 0.05.

4. Results

4.1 The two groups were found to be equivalent in pre-test.

Preliminary comparisons revealed that there were no significant differences between the two groups in the mean pre-test fluency indicators, as well as in pre-test motivation questionnaire scores, which validated the sufficiency of random assignment.

4.2 Writing Fluency Results

Table (3): Means (M) and Standard Deviations (SD) of Fluency Indicators Pre-intervention and Post-

Intervention.

Indicator	Group	Pre-test M (SD)	Post-test M (SD)	Gain	Paired t	p	Cohen's d
WPM (words/min)	Experimental	12.4 (2.8)	16.9 (3.1)	+4.5	6.82	<0.001	1.24
WPM (words/min)	Control	12.6 (2.6)	13.8 (2.9)	+1.2	2.15	0.040	0.39
Corrected Fluency	Experimental	10.1 (2.5)	14.2 (2.6)	+4.1	5.94	<0.001	1.08
Corrected Fluency	Control	10.3 (2.4)	11.1 (2.5)	+0.8	1.42	0.166	0.26
Function Word %	Experimental	34.2 (5.1)	41.7 (4.8)	+7.5	5.21	<0.001	0.95
Function Word %	Control	33.9 (4.9)	35.6 (5.0)	+1.7	1.68	0.104	0.31

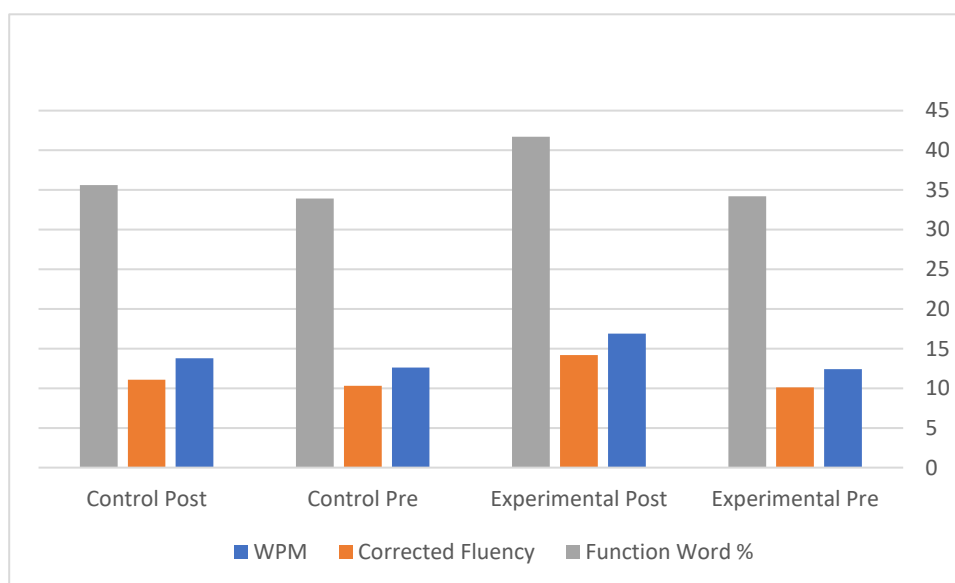


Figure 1 Pre-test vs Post-test Writing Fluency

The results showed that the experimental group improved significantly in all fluency indicators compared to the control group, with effect sizes ranging from medium to large ($d = 0.95$ to 1.24).

ANCOVA for Post-test WPM:

After controlling for pre-test scores, ANCOVA revealed a statistically significant effect of the group on post-test writing speed ($F(1,57) = 25.63, p < 0.001$). The effect size was ($\eta^2 = 0.31$), meaning that 31% of the variance in post-test writing speed can be attributed to the use of ChatGPT.

4.3 Writing Motivation Questionnaire (WMQ) Results

4.3.1 Descriptive Statistics for Motivation Dimensions and Total Score

Table (4): Means (M) and Standard Deviations (SD) for Motivation Dimensions and Total Score (Pre-test and Post-test)

Dimension (Max Score)	Group	Pre-test M (SD)	Post-test M (SD)	Absolute Gain	% Gain
Intrinsic Motivation (25)	Experimental	13.8 (3.2)	17.9 (3.0)	+4.1	29.7%
Intrinsic Motivation (25)	Control	13.5 (3.1)	14.4 (3.3)	+0.9	6.7%
Extrinsic Motivation (20)	Experimental	13.1 (2.5)	15.8 (2.4)	+2.7	20.6%

Extrinsic Motivation (20)	Control	13.3 (2.7)	14.0 (2.6)	+0.7	5.3%
Self-efficacy (25)	Experimental	12.8 (3.4)	18.2 (3.1)	+5.4	42.2%
Self-efficacy (25)	Control	12.5 (3.3)	13.4 (3.2)	+0.9	7.2%
Writing Anxiety (reverse, 20)	Experimental	10.9 (2.9)	15.2 (2.7)	+4.3	39.4%
Writing Anxiety (reverse, 20)	Control	11.0 (3.0)	11.8 (2.9)	+0.8	7.3%
Total Score (90)	Experimental	50.6 (8.4)	67.1 (7.2)	+16.5	32.6%
Total Score (90)	Control	50.3 (8.1)	53.6 (7.9)	+3.3	6.6%

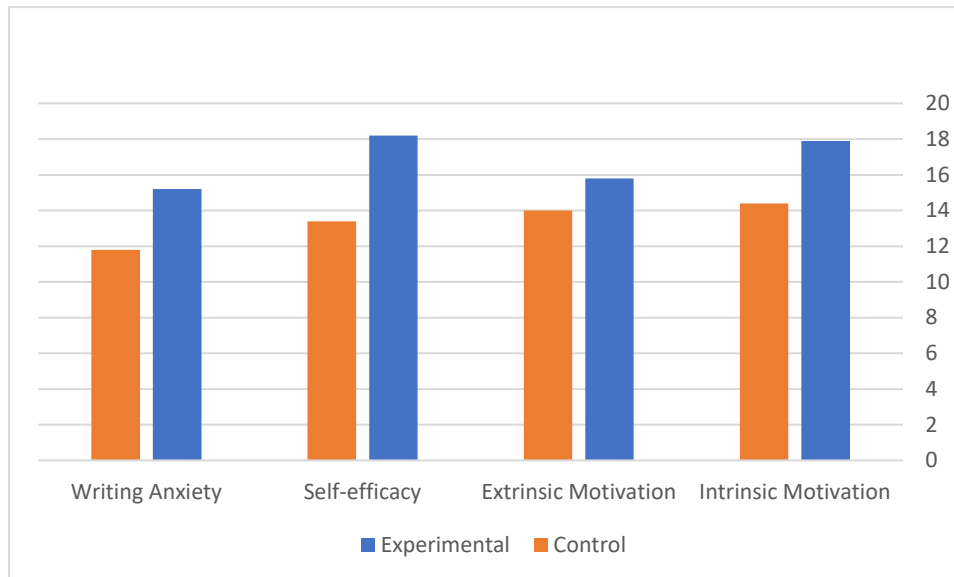


Figure 2: Post-test Comparison of Writing Motivation Dimensions

4.3.2 Paired -Samples t -tests (In Each Group)

The experimental group showed a statistically significant improvement in the total motivation score ($t = 8.94$, $p < 0.001$, $d = 1.63$) and in all four dimensions: intrinsic motivation ($t = 6.21$, $p < 0.001$, $d = 1.13$), extrinsic motivation ($t = 5.47$, $p < 0.001$, $d = 0.99$), self-efficacy ($t = 7.83$, $p < 0.001$, $d = 1.43$), and writing anxiety ($t = 6.58$, $p < 0.001$, $d = 1.20$).

The control group also improved but to a lesser degree and with small effect sizes: total score ($t = 2.81$, $p = 0.009$, $d = 0.51$), intrinsic motivation ($t = 2.23$, $p = 0.034$, $d = 0.41$), while the differences in extrinsic motivation ($t = 1.58$, $p = 0.125$, $d = 0.29$) and writing anxiety ($t = 1.92$, $p = 0.065$, $d = 0.35$) did not reach statistical significance.

4.3.3 ANCOVA of Post-test Total Motivation Score.

ANCOVA was done on the post-test total writing motivation score whereby the pre-test score was used as a covariate. The findings indicated that the group had a significant effect on post-test motivation ($F(1,57) = 11.26$, $p = 0.001$) with a medium effect size (0.16), which implies that 16 percent of the variance of motivation to write post-test can be explained by the use of ChatGPT.

4.3.4 MANOVA of Four Dimensions of Motivation.

A multivariate analysis of variance (MANOVA) was carried out to analyse differences between the two groups in all four motivation dimensions simultaneously. The results indicated a significant effect of the group on the combined dimensions (Wilks' Lambda = 0.67, $F(4,53) = 6.52$, $p < 0.001$, $\eta^2 = 0.33$). Subsequent univariate ANOVAs revealed that the experimental group excelled in each of the separate dimensions as compared to the control group:

Table (5): ANOVA Results of Post-test Motivation Dimensions.

Dimension	F(1,58)	p	η^2
Intrinsic Motivation	14.28	<0.001	0.20
Extrinsic Motivation	6.91	0.011	0.11
Self-efficacy	19.45	<0.001	0.25
Writing Anxiety (reverse)	12.07	0.001	0.17

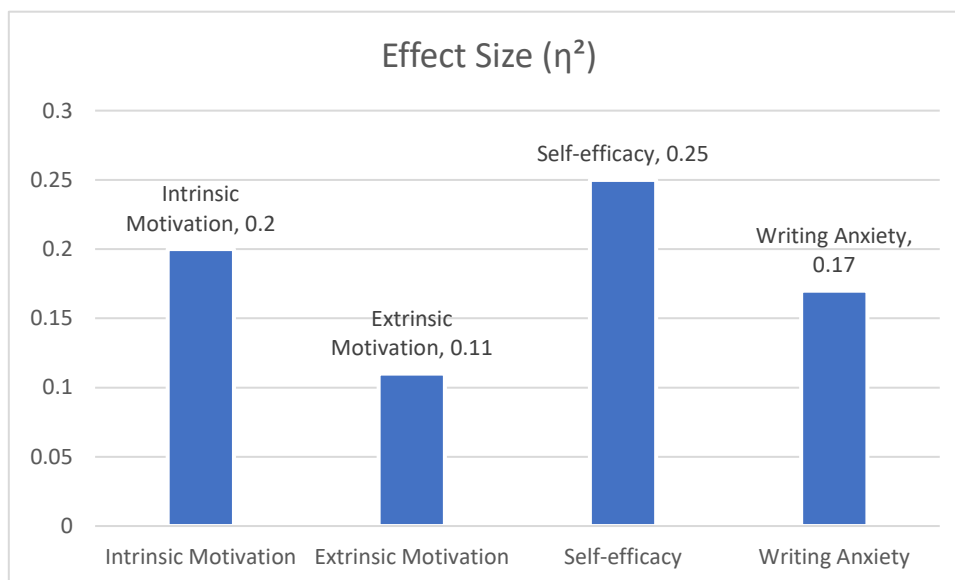


Figure 3: Effect Sizes of Motivation Dimensions Based on ANCOVA/ANOVA Results

The dimension that was most influenced was self-efficacy ($\eta^2 = 0.25$) followed by intrinsic motivation ($\eta^2 = 0.20$), writing anxiety ($\eta^2 = 0.17$), and extrinsic motivation ($\eta^2 = 0.11$).

4.3.5 Item-Level Analysis

Mean scores of the post-test questionnaire items of the experimental group were calculated in order to determine the items that respond to the intervention most. Table (6) displays the first five items with the highest means.

Table (6): Five best Items on the Motivation Questionnaire (Experimental Group Post-test)

Code	Item	Dimension of the item	Mean (out of 5)
WMQ13	I can keep on writing without taking long breaks in case I get instant feedback.	Self-efficacy	4.20
WMQ4	I enjoy writing in English and having immediate feedback.	Intrinsic Motivation	4.13
WMQ14	I feel confident about my skills to write a full essay by a given time frame.	Self-efficacy	4.07
WMQ18	I am afraid to write without revisioning. (reverse)	Writing Anxiety	4.03
WMQ5	Digital assistive tools have made writing in English an enjoyable activity.	Intrinsic Motivation	3.97

4.4 Summary of Results

The key results of the research can be summarised as follows:

1. Writing Fluency: ChatGPT (experimental) outperformed the control group on all indicators of fluency (WPM, corrected fluency, function word percentage). The writing speed (WPM) effect size of the intervention was $\eta^2 = 0.31$, which is a large effect.
2. Writing Motivation: The overall questionnaire score of the experimental group improved by 50.6 to 67.1 (32.6% improvement) whereas the improvement in the control group was not more than 6.6. The impact of the intervention on overall motivation was medium ($\eta^2 = 0.16$).

3. Motivation Dimensions: Self-efficacy was the most improved dimension (42.2% gain, $\eta^2 = 0.25$), followed by writing anxiety (39.4% gain, $\eta^2 = 0.17$), then intrinsic motivation (29.7%, $\eta^2 = 0.20$), and finally extrinsic motivation (20.6%, $\eta^2 = 0.11$). 4. Item-level analysis: The highest means (between 3.97 and 4.20 out of 5) were on the items that were associated with the ability to continue writing without breaks (WMQ13), enjoyment of writing with quick feedback (WMQ4), confidence in writing with a set period of time (WMQ14). This validates the fact that the primary contributor to the improvements was the immediate feedback. Collectively, these findings reveal that ChatGPT application positively, and with a moderate-to-large influence, develops academic writing fluency and contributes to a more positive impact on writing motivation, particularly in the aspects of self-efficacy and writing anxiety reduction, among EFL learners at the University of Tikrit.

5. Conclusions & Recommendations

5.1 Conclusions

According to the results of the current investigation, one can make the following conclusions:

1. ChatGPT is a helpful tool to enhance certain measures of writing fluency in EFL students. The findings proved that the experimental group (using ChatGPT) performed significantly better than the control group in all the three fluency indicators assessed: words per minute (WPM), corrected fluency (words minus spelling errors per minute), and function words percentage. The high effect size (WPM with 0.31) proves that ChatGPT can have a significant role in the development of the speed and basic structural points of academic writing among EFL students at the University of Tikrit.

2. ChatGPT positively influences general writing motivation and writing anxiety, and the greatest impact on self-efficacy. The experimental group reported a significant change in the overall motivation score (50.6 to 67.1 of 90, an increase of 32.6%), whereas the control group did it only slightly (6.6%). Self-efficacy (42.2% gain, $\eta^2 = 0.25$), writing anxiety (39.4% gain, $\eta^2 = 0.17$), intrinsic motivation (29.7%, $\eta^2 = 0.20$) and extrinsic motivation (20.6, $\eta^2 = 0.11$) had the most significant improvement in the four dimensions. These findings suggest that ChatGPT may be beneficial not only in the cognitive domain but also in the affective and psychological ones, which is why it can be a rather holistic tool to support writing instruction.

3. The improvements noticed can be directly connected to the instant feedback offered by ChatGPT. The item-level analysis showed that the best mean scores in the post-test were related to items that explicitly mentioned the features of ChatGPT: I can continue writing without having to pause and wait to receive feedback on my work (WMQ13, mean = 4.20/5), I feel pleasure when writing in English and getting instant feedback (WMQ4, mean = 4.13/5), Writing in English has become an enjoyable experience. This validates the fact that the immediacy of feedback, and not the content of the feedback per se, was the key mechanism that created the observed improvements.

4. This study model can be utilized in the University of Tikrit and can be implemented to other educational institutions in Iraq. The eight-week intervention that incorporated ChatGPT as a real-time feedback option and paired with manual rewriting was possible in the current course framework. This model can be generalised to other English departments in other Iraqi universities with some suitable local adaptations (e.g. class size, technical infrastructure, student proficiency levels, etc.).

5.2 Recommendations

1. To faculty members: Systematic integration of ChatGPT in academic writing teaching, assigning training sessions to students on how to use it efficiently and ethically, and focusing on the need to review outputs instead of blindly accepting them should be encouraged.

2. To department and university administration: Recommendations include to offer training workshops to teachers and students, to build curricula to incorporate activities that use ChatGPT, and to provide the technical infrastructure (computer labs, subscriptions) to support this kind of teaching.

3. To the researchers of the future: It is recommended that longitudinal studies can be conducted to quantify the effect sustainability, qualitative studies to determine the processes of interaction with the tool and comparisons of ChatGPT and other AI tools (Gemini, Claude, Grammarly).

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