Impact of Employing a Technology-Based Grammarly Tool Versus an Artificial Intelligence-Based ChatGPT Application as Corrective Feedback on Iranian EFL Learners' Writing Skills

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Citation

Naderi, N. (2025). Impact of Employing a Technology-Based Grammarly Tool Versus an Artificial Intelligence-Based ChatGPT Application as Corrective Feedback on Iranian EFL Learners' Writing Skills . *International Journal of Language and Translation Research*, *5*(3), pp. 11-30.

Available online

Keywords: ChatGPT, Corrective Feedback, Grammarly®, Noticing, Writing Skill

Abstract

Nowadays, technology-based programs as human-assistant tools are extremely used in English language learning courses. However, recently, the emergence of artificial intelligence as the simulation of the human brain has strongly affected the common technology-based tools in various fields, such as education. This study aims to evaluate the impact of Grammarly® software as a technology-based immediate corrective software versus artificial intelligence as a tool that completely writes with different styles and texts in improving the learners' writing achievements, compared to the traditional teacher-directed approach among the 60 sophomore English students in …. Azad University branch. Before initiating the 15-session treatment, a pre-test including 20 questions comprising four different variables named definite and indefinite articles, punctuation, passive voices, and the correct spelling of the words was run. The participants were randomly and equally divided into three groups: a traditional group receiving face-to-face traditional treatments, the technology-based group that was asked to use the Grammarly® software in writing activities, and the last group that employed the artificial intelligence named ChatGPT as the simulation of the human brain in writing. Similar to the pre-test but with different questions, a post-test was administered to evaluate the impacts of each intervention on the final writing achievements in each group.

تأثیر استفاده از ابزار Grammarly مبتنی بر فناوری در مقایسه با برنامه ChatGPT مبتنی بر هوش مصنوعی به عنوان بازخورد اصلاحی بر مهارت نوشتاری زبان‌آموزان ایرانی

امروزه، برنامه‌های مبتنی بر فناوری به عنوان ابزارهای کمکی انسان در دوره‌های یادگیری زبان انگلیسی بسیار مورد استفاده قرار می‌گیرند. با این حال، اخیراً ظهور هوش مصنوعی به عنوان شبیه‌سازی مغز انسان، ابزارهای رایج مبتنی بر فناوری را در زمینه‌های مختلف مانند آموزش به شدت تحت تأثیر قرار داده است. این مطالعه با هدف ارزیابی تأثیر نرم‌افزار Grammarly® به عنوان یک نرم‌افزار اصلاحی فوری مبتنی بر فناوری در مقایسه با هوش مصنوعی به عنوان ابزاری که کاملاً با سبک‌ها و متون مختلف می‌نویسد، در بهبود دستاوردهای نوشتاری زبان‌آموزان، در مقایسه با رویکرد سنتی معلم‌محور، در بین ۶۰ دانشجوی سال دوم رشته زبان انگلیسی در .... واحد دانشگاه آزاد انجام شد. قبل از شروع دوره ۱۵ جلسه‌ای، یک پیش‌آزمون شامل ۲۰ سؤال شامل چهار متغیر مختلف به نام‌های حروف تعریف معلوم و مجهول، علائم نگارشی، افعال مجهول و املای صحیح کلمات اجرا شد. شرکت‌کنندگان به طور تصادفی و مساوی به سه گروه تقسیم شدند: یک گروه سنتی که درمان‌های سنتی حضوری دریافت می‌کردند، گروه مبتنی بر فناوری که از آنها خواسته شد از نرم‌افزار Grammarly® در فعالیت‌های نوشتاری استفاده کنند، و گروه آخر که از هوش مصنوعی به نام ChatGPT به عنوان شبیه‌سازی مغز انسان در نوشتار استفاده کردند. مشابه پیش‌آزمون اما با سوالات متفاوت، پس‌آزمونی برای ارزیابی تأثیرات هر مداخله بر دستاوردهای نهایی نوشتاری در هر گروه انجام شد. نتایج نشان داد که...

کلمات کلیدی: ChatGPT ، بازخورد اصلاحی، Grammarly®، توجه، مهارت نوشتاری

Introduction

With English becoming the dominant language of international business and communication, the attitudes and tendencies toward learning English among many students have increased in recent decades, resulting in the fast growth of various methods and strategies in learning and teaching in different pedagogical environments (Grabe & Stoller, 2002). As Easton (2010) describes, improving four basic skills of language learning (speaking, listening, writing, and reading) has a close relationship with learning the grammatical structure and syntactic features. Introducing the necessities for language learning in the modern age, Easton (2010) noted that "the focus of language education is on grammar, memorization, and learning to connect people around the globe in the 21st century" (p. 16). Similarly, the tools and strategies utilized in learning and teaching grammar should be adopted along with the growth of technology. Hazarika (2017) emphasized that the rapid extension of computer-based packages, such as various software, applications, and different internet-based online systems within the English language learning field seems to create greater satisfaction and autonomy among learners.

As Kranthi (2017) defines, Technology-enhanced language learning (hereafter TELL) is the study of applications of technology in language teaching and learning to help and improve the teaching methods among English teachers. As Rao (2017) clarified, writing is an integral part of any language and may just be one of the most valuable skills humans have ever developed because it can be used from simple daily notes to translating and learning another language. According to Easton (2010), writing is one of the most difficult language-learning skills for many ESL/EFL learners because of the complicated structures related to word spelling, pronunciation, vocabulary, and grammatical structure; therefore, the usage of computer-based writing-aided software has been growing swiftly over the past two decades and as specific writing-aided interventions, they will gradually replace the correction role of teachers in the classroom to improve students writing achievements inside and outside of EFL learning environments. Indeed, the issue of Corrective Feedback (hereafter CF) timing in different skills, such as writing, has received much attention thanks to the rapid extension of computerized tools in pedagogical environments (Belali & Sadeghi, 2019). Indeed, Artificial Intelligence (hereafter AI) has experienced rapid growth and has transformed many areas of society. AI has positioned itself at the forefront of research fields ranging from medicine and robotics to education and autonomous driving. Broadly speaking, artificial intelligence refers to the ability of a computer system to mimic the behavior of the human brain. This involves receiving information in the form of external data, learning through training, and based on that learning, achieving the goals for which it was designed (Brazdil & Jorge, 2021).

The implementation of artificial intelligence in education has had a significant impact, evidenced by improvements in the efficiency of the educational process, the promotion of global learning, the personalization of learning, the creation of more intelligent content, and the optimization of educational management in terms of effectiveness and efficiency (Jara & Ochoa, 2020). Nowadays, new technologies play a fundamental role in optimizing the teaching–learning

process. Education is not limited to being a mere product but is a process in which learning goes beyond the simple acquisition of knowledge. In this sense, AI emerges as a new technology with great potential in the field of education, as AI-based systems could foster personalized learning, adapting to the needs and interests of each student (Sun et al., 2021).

Generally speaking, the reason to use different technology-based pedagogical tools or AI in writing skills is derived from various problems in traditional teaching and learning methods; traditional teacher-oriented methods have faced many challenges in the case of CF timing and increasing learners' noticing and attention (Ünlü, 2015). Although many teachers may be aware of the importance of different writing software with immediate CF in Iranian EFL learning environments, a few of them are interested in utilizing different technology-based interventions because few language teaching institutions and even universities have prepared the required infrastructures for administering CF software (Sahragard & Sadri, 2009). The problem, which is related to the learner's underachievement in grammatical and writing skills, is twofold in the current study. The first general problem, according to Sahragard and Sadri (2009), is that "students cannot reach the proper level to use the acquired knowledge, and the second problem is that new writing-based software interventions are rarely used in learning methods as a solution to receive better feedback" (p. 18).

The main problem that has been observed by the researcher within the traditional teaching models of writing is that they mostly emphasize teacher-based CF. Indeed, some teachers are still frightened of losing authority within the classes and have an indecisive view of utilizing technology-based pedagogical tools in their classrooms (Ahmadi, 2018). Also, the time the teacher could assign to correct every student is not enough, and as observed by the researcher, many of the students' mistakes and writing problems remain uncorrected because of the lack of time and the number of students in each class. The other problem is related to the students' noticing and attention, and as Schmidt (2010) emphasizes, the amount of learners' attention and noticing plays a key role in learning different language skills. During years of teaching in different English institutions, the researcher has observed that the existing teacher-oriented methods in teaching and learning grammar and writing skills rarely improve learners' amount of noticing and attention, resulting in continuous problems in utilizing different grammatical features such as wrong punctuation, wrong passive voice making, wrong spelling, and wrong use of definite and indefinite articles among English learners. Consequently, lack of noticing and attention, insufficient immediate CF, and the teachers' unfamiliarity with the advantages of employing technology-based instruments in teaching and learning writing skills were the main observed problems that encouraged the researcher to conduct the current study. As Rao (2019) argues, traditional methods are gradually being replaced with new technology-based tools and the recent emergence of AI that can assist both teachers and students in improving their writing skills.

Academic writing holds a pivotal role in the language development of English language learners, necessitating proficiency in diverse areas such as writing organization, coherence, grammar, and vocabulary (Campbell, 2019). Proficient writing skills empower learners to effectively communicate their ideas, articulate thoughts clearly, and achieve academic excellence

across various professional domains (Yoon, 2011). However, the process of monitoring and providing insightful feedback on student writing poses challenges in terms of time, effort, and subjectivity (Yu & Lee, 2014; Lim & Phua, 2019). Moreover, English language learners often face motivation constraints due to time limitations, which hinder their ability to allocate sufficient time and effort toward improving their writing abilities (Lee, 2017).

The integration of technology in English language classrooms is widely recognized as a means to overcome certain obstacles in language learning processes (Roll & Wylie, 2016; Knox, 2020), particularly in writing tasks where time constraints often arise (Stapleton & Radia, 2010; Kessler, 2020; Rahimi & Fathi, 2022; Wang, 2022). With the present availability of technology and online platforms, learners now have the convenience of practicing their language skills, specifically writing, at any time and from anywhere (Yan, 2023). This includes the use of advanced artificial intelligence (AI)-based computer and mobile programs, which offer interactive and personalized tools for honing writing abilities as well as enhanced motivation (Jiang, 2022; Meunier et al., 2022; Yan, 2023).

Significantly, technology-based interventions can facilitate the process of correction and feedback with high accuracy and fewer mistakes, improve the learners' noticing and attention, and most importantly, long-lasting correction of various types of errors in writing, compared to teacher-directed intervention, where teachers may have less accuracy, a lower amount of noticing, and a lack of time. Moreover, the association of Artificial Intelligence (AI) and education has attracted researchers' attention, as it is very beneficial for learners, affecting the whole teaching procedure. The emergence of AI-powered writing tools, accessible on mobile devices, provides a novel avenue to address the challenges associated with developing writing proficiency through traditional training methods (Zawacki-Richter et al., 2019; Jia et al., 2022; Kohnke, 2023). These AI-assisted writing tools offer automated feedback on various aspects of writing, including organization, coherence, grammar, and vocabulary, thereby facilitating more effective writing performance improvements. Additionally, learners can expedite their writing development as AI tools help them identify and rectify grammatical and lexical errors, while also suggesting alternative sentence structures to enhance the overall writing quality and structure (Zhao, 2022; Chen, 2023; Salvagno et al., 2023). AI, exemplified by ChatGPT, holds the promise of fabricating an environment mirroring these collaborative interactions by providing real-time feedback, suggestions, and support akin to peer assistance.

Therefore, the researcher attempted to evaluate the empirical use and the impact of Grammarly® and ChatGPT on writing skill improvement among EFL learners. Grammarly® is one of the newest online software with different CFs, specifically designed to assist English learners in improving their writing capabilities. As Ghufron and Rosyida (2018) describe, Grammarly® was designed with the ability to immediately correct English learners' writing errors to improve students' writing skills through immediate CF and noticing. Similarly, in AI-assisted learning, ChatGPT's real-time feedback mechanisms provide learners with continuous guidance

and suggestions for enhancing their writing skills. Recognizing the interplay between feedback and collaborative learning is crucial in assessing the effectiveness of AI-assisted language learning.

The impact of Grammarly® on improving writing skills has been evaluated in different studies (Parra & Calero, 2019; Ghufron & Rosyida, 2018; Qassemzadeh & Soleimani, 2015); however, they have only limited their studies to one or two grammar-checking features and no study has attempted to compare Grammarly with ChatGPT as a new emergent AI in improving EFL writing skills. Thus, the significance of the current study that makes it innovative compared to the previous studies is that the researcher attempted to evaluate four different writing skills, including correcting word spelling, the correct usage of definite and indefinite articles, passive and active voice correction, and punctuation correction, on EFL students. Unlike previously mentioned studies that only considered self-correction in utilizing Grammarly®, this research significantly attempted to observe the possible improvement in learners' noticing and attention versus AI-based ChatGPT. Therefore, employing technology-based software such as Grammarly® and AI-based ChatGPT can assist teachers and learners in dealing with challenges in improving writing skill achievement and may propose practical solutions to the existing problems in this area. To this end, the researcher aimed to employ Grammarly® and ChatGPT to analyze the impact of the immediate CF on improving the students' final writing skill achievement. As the ultimate goal of the study, the researcher specifically aimed to evaluate the learner's final writing achievements in employing the correct use of definite and indefinite articles, passive voices, punctuation, and correct spelling of the words based on the noticing hypothesis.

To achieve the goals, this study attempted to answer the following questions::

RQ1. Is there any significant difference between the traditional and technology-based Grammarly groups in responding to all four variables in the pre-test and post-test?

RQ2. Is there any significant difference between the traditional and AI-based ChatGPT groups in responding to all four variables in the pre-test and post-test?

RQ3. Is there any significant difference between the technology-based Grammarly and ChatGPT groups in responding to all four variables in the pre-test and post-test?

RQ4. To what extent does employing Grammarly® and ChatGPT as immediate corrective feedback tools differentially influence Iranian EFL learners' *noticing* and *attention* toward grammatical and lexical errors during writing tasks?

RQ5. What are the Iranian EFL learners' *perceptions and attitudes* toward the use of Grammarly® versus ChatGPT as feedback-providing tools in improving their writing accuracy, autonomy, and engagement compared to traditional teacher-directed correction?

Literature Review

Technology-Enhanced Language Learning (TELL)

Technology is an effective tool and a significant part of the learning process for learners. Technology can support the curriculum so that learners can improve their learning achievement and different language skills (Costley, 2014). All basic language learning skills like listening, speaking, reading, and writing, along with other grammatical, sociolinguistic, discourse, and

strategic aspects of language, can be affected by technology (Chapelle, Cotos, & Lee, 2015). Technology-Enhanced Language Learning (hereafter TELL) evaluates the utilization of technology in different aspects of language learning and teaching. According to Patel (2014), it refers to "the use of the computer as a technological innovation to display multimedia as a means of complementing a teaching method" (p. 1). The ultimate aim of employing technology in language learning environments is to improve learning achievement through facilitating the methods and tools. Different studies (Chirimbu & Tafazoli, 2013; Ghanizadeh & Razavi, 2015; Gilakjani & Sabouri, 2017) attempted to evaluate the impact of utilizing technology on different aspects of language learning, such as reading, speaking, listening, writing, etc.

To evaluate the role of TELL on language learning achievement, Enayati and Gilakjani (2020) aimed to analyze the impact of technology on improving vocabulary learning skills among 60 Iranian intermediate learners, dividing them equally into the control group with no treatment and the experimental group receiving TEM software as the pedagogical treatment. An independent sample *t*-test was run to analyze the data in the pre-test and post-test. The results of the post-test in Enayati and Gilakjani (2017) showed that the participants of the experimental group performed better than the control group. Thus, it can be concluded that the true combination of multimedia and teaching methodology is very important to attract learners' attention towards English language learning.

Grammarly® Software

Grammarly®, initially released in 2009, is a grammar-checking tool in a software package or online versions to be installed on the Microsoft Office Word platform to correct grammatical mistakes during typing. It is productivity software that enhances the quality of writing significantly through machine learning and deep learning algorithms. Grammarly® can be installed in the *Microsoft Word Office* package and opens as a sidebar home window, as well as shows errors in a contextual location within the file. Grammarly® offers grammar checking, spell checking, passive voice misuse, punctuations in compounds, correcting hard-to-read texts, wordy sentences, and plagiarism detection services along with suggestions about writing clarity, concision, vocabulary, delivery style, and tone. In operation, Grammarly® underscores crucial writing errors in red (punctuation and standard grammar), and advanced errors in yellow (style and best practices), although the latter ability is restricted to premium users. Additionally, it can discover the error matter that Grammarly® adds at the end of every record to be an efficient way of showing just how much editing and enhancing work the user has left.

Different researchers (Parra & Calero, 2019; Ghufron & Rosyida, 2018; Qassemzadeh & Soleimani, 2015) conducted research around the world to evaluate the impact of technology on different language skills improvement, such as writing ability. Salehi and Amiri (2019), for example, aimed to investigate the effects of using Microsoft Office Word on Iranian English as a Foreign Language (EFL) lecturers' grammar knowledge and their tendency towards utilizing

technology to improve their grammar knowledge. The results revealed that employing Microsoft Word was useful in improving the grammar skills among participants of the experiment. Indeed, Aminpanah et al. (2016) conducted a study to investigate the application of Computer-Assisted Language Learning (CALL) on the grammar of writing in fifty EFL learners. A pre-test and post-test were run in the form of paragraph writing, and an adopted editing checklist was used to collect data. The results of the study showed that the students' grammar of writing scores in the experimental group were significantly improved in the post-test, suggesting that the implication of CALL in teaching and learning grammar of writing should receive much more consideration to improve the learners' writing skills.

Artificial Intelligence (AI)

The emergence of big data, cloud computing, artificial neural networks, and machine learning has enabled engineers to create a machine that can simulate human intelligence. Building on these technologies, this study refers to machines that can perceive, recognize, learn, react, and solve problems as artificial intelligence (AI) (Kumar & Thakur, 2012). Inevitably, such smart technologies will revolutionize the workplaces of the future (Horakova et al., 2017). Thus, while AI can interact and help humans perform at higher levels, it is emerging as the next disruptive innovation [4]. AI is currently viewed by many as a driver that is integral to the fourth industrial revolution, and it may trigger the fourth revolution in education. Learning about AI has also begun to be part of the school curriculum (Knox, 2020). AI has been increasingly propagated as having strategic value for education (Sharma et al., 2019). Loeckx [8] suggested that AI could be an effective learning tool that lessens the burdens of both teachers and students and offers effective learning experiences for students. Coupled with current education reforms such as the digitalization of educational resources, gamification, and personalized learning experiences, there are many opportunities for the development of AI applications in education.

AI can be defined as a system incorporating intelligent programs that collaborate with humans to perform various tasks (Aldosari, 2020). In educational settings, AI can make intelligent decisions akin to human decision-making (Akerkar, 2014). Applied linguistics researchers have recognized the potential of AI in language learning and teaching contexts, aiming to enhance teaching methodologies for language instructors and facilitate language learners' language acquisition (Luckin et al., 2016; Zhang & Zou, 2020; Nazari et al., 2021; Sun et al., 2021; Xia et al., 2022).

Within education, it is critical to recognize that the implementation of AI raises significant challenges and ethical considerations. Issues such as data privacy, equity of access to education, and the impact on the role of the educator require careful attention. It is essential to address these aspects responsibly to ensure that AI is used beneficially and equitably for all learners [4]. In this regard, it is important to find a balance between technology and the essential role of educators to ensure that the focus remains on the holistic development of students and their preparation for an ever-changing world. AI-assisted online platforms can be employed to generate the necessary language input and output, aiding language learners in their language development. These AI tools,

accessible on computers and mobile devices, particularly support the enhancement of writing skills. One noteworthy AI-powered tool is ChatGPT.

ChatGPT

ChatGPT, an AI-assisted Chatbot created by OpenAI (Barrot, 2023). ChatGPT can be effectively utilized in diverse language learning courses to enhance learners' writing abilities (Barrot, 2023). Equipped with comprehensive knowledge, ChatGPT generates words and grammatically correct structures to facilitate the creation of coherent and cohesive written text. This tool comprehends human queries and provides appropriate responses. Moreover, ChatGPT assists language learners in addressing writing challenges related to organization, coherence, grammar, and vocabulary. It offers alternative suggestions to rectify ungrammatical sentences and improve overall writing proficiency.

ChatGPT has been recognized for its potential to enhance writing performance (Huang & Tan, 2023). The AI-powered tool facilitates the production of coherent and cohesive text by providing learners with immediate feedback and alternative grammatically correct sentences (Huang & Tan, 2023). However, it is important to consider certain limitations when using ChatGPT for different writing tasks. Frequent reliance on generated text from ChatGPT may hinder language learners' writing abilities. Additionally, using the generated text without appropriate review and editing may lead to issues of plagiarism that should be carefully addressed (Huang & Tan, 2023).

Corrective Feedback

In the field of language learning, the term 'Corrective Feedback' (CF) has been used in various language classrooms (Schachter, 1991). Nassaji and Kartchava (2017) defined CF "as a response to the learner's erroneous output to improve the accuracy of the targeted form" (p. 14). Traditionally, feedback has been used as a pedagogical instrument to correct writing, speaking, listening, and other skills among English language learners. As Long (1996) mentioned, EFL teachers extensively have used CF essential tools in different forms, such as exam papers, exercise books, oral tests, or even through the lessons to provide useful comments on students' answers. In written CF, Ellis (2009) described that the correction is always delayed to allow teachers to collect written work and respond.

The teachers, however, in oral CF may choose to respond immediately to correct the learner or follow the delayed feedback rules. Nowadays, the emergence of new technology-based pedagogical tools has changed the shape of CF.

Belali and Sadeghi (2019) believe that the issue of feedback timing has received much attention thanks to the rapid extension of computers as a modern tool in pedagogical environments ranging from implicit to explicit responses. The recent development in utilizing different computer-mediated tools resulted in reducing the time of CF and facilitated the learning of the

English language, assisting the learners to improve their skills quickly. The effectiveness of computer-based CF in language learning has been the subject of different studies (AbuSeileek, 2013; Sauro, 2009; Dekhinet, 2008; Sachs & Suh, 2007). Seiffedin and El-Sakka (2017) conducted a study to evaluate the impact of direct and indirect CF on EFL learners' writing skills via a pre-post quasi-experimental design. To this end, 48 Eqyptian English learners were randomly divided into the control and experimental groups; the experimental group received direct-indirect teacher CF on writing class activities through e-mail whereas no CF was designed for the control group. Running a paired sample t-test, the mean scores between both groups in the pre-test and post-test were calculated. The results revealed that writing skill improvement in the experimental group was significantly higher than in the control group.

Noticing Hypothesis

Attention and noticing play a significant role in language uptake and learning. According to Schmidt (2001), the term *Noticing* refers to "focal awareness, and at this level, one can pay attention to a certain stimulus as a private experience and report it verbally" (p. 82). Schmidt (1994) argued that attention and noticing along with awareness and consciousness are the key elements in practical language learning. Understanding the significant role of noticing in learning can guide the students to learn the language with much more attention, paying more attention to the details and different possible ways to acquire the necessary information. As Ünlü (2015) stated, most grammatical and linguistic features go unnoticed by learners, and learners never even pay the slightest attention to them; therefore, technology can be assumed as a great help to increase the students' couscous and unconscious noticing and attention.

According to Arifah (2014), technology can increase learners' noticing through different tools like the internet, multimedia, software, etc. Students can learn meaningfully when technology is used in the process of learning through using computers and the internet. Navidinia. Mobaraki and Malekzadeh (2019) attempted to evaluate the impact of noticing EFL learners' speaking accuracy. To this end, 32 Iranian EFL students were randomly divided into the control and experimental conversation classes. Through a pre-post-test study design, the experimental learners were asked to record their authentic conversations as a tool to increase the students' noticing, compared to the control group with no recording. The experimental group also was asked to transcribe their voices to find their grammatical, phonological, and lexico-semantic mistakes. The results revealed that the frequency of speaking errors among participants in the experimental group was significantly lower than in the control group, showing the effectiveness of noticing and attention in language learning improvement.

Method

Participants and Setting

To conduct this study, 125 sophomore EFL students, including 60 males and 190 females, ranging from 20 to 26 years old, in …. Azad University Branch (2023-2024 Academic Year) were selected to start the sampling process. To ascertain the homogeneity of participants in terms of their general

English language proficiency, the Oxford Online Placement Test was administered. The participants whose results were between one standard deviation above and below the mean were selected as the main population of the study. Consequently, 60 sophomore students, 10 males, and 30 females, ranging from 20 to 26 (M=23), were chosen as the final participants of the current research.

Then, the participants were randomly divided into three different groups: a traditional group receiving face-to-face traditional treatments, the technology-based group that was asked to use the Grammarly® software in writing activities, and the last group that employed the artificial intelligence named ChatGPT as a simulation of the human brain in writing.

Materials and Instruments

Different instruments were employed to collect statistical data for the current study:

Achievement Tests

To have a standard criterion to evaluate the students' achievements after training, a pre-test was designed by the researcher, including 20 questions to statistically evaluate the students' prior knowledge on different variables. A pool of 20 multiple-choice test items was distributed among all participants, including five items for definite and indefinite articles, five items for the correct form of passive voices, five items for the correct use of punctuation, and five items for the correct spelling of the words (Appendix 1). The meaningful statistical results obtained from different statistical analyses were calculated to observe the significant difference between the English sophomore students in the three groups. The same test with different questions was designed and employed as a post-test (Appendix 2).

The scores were rated from zero to twenty with no negative answer penalty. The scale adopted for this study included the appropriate use of definite and indefinite articles, passive voice, punctuation, and correct spelling. The rating for each test was based on a 20-point scale, allocating 5 points to each variable. Thus, the participants' answer to each item was rated from 1 to 5. Twenty multiple-choice questions rated from 1 to 20 points, five scales for each variable, were designed in three different versions for all achievement tests. The inter-rater reliability was used in the current study; two raters analyzed the erroneous patterns, and the obtained mean scores were compared to reach homogeneity in tests. The level of consistency across two raters in the scores given to participants was the measure of inter-rater reliability of the instrument. A group of professional English teachers validated all the questions to make sure they were sufficiently compatible with the aims of the study.

Oxford Online Placement Test

Before running the study with the final selected participants, the Oxford Online Placement Test (OOPT), including 50 multiple-choice questions, was performed to extract and homogenize the final 40 participants among 125 initial sophomore students.

Procedure

The current study was designed to evaluate the impact of a computer-based intervention named Grammarly® versus AI-based ChatGPT on writing skill improvement among Iranian EFL students, compared with the traditional learning approaches in the control group. Initially, the researcher aimed to select the final participants from a total number of 125 sophomore learners who were studying Teaching English as a Foreign Language, English Translation Theories, and English Literature at …. Azad University Branch. To this end, an Oxford Online Placement Test was conducted to select the final participants of the study. Consequently, 60 sophomore students ranked in the intermediate level were extracted. The researcher distributed the moral research protocols between the final participants to confirm their volunteer participation in the research process. However, the questions, the hypothesis, and the analysis of the research were kept hidden from the participants. After that, the researcher attempted to employ random sampling to divide the sophomore students into traditional (N=20), Grammarly® software (N=20), and AI-based ChatGPT (N=20) groups.

One week before initiating the English writing classes, a pre-test was conducted among all participants to collect the students' final scores before exposing different interventions. The students' prior knowledge of writing skills was examined through a pre-test (Appendix 1) as the standard criteria to be compared with the final results. The test included twenty multiple-choice questions to be answered in thirty minutes. The validity and reliability of the pre-test and post-test were considered.

After running the pre-test, the English classes were initiated. The traditional group received writing intervention through teacher-centered approaches, where the learners had to check their class activity with the teacher to get the correction feedback. Meanwhile, the Grammarly group employed the Grammarly® software intervention as the immediate CF in writing skill achievements. Also, the AI-based group was asked to employ ChatGPT in writing activities. All groups were designed to learn four basic writing skills, including definite and indefinite articles, passive voice, punctuation, and correct spelling. The independent variable was the writing skill learning method, either teacher-directed or Grammarly®-based software. The teacher prepared the pedagogical content related to the aforementioned variables to teach the students for half an hour. The last 30 minutes of each session were allocated to a writing activity where teachers used the same topics for all students. The teacher in the traditional group attempted to prepare as much CF as possible, though it was not possible to correct all students because of time limitations. On the contrary, the teacher in the Grammarly and ChatGPT groups, as an observer in writing activities, asked the students to type in Microsoft Office software and the ChatGPT application to observe their immediate CF. After the end of all fifteen sessions, a similar test, named a post-test with different questions, was conducted. By running the post-test (Appendix 2), the researcher attempted to observe which methods had resulted in much more significant writing skill achievements in four different variables among the participants. The scores obtained from the post-test were also collected.

The different statistical results were analyzed carefully to conclude the significant effects of each intervention on the post-test between the traditional, Grammarly, and ChatGPT groups. The data collected in the pre-test and post-test were inserted into SPSS statistical software to analyze the students' performance after treatment.

Results

After collecting and summarizing the data, the Independent-Samples t-Test technique was used to answer all the questions of the study.

Research Question One

Research question (1) attempted to analyze the significant differences between the control and experimental groups in responding to definite and indefinite article questions in the pre-test and post-test. Employing an independent samples t-test, the results obtained from a comparison between the control and experimental groups in pre-test and post-test were presented in Table 1.

Table 1

Independent Samples t-Test for Definite and Indefinite Articles in Pre-test and Post-test

Year	**Group**	**Control (n1=20)**		**Experimental (n2=20)**				
	Statistics Time	Mean	Std. Deviation	Mean	Std. Deviation	t	df	**Sig**
Sophomores	Pre-test	2	0.97	1.95	0.69	-.19	38	**.9**
	Post-test	**3.1**	**0.79**	**4.4**	**0.60**	**-5.88**	**38**	**.000**

In the pre-test, the mean score and standard deviation of the definite and indefinite articles grammatical skill in the control group were computed through an independent samples t-test as M=2, SD=.97, compared to M=1.95, SD=.69; t (38)= -0.19 in the experimental group. No significant difference ($p > .05$) was observed between the control and experimental groups in the pre-test. In the post-test, however, there was a significant difference between the means scores in the control group (M=3.1, SD=.79) and experimental group (M=4.4, SD=.60; t (38) = -5.88, $p < .05$). Consequently, utilizing Grammarly® as a pedagogical definite and indefinite article intervention significantly improved the learners' achievement in writing skills compared to participants in the control group.

Research Question Two

Analyzing the significant differences between the control and experimental groups in responding to the passive voice questions in the pre-test and post-test were considered in the second question of the study. The independent samples t-test analysis of the results between the pre-test and post-test scores was shown in table 2.

Table 2

Independent Samples t-Test for Passive Voice in Pre-test and Post-test

Year	Group	Control (n1=20)		Experimental (n2=20)				
	Statistics Time	Mean	Std. Deviation	Mean	Std. Deviation	t	df	Sig
Sophomore	pre-test	2	0.92	2.15	0.99	-.50	38	.6
	post-test	3.45	0.76	4.45	0.60	-4.61	38	.000

In the pre-test, the passive voice skill scores in the control group (M=2, SD=.92) were not significantly different from the results in the experimental group (M=2.15, SD=.99; t (38) = -0.50, p > .05). On the contrary, there was a significant difference between the means scores in the control group (M=3.1, SD=.79) and the experimental group (M=4.4, SD=.60; t (38) = -4.61, p < .05) in the post-test. Thus, the independent samples t-test showed that the use of Grammarly® in correcting the passive voice errors resulted in a significant improvement in writing learning achievement in the experimental group.

Research Question Three

The third question attempted to analyze the significant differences between the control and experimental groups in responding to the punctuation questions in the pre-test and post-test. The results obtained from a comparison between pre-test and post-test through conducting an independent samples t-test were presented in Table 3.

Table 3

Independent Samples t-Test for Punctuation in Pre-test and Post-test

Year	Group	Control (n1=20)		Experimental (n2=20)				
	Statistics Time	Mean	Std. Deviation	Mean	Std. Deviation	t	df	Sig
Sophomore	pre-test	1.85	0.93	1.95	0.94	-.34	38	.7
	post-test	3	0.86	4.15	0.75	-4.52	38	.000

In the pre-test, the mean score and standard deviation of the punctuation grammatical skill in the control group were calculated through an independent samples t-test as M=1.85, SD=.93, compared to M=1.95, SD=.93; t (38)= -0.34 in the experimental group. As Table 4 showed, no significant difference (p > .05) was observed between the two groups in the pre-test. In the post-test, however, there was a significant difference between the mean scores in the control group (M=3, SD=.86) and experimental group (M=4.15, SD=.75; t (38) = -4.52, p < .05). Therefore,

utilizing Grammarly® as a pedagogical punctuation intervention significantly improved the learners' achievement compared to the participants in the control group.

Research Question Four

Analyzing the significant differences between the control and experimental groups in responding to the correct spelling questions in the pre-test and post-test was considered in the fourth question of the study. Employing the independent samples T-test analysis, the results between the pre-test and post-test scores were shown in Table 4.

Table 4

Independent Samples t-Test for Correct Spelling in Pre-test and Post-test

Year	**Group**	**Control (n1=20)**		**Experimental (n2=20)**				
	Statistics Time	Mean	Std. Deviation	Mean	Std. Deviatio	t	df	Sig
Sophomore	pre-test	1.6	0.50	1.7	0.73	-.50	38	.6
	post-test	2.9	0.64	4.1	0.72	-5.58	38	.000

In the pre-test, the correct spelling scores in the control group (M=1.6, SD=.50) were not significantly different from the results (M=1.7, SD=.73; t (38) = -0.50, p > .05) in the experimental group. On the contrary, there was a significant difference between the mean scores in the control group (M=2.9, SD=.64) and experimental group (M=4.1, SD=.72; t (38) = -5.58, p < .05) in the post-test. Consequently, the use of Grammarly® software and its feature in correcting the spelling errors for students resulted in a significant improvement in language learning achievement in the experimental group.

Research Question Five

Analyzing the significant differences between the control and experimental groups in responding to four variables in the pre-test and post-test were considered in the fifth question of the study. The independent samples t-test analysis of the results between the pre-test and post-test total scores in four different sets of questions (N=20) is shown in Table 6.

Table 6

Independent Samples t-Test for Four Variables in Pre-test and Post-test between Control and Experimental Groups

Statistics	**Mean**	**SD**	**df**	**t**	**sig**
Pre-test & Post-test Control	2.49	.37	38	-5.98	.000
Pre-test & Post-test Experimental	3.11	.27			

An independent-samples t-test was run to analyze the overall significant difference between participants' mean performance in pre-test and post-test in the control group and the participants' mean performance in pre-test and post-test in the experimental group. Indeed, four different writing-skill variables, namely, definite and indefinite articles, passive voice, punctuation, and correct spelling of words, were summed as one main variable, showing the final language achievement among participants. The mean scores of the pre-test and post-test in the experimental group (M=3.11, SD=.27) were significantly higher than the means scores in the control group (M=2.49, SD=.37; t (38) = -5.98, $p < .05$), showing, thus, a significant difference between the participants' performance in the control and experimental group.

Consequently, the analysis showed a significant difference in improving four writing skills in favor of the experimental group, emphasizing the impact of Grammarly® software as an immediate CF on final achievement among participants through the significant increase of the students' noticing and attention in various writing skills.

Discussion

Analyzing the first question of the study, the results of the independent-samples t-test revealed a significant difference between the control group (M=3.1) and experimental group (M=4.4) in utilizing computer-based Grammarly® software in improving definite and indefinite article writing skills. In line with the findings of Bailey and Lee (2020), where employing Grammarly significantly increased the students' skills in utilizing the correct use of definite and indefinite articles, the findings of this study also revealed significant differences between the experimental and control groups and increasing the experimental group learners' noticing and attention was because of the immediate CF nature of Grammarly® software in improving students' definite and indefinite article writing skills.

In contrast to Qassemzadeh and Soleimani (2015) study who found the effect of the teacher on learning passive structure, in pre-test and post-test, more than the effect of Grammarly® Software on learning the passive structure, the results of the second research question through running an independent-samples t-test also showed the significant impact of the Grammarly® software as an immediate CF in decreasing the passive voice writing errors among the experimental group learners (M=4.45), compared to the control group (M=3.45), because of the important role of Grammarly® software in assisting the learners to increase the noticing and attention while writing. However, the results of Qassemzadeh and Soleimani's (2015) research in delayed post-test supported the impact of Grammarly® Software feedback on learning passive structures among the EFL Experimental group (M=4.4) and control group (M=3.1) learners.

Consistent with the findings of the study conducted by Ghufron and Rosyida (2018) on analyzing the impact of Grammarly on punctuation and correct spelling learning achievement among EFL learners, the third question of the study was seeking for the significant differences between the control group (M=3) and experimental group (M=4.15) in responding to the punctuation questions in the pre-test and post-test. Therefore, the results obtained from the independent-samples t-test were accompanied by the significant differences in the correct usage

of the punctuations among the experimental group participants in the post-test as a result of employing the Grammarly® software with immediate CF ability.

Indeed, the fourth question considering the impact of Grammarly® software on the correct spelling of words among participants through the independent-samples t-test revealed a significant difference between the control group (M=2.9) and the experimental group (M=4.1); the students in the experimental group were successful to answer the questions with fewer errors because of the significant impact of Grammarly® software as an immediate CF in improving the learners' noticing and attention and, consequently, resulting in a decrease of the misspelling in writing. Similar to Ghufron and Rosyida (2018), the results of the study conducted by Karyuatry (2018) support the findings of the current study where Grammarly® software significantly improved the students' grammar and diction.

The last question of the study summed four writing features as one main variable to analyze the overall significant difference between participants' mean performance in pre-test and post-test in the control group and the participants' mean performance in pre-test and post-test in the experimental group. In line with the findings of Park (2020), Huang, Li, and Taylor (2020), Enayati and Gilakjani (2020), and Parra and Calero (2019), the results obtained from the independent-samples t-test revealed that the mean scores of the pre-test and post-test in the experimental group (M=3.11, SD=.27) were significantly higher than the means scores in the control group (M=2.49, SD=.37; t (38) = -5.98, $p < .05$), showing, thus, a significant difference between the participants' performance in the control and experimental group. Consequently, utilizing Grammarly® software as an immediate CF intervention resulted in increasing the students' noticing and attention, and significantly higher improvement in four different writing skills achievement among the experimental group, compared to the control group.

Considering the mentioned similarities between the results of this study and other mentioned researches, it can be argued that concerning the role of technology-based immediate feedback in correcting errors, Grammarly® can significantly improve the students' final achievement writing skills, and positively increase the students' attention in English language learning process.

Conclusion

The results of the current study revealed a significant difference between the control and experimental groups in utilizing computer-based Grammarly® software in improving four different writing skill abilities. Utilizing Grammarly® as an immediate CF intervention resulted in increasing the students' noticing and attention in four obtained skills in writing. The main findings of different analyses through conducting an independent-samples t-test revealed a significant impact of utilizing Grammarly® to improve the final grammar-learning achievements among participants in the experimental group, compared to the traditional-based EFL learners in the control group. The Grammarly® software, which provides immediate CFs for the participants, had a significant impact on increasing the students' noticing and attention on learning various

writing skills. Therefore, analyzing different grammatical features through the Grammarly® software in pre-test and post-test between the control and experimental groups showed that all features had a significant impact on the learners' final writing skill achievement. Therefore, the traditional teacher-oriented approaches in instructing grammar cannot prepare immediate feedback for students, reducing students' attention, and focusing. Consequently, the students' improvements in learning writing skills can be accounted for by Schmidt's (2001) attention theory where students' attention and their class-engagement may significantly be affected by the tools they employ as pedagogical interventions. In simple words, software's attractiveness, ease of use, accuracy, various capabilities, etc. are factors that impact learners' attention, resulting in more class-participation.

As an inevitable part of any academic research, conducting the current study was faced with different challenges. However, it is worth noting that one major limitation in this study was that due to economic sanctions it was not possible to purchase the whole software package and also due to inaccessibility to the International Payments the original version of the Grammarly® was copy-righted and buying the original versions for all participants in the experimental group was impossible. Therefore, only a few features of the software that were free in the trial version could be evaluated during the study, and some basic writing features remained untouched. Based on the limited trial version of the Grammarly®, the data and the results obtained from this study could be useful in any academic discussion, especially for those teachers who negatively interpret the use of computer-aided language skills as a pedagogical intervention. The potential of the Grammarly® software goes beyond providing simple practice and reinforcement of four limited grammatical variables; therefore, other researches consisting of different features in the original version can be conducted to evaluate different aspects of utilizing Grammarly® on improving the writing skill achievement in the pedagogical environments. Also, researches with different populations and different types of writing or grammar courses should be conducted. Indeed, the impact of the Grammarly® software on each writing skill might help the students and teachers to determine the strengths and weaknesses of technology in learning different grammatical features. These areas of research can be of importance to universities where future English teachers are graduating. In that case, all educators, teachers, and especially the educational system would benefit from the results of the study. Consequently, due to the worldwide prevalence of COVID-19 and its drastic effects on the educational system, Grammarly® software with immediate CF can also assist the teachers to provide the learners with a useful self-corrective writing tool in online classes where teachers can't check all the students' writing mistakes, helping the students to immediately find the writing errors in offline classes when they have no access to their teachers.

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