

Original Research

Investigating the Effect of AI Writing Assistance Tools on Iranian Intermediate EFL Learners' Writing Performance: A Comparative Study of ProWritingAid and Grammarly

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Submission date: 13-12-2023

Acceptance date: 08-04-2024

Abstract

This experiment is intended to determine the consequences of two artificial intelligence writing assistance tools, namely ProWritingAid and Grammarly, on the writing proficiency of Iranian Intermediate EFL learners. Additionally, the study seeks to ascertain which of these tools, ProWritingAid or Grammarly, exerts a more substantial influence on the writing competency of EFL pupils. A quasi-experimental study design was utilized. Through the Oxford Placement Test, a sample of 96 male students was selected from two private language institutes located in Marand, Iran. Two experimental groups and a control group were formed using a non-random allocation method. Each experimental group utilized one of the artificial intelligence writing aid technologies. Subsequently, an eight-session treatment phase was conducted. Then, one-way ANOVA was adopted to evaluate the results of the writing post-test and it pointed out that both experimental groups accomplished exceedingly well compared to the control group. In addition, it was observed that the group that utilized Grammarly exhibited significantly better performance in comparison to the group that used ProWritingAid. The study's conclusions have major ramifications for educators, language learners, and artificial intelligence writing aid technology developers. Educators have the opportunity to employ artificial intelligence driven writing assistance tools for the purpose of delivering prompt and customized feedback to students.

Keywords: Artificial Intelligence (AI), Writing Performance, Grammarly, ProWritingAid

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1. Introduction

Language is fundamental to human communication in all domains and is used to communicate, ask questions, give orders, and express requirements (Bonvillain, 2019). It aids human communication. English is instructed as a foreign language in Iranian schools. To be specific, English is the most widely spoken language (Zhang, 2013). Thus, global engagement requires a strong mastery of English. Mastering English requires conversational, auditory, textual, and written skills (Kaharuddin, 2019). Based on a review of these four abilities, writing is crucial to English competence and academic success. Writing conveys emotions, thoughts, ambitions, and aspirations, making it an effective language skill (Akkaya & Kirmiz, 2013). Writing is the most demanding of the four English language skills, reading, listening, writing and speaking, which is pertinent to teaching and learning since it grades students. Writing is crucial to academic success. Thus, second language (L2) students increase this skill (Hamed, 2012).

Educational institutions have utilized computers for decades, spending millions on their acquisition and maintenance. The mix of audio, text, and video makes multimedia a great learning format and has created an industry in computer-assisted language learning (CALL) (Ayres, 2002). CALL applies computers to display, support, and evaluate information. Over the course of the previous decade, the development of artificial intelligence (AI) education has emerged as a key focus for educators on an international level (Sing et al., 2022). The field of artificial intelligence in education has experienced significant advancements in research and development (Hwang et al., 2020). AI is a broad concept encompassing automated systems capable of emulating human cognitive processes, including learning, deduction, and self-correction (Popenici & Kerr, 2017). One of the key goals in the field of artificial intelligence is to develop automated systems capable of analyzing their surroundings and performing tasks in a manner comparable to human beings. The progress of technology has led to the emergence of AI, which has introduced novel educational experiences in the domains of evaluations, education, content generation, and feedback for both educators and learners. The significant donations of digital writing tools are mainly evident in the provision of formative feedback and assessment. In addition, the recent advancements in AI tools offer a comprehensive teaching methodology and plagiarism detection feature, which can potentially aid English as foreign language (EFL) learners in their research writing development (Zawacki-Richter et al., 2019).

ProWritingAid is a no-cost artificial intelligence writing aid program that evaluates the precision of written content. The aforementioned instrument may be readily accessed without any monetary charge using the website <https://www.prowritingaid.com/>. This tool serves writers in self-editing by providing evaluations on SPAG (Spelling, Punctuation, and Grammar). Students have the opportunity to assess their writing skills autonomously via the use of this program, which provides them with a comprehensive report and a corresponding score (Wahyuda & Putera, 2022). To provide more clarification, ProWritingAid is a very advantageous resource for those engaged in remote learning. Students have the opportunity to enhance and evaluate their work themselves, without the need to rely only on comments from their teachers. According to Ariyanto et al. (2019), users have the ability to efficiently assess their work for potential faults in spelling, grammar, and punctuation. The other free AI writing assistant tool is Grammarly. Grammarly, which falls within the domain of AI and technical research in the field of natural language processing, has several implementations that aim to address the increasing needs of the community (Ventayen & Orlanda-Ventayen, 2018). Grammarly is accessible via the official website, which may be found at <https://www.grammarly.com/>. It is a computerized database for the purpose of proofreading grammatical sentences. Additionally, it improves speech, grammar, synonyms (vocabulary utilization), and plagiarism detection. Grammarly assists instructors and students in correcting EFL writing, especially when teachers use a variety of instructional techniques, approaches, tactics, or even resources online and offline (Daniels & Leslie, 2013). The Grammarly products use an integrated system that embraces artificial intelligence methodologies, including deep learning, machine learning, and natural language processing, to enhance their functionality. The manner in which an individual does a job is emulated by artificial intelligence technology.

Thus, most EFL students struggle to write in English (Valencia & Buly, 2004). Students' incapacity to write may be caused by several factors. Certain components are frequent in this area. Insufficient vocabulary, grammar, accuracy, fluency, familiarity with the subject, insufficient use of effective writing strategies, significant challenges processing information, and difficulties writing it down. Besides the mentioned writing issues, EFL instructors question the effectiveness of AI writing assistant tools like ProWritingAid and Grammarly in improving or evaluating students' writing through corrective or evaluative feedback. Therefore, it is vital to evaluate their practicality and usefulness in Iranian EFL

classrooms, especially because technology integration is an emerging discipline that requires time to fully integrate into current teaching. This paper serves a purpose because it fills a gap by examining AI-based feedback on Iranian EFL learners' writing abilities in CALL-based contexts. Thus, this study is crucial for several reasons. Instructors and students should utilize AI writing assistants like ProWritingAid and Grammarly for many reasons. Since they make no assumptions about the topic, content, or students, these technologies provide educators and students objective data. They care more about writing content than production. These technologies provide students feedback, detect errors, explain why they happened, and even educate them about the error. Considering this, these technologies might provide learners with instant feedback, inspiring them. Immediate feedback and positive reinforcement are essential for appraising students' achievement. New teaching and learning technology tools like ProWritingAid and Grammarly could potentially elevate writing skills and drive students to utilize them. In addition, AI-based language learning aids and their impact on EFL learners' performance, notably in Iran, are not widely researched.

Therefore, the intention of this paper is to find out the manner in which using two of the AI writing assistant tools, ProWritingAid and Grammarly, affects the writing performance of Iranian Intermediate EFL students, and more specifically, how much progress EFL students make in their writing after receiving this novel form of feedback. The study also compares ProWritingAid and Grammarly to see whether one has a higher advantage in the writing skills of Iranian intermediate EFL students.

2. Literature Review

This review of the literature thoroughly explores the multidimensional factors related to the variables discussed in this research, including both theoretical and empirical aspects. This examination comprises significant studies and profound ideas, providing a detailed comprehension of the present state of research on the topic. The literature review is divided into two sections: the first segment explores theoretical frameworks, while the second segment analyzes empirical investigations.

2.1. Theories of Writing

In the opinion of Chastain (1988), writing is considered both a crucial method for learning a language and an essential ability for effective communication. The process entails generating

concepts, attentively considering their presentation, and structuring them in a manner that ensures comprehension by the recipient (Emig, 1997). Additionally, it encompasses social interaction as a means of conveying information effectively to readers. Due to its incorporation of concept comprehension, cognitive representation of knowledge, and practical application of subjects, language creation is seen as an essential but demanding talent (Akhtar et al., 2019; József, 2001). Chakraverty and Gautum (2000) argue that writing is a contemplative process that requires the writer to provide sufficient time for thoughtful examination of the given topic, as well as for organizing and assessing any existing knowledge. Authors seek a proper vocabulary to organize these notions into a coherent discourse.

Andrews (2001) has a unique perspective. He perceives writing as a multifaceted endeavor that necessitates the use of imagination, senses, state of mind, intellectual state, and other components. Cumming (1998) supplies a viewpoint from the field of syntax on writing. According to him, writing is a natural process characterized by the emergence of ideas, with an emphasis on conveying meaning and facilitating communication rather than on form and language. Shokrpour and Fallahzadeh (2007) propose a modern definition of writing as a multifaceted activity. It is seen as a collective action that demonstrates the author's communication skills. In addition, as stated by Myhill (2009), First Language (L1) writing may be categorized into three distinct domains. The domains include three distinct viewpoints: linguistic, sociocultural, and cognitive-psychological.

As stated by Flower (1984), writing is a deliberate process of conveying the intended meaning of the writer, reflecting the cognitive struggles experienced by writers, and eliciting many interpretations from readers. Writing is a complex task that poses challenges for instructors in providing pupils with clear and concise guidance to writing well. The role of educators is to aid students in comprehending the intricacies of the process and provide them with strategies to effectively manage each stage, thus enabling them to attain their writing objectives (Alber-Morgan et al., 2007; Scardamalia & Bereiter, 1982; Widayanti, 2011). Gunadevi and Narayana (2017) assert that writing is a dynamic activity that involves some tasks, including generating ideas, setting goals, strategizing, evaluating, and revising. As to Hillocks (2002), grammar instruction used to be the main focus of writing education in the past, with a strong emphasis on writing mechanics. This nascent methodology garnered unfavorable critique due to its inability to facilitate the acquisition of knowledge.

2.2. Theories of AI and Its Importance in EFL Context

AI was originally proposed in 1955 by John McCarthy, an innovator in this field (McCarthy et al., 2006). McCarthy et al., (2006) formulated a proposal for the 1956 Dartmouth Summer Research Project on Artificial Intelligence, where they outlined the concept of AI. The proposal presented a definition of AI as the capacity of machines to replicate the cognitive abilities exhibited by intelligent entities. The primary objective of this endeavor is to gain a comprehensive understanding of the cognitive processes and mechanisms underlying human cognition, with the ultimate goal of leveraging this knowledge to inform the design and development of technological innovations. Within the scope of language education, AI replicates the actions and characteristics exhibited by both language teachers and language learners. To replicate the actions of an instructor, a machine must function according to a pedagogical approach.

In broad terms, the literature on AI concentrates mainly on the development of intelligent machines (Nilsson, 2011). Various proposed definitions, including those put forth by Luckin et al. (2016), consistently emphasize that the notion of intelligence in this context pertains to human intelligence. In essence, AI technologies can be regarded as representations of human cognitive processes and behavioral patterns. Consistent with this assertion, within the field of education, and specifically in the domain of language teaching and learning, AI would function in the role of a language instructor (Matthews, 1993).

The field of language learning and teaching has witnessed significant interest in the application of AI (Haristiani et al, 2019). According to Azwary et al. (2016), computer programs that utilize AI have the capability to engage in conversations through both audio and text formats. These programs are designed to generate intelligent responses using natural language processing, enabling them to actively interact with users. Furthermore, AI represents a significant advancement in the deployment of computational technologies in the sphere of language education. The aforementioned practices emerged during the 1960s and subsequently led to the development of CALL. Approximately ten years later, the emergence of AI applications led to the expansion of CALL studies, giving rise to a new field known as Intelligent CALL (ICALL) (Lu, 2018). Due to these advancements in technology, AI-powered devices have gained the capability to engage in conversation with learners, comprehend their speech, offer feedback on their oral language skills, and assess the quality of their written work.

2.3. Empirical Studies of Grammarly and ProWritingAid

The integration of computer-based language learning in language classrooms, particularly in the context of EFL, has become indispensable for facilitating learner progress. Consequently, there has been a rapid proliferation of technologically advanced computer-based language programs. One of the prominent computer programs in this domain is an AI-based automated assessment system. Learners' writing errors can be effectively identified through the utilization of an AI-based writing assistant tools. For this purpose, several previous research investigations have been conducted on Grammarly and ProWritingAid, both of which are regarded as AI writing assistant tools. Chang et al. (2021) implemented Grammarly, an AI-powered writing feedback tool, to enhance EFL writing and student acceptability. Quasi-experimental study included 53 Chinese English learners. The experimental group (EG) utilized Grammarly to edit and revise their work, whereas the control group (CG) got traditional instruction. An independent t-test showed the performance of the experimental group in the post-test of writing was superior to that of the control group. In same vein, Hadiat (2022) carried out an examination to investigate the potential impact of Grammarly on students' proficiency in writing descriptive text. Additionally, she sought to discover their viewpoints on the usage of Grammarly in improving the correctness of their written descriptive text. The data for this research were collected by the administration of a questionnaire, conducting interviews, and observing online classrooms. Various methods were used to analyze the data, such as a frequency table, coding, content analysis, and triangulation. The results of the study indicate that the use of Grammarly has the potential to improve the precision of composing descriptive text. According to the study's findings, the majority of students have favorable attitudes toward the use of Grammarly in composing descriptive texts. This is mostly attributed to the software's ability to foster motivation among pupils to strengthen their propensity to write, as well as its facilitation in identifying errors within their written texts.

In addition, Fahmi and Cahyono (2021) encountered EFL students' perceptions residing in Grammarly and instructor feedback regarding writing training. The findings of the study revealed that a significant majority of students, specifically 93%, reported perceiving Grammarly as a user-friendly tool. Moreover, 78% of the participants expressed that they found the remarks addressed by Grammarly to be easily comprehensible. The utilization of Grammarly and feedback from teachers has a positive influence on the

development of students' writing abilities. Furthermore, Thi and Nikolov (2022) conducted a study to examine the influence of utilizing Grammarly and receiving instructor feedback on students' writing abilities. The findings derived from the pre-test and post-test indicate a substantial improvement in writing accuracy and a reduction in language-related errors among students by the conclusion of the semester. Similarly, Grammarly was examined by Ebadi et al. (2022) to assist Iranian EFL students correct composition mistakes. They separated 90 Iranian students into three groups: one getting both Grammarly and instructor input, another only Grammarly feedback, and a control group receiving just teacher evaluation. Post-test results revealed that Grammarly and teacher comments improved performance. In addition, Sistani and Tabatabaei's (2023) research sought to compare and contrast the effects of teacher feedback and Grammarly on the competency of Iranian EFL students in writing. According to the findings of the pre-and post-tests, the experimental group prevailed over the control group. This result reveals that EFL students' writing skills strengthened once they implemented Grammarly.

Miranty et al. (2021) examined a particular approach to using Grammarly as an efficient tool for instructing L2 writing. They used a switching replication design inside an experimental framework. The participants were taking a writing course as part of their academic curriculum. They were categorized into experimental and control groups. The students were offered pre-tests and post-tests, after which they were provided with open-ended online questionnaires after the course. A formal interview was undertaken with the instructor of writing. Concerning the interview, the teacher's experiences were obtained and deliberated. The findings indicated that the students' writing scores in the experimental group exhibited a substantial improvement from the pre-tests to the post-tests. However, when compared to the control group's writing outcomes, there was no discernible improvement. Additionally, the scores of both groups suggested that the efficacy of Grammarly in teaching writing in an EFL class was similar to that of instructor corrective feedback.

In the case of ProWritingAid, Wahyuda and Putera (2022) investigated the efficacy of ProWritingAid in enhancing writing proficiency among students in the eleventh grade of senior high school. A single-instance observational study was undertaken, employing a paired t-test to analyze the collected data. The findings indicated a statistically significant result ($p < 0.001$), leading to the rejection of the null hypothesis (H_0) and acceptance of the alternative hypothesis (H_0). This suggests that the ProWritingAid application is effective in

enhancing students' writing skills. In same line, Ariyanto et al. (2019) examined instructors' and students' views on ProWritingAid and teacher feedback. Thirty-three informatics engineering students took an English for special purpose writing class. The survey research approach collected data through student surveys and teacher interviews. Such strategies are useful for both instructors and students, therefore teachers want to use them for future development. Teachers say these methods enhance writing and save time. Teacher input improves content, whereas ProWritingAid improves grammar. In addition, the advantages of online composition supplies for EFL students during the Covid-19 outbreak have been acknowledged by ProWritingAid, as shown in the research conducted by Handayani and Handayani (2020). The researchers conducted an investigation into the challenges faced by students in the process of learning to write, attributing these issues to instructors who lacked innovation in their teaching methods for writing. ProWritingAid is assigned the obligation of fixing the concerns. By integrating the use of professional writing aid into the process of writing education, it is possible for students to enhance their ability to effectively engage with their written work. Additionally, the study conducted by Rahma and Zen (2023) sought to identify the categories of writing mistakes made by students that were either identified or missed by ProWritingAid, a software tool designed for language checking. The present study used a qualitative research design, using the document analysis approach facilitated by the use of ProWritingAid software. The findings of the study revealed that ProWritingAid exhibited the capability to identify a total of 21 distinct categories of writing mistakes, including omissions of pronouns, prepositions, and determiners. In addition, it was observed that there were unnoticed faults present, such as instances of needless capitalization and missing punctuation. In summary, ProWritingAid has the capability to assist students in the analysis of their faults.

On the other hand, the primary objectives of Wahyuda's (2022) study were to assess the efficacy of the Grammarly and ProWritingAid tools for enhancing writing skills among students at MAN Batu while considering their individual writing proficiency levels. The second purpose of this study was to assess the effectiveness of both Grammarly and ProWritingAid in teaching writing skills to students at different proficiency levels, specifically focusing on MAN Batu students. Conclusions from this research imply that writers may benefit from using Grammarly and ProWritingAid. The Grammarly program demonstrates more efficacy when used by cohort of pupils with lower English writing

proficiency, whilst the ProWritingAid application exhibits enhanced effectiveness when utilized by groups of students with higher English writing proficiency. In contrast to the main goals of Wahyuda's (2022) study, the present research highlights the need for a more extensive assessment of the effectiveness of Grammarly and ProWritingAid tools in improving writing abilities among students. While Wahyuda's research primarily aimed to evaluate the efficacy of the tools based on individual writing competence levels, the objective of this analysis is to point out gaps in the existing literature and look over the current methodology. It is clear that while Wahyuda's results have positive implications, more careful examination is needed to uncover detailed insights and improve educational procedures. The present research aims to contribute by using a critical approach to identify areas for development and enhance the comprehension of how writing aid tools may effectively meet the needs of students with varying levels of competence.

Thus, the current study on the influence of AI writing aid tools mostly concentrates on general EFL situations, disregarding specialized examinations of the writing proficiency of Iranian Intermediate EFL learners. This study gap is especially evident while doing a comparison analysis of two commonly used AI writing aid applications, ProWritingAid and Grammarly, inside the educational environment in Iran. Although earlier research has investigated the efficacy of these tools in various linguistic contexts, there is a lack of studies investigating their impact on the varied writing abilities of Iranian intermediate EFL students. Moreover, the existing literature lacks a comprehensive examination of the degree of improvement achieved by EFL students after the receipt of feedback from these tools. Hence, this research endeavors to fill this void by examining the precise influence of ProWritingAid and Grammarly on the writing proficiency of Iranian Intermediate EFL learners. It aims to offer valuable insights into the comparative benefits of these tools and contribute significant knowledge to the domain of AI-assisted language learning. Therefore, the research questions are as follows:

Q1: Does 'ProWritingAid' have any significant effect on Iranian Intermediate EFL learners' writing performance?

Q2: Does 'Grammarly' have any significant effect on Iranian Intermediate EFL learners' writing performance?

Q3: Do 'ProWritingAid' and 'Grammarly' have the same effect on Iranian Intermediate EFL learners' writing performance?

Moreover, the null hypotheses for the research are as follows:

H01: The 'ProWritingAid' does not have any significant effect on Iranian Intermediate EFL learners' writing performance.

H02: The 'Grammarly' does not have any significant effect on Iranian Intermediate EFL learners' writing performance.

H03: 'ProWritingAid' and 'Grammarly' do not have the same effect on Iranian Intermediate EFL learners' writing performance.

3. Methodology

3.1. Design and Context of the Study

Quasi-experimental best describes this study's design. Cook and Campbell (1979) specify quasi-experimental research as a study that approximates true experimental research but does not satisfy its prerequisites. The assignment of participants is not conducted in a random manner. The dependent variable in the present research is the students' writing performance. The independent variables are AI writing assistance tools, ProWritingAid and Grammarly tools. The context of the study was two private language institutions which located in Marand city, Iran.

3.2. Participants

The population for this study comprised 450 students who were enrolled in two private language institutes located in Marand, Iran. The sample for this study consisted of 145 male students who were selected through convenience sampling method within the population. All the participants in the study were EFL students at an intermediate level, with Turkish being their native language. Their ages ranged from 15 to 18 years old. The researchers assessed the participants' overall proficiency homogeneity by administering the Oxford Placement Test. The study utilized a sample that was homogeneous, comprising of learners whose test scores were approximately 1 standard deviation (SD) away from the mean. Out of the total group of 145 students, a subset of 96 male students was chosen as the final participants for the study based on their specific Oxford Placement Test scores. Subsequently, non-random assignment to two experimental and one control groups proceeded, and each group encompassed 32 males.

Table 1.

Demographic Background of the Participants

No. of Students	96
Gender	Male
Native Language	Turkish
Major	English language learners
Institute	Shayanfar Pardis
Academic Years	2023

3.3. Instruments

3.3.1. Oxford Placement Test (OPT)

The Oxford Placement Test was employed to determine the participants' proficiency levels. The implementation was carried out with the aim of guaranteeing the uniformity of the study's sample in relation to their proficiency in the English language. The examination comprises a total of 60 multiple-choice items, encompassing grammar, vocabulary, and close tests. The allotted time for participants to complete the test was limited to 45 minutes. The KR-21 consistency estimation was employed to evaluate the reliability of the OPT test, yielding a coefficient of 0.89, indicating a sufficient level of reliability.

3.3.2. Pre-Test and Post-Test of Writing

Before the research begins, a writing pre-test was conducted to confirm the homogeneity and equality of all participants. Participants had 40 minutes to write between 150 and 200 words on one of two given subjects (*'The Importance of Education in Today's Society'* or *'The Effects of Climate Change on the Environment'*). Regarding the writing post-test, a similar writing test to the pre-test was conducted after treatment, and the conclusions were compared. The two experts rated the writings and their inter-rater reliability was measured.

3.3.3. ESL Composition Profile

The ESL Composition Profile, which was established by Jacobs et al., (1981), provided a criteria for evaluating the accuracy of the students' written work. This profile encompasses a set of criteria designed to evaluate the proficiency of students' writing skills across various dimensions, such as vocabulary, structure, language usage, and technique. The profile is structured into four distinct sections, namely Very Poor, Fair to Poor, Good to Average, and Excellent to Very Good. Each section is assigned scores within the ranges of 7-9, 10-13, 14-

17, and 18-20, respectively. The raters assigned scores based on the specific criteria encompassed within each category.

3.4. Data Collection Procedure

A non-random selection of 145 male students was made from a population of 450 students enrolled in two private language institutes in Marand, Iran. The researchers assessed the participants' general proficiency homogeneity through using the Oxford Placement Test. The final participants of the study were selected from an initial sample of 145 students, with a total of 96 male students chosen based on their OPT scores. Two experimental and one control groups were then non-randomly assigned. Each group comprised 32 male students.

Prior to commencing the research, all subjects were supplied with a pre-test., in order to ascertain their homogeneity and equality. The allotted time frame for participants was 40 minutes, within which they were required to produce a written composition consisting of a minimum of 150 words and a maximum of 200 words. The written composition was to be centered on one of two predetermined subjects. Subsequently, ProWritingAid was presented to the first experimental group, acknowledging the accessibility constraints for users in Iran. Additionally, the second experimental group was exposed to the introduction of Grammarly.

The students of control group obtained instruction in the conventional way. The participants completed their writing assignments utilizing traditional writing instruments such as pens and paper. During each instructional session, they were provided with a writing task to be completed in the classroom setting. The instructor collected the students' writing tasks upon completion of their tasks at the conclusion of each session. Subsequently, the instructor perused the tasks and provided written remarks and constructive feedback on ways to enhance their quality. Subsequently, the writing assignments, along with corresponding feedback, were distributed to the students during the subsequent session. In addition, students completed a writing assignment outside of class and submitted it for evaluation by the instructor during the subsequent session.

In contrast, the participants in the experimental groups employed electronic devices such as computers or cell phones during the carrying out of their writing assignments. The first experimental group utilized ProWritingAid, an AI writing assistant tool, during their writing tasks. This tool offered automated feedback on their writing assignments. Additionally, the instructor offered comments and feedback subsequent to each session.

Furthermore, the students completed a writing assignment utilizing ProWritingAid in their personal residences and subsequently presented it to the instructor during the subsequent class session in order to receive feedback.

The procedure for the second experimental group was similar to that of the first experimental group, with the exception that the students in the second experimental group utilized Grammarly as an AI writing assistant tool during their writing tasks. Therefore, the duration of the treatment encompassed a total of eight sessions, with each session spanning a duration of 90 minutes. Following the conclusion of the treatment, during the final session, a post-test identical to the pre-test was handed out to all groups. The test format and duration were consistent across all groups. The researchers supplied the ESL Composition Profile, originated by Jacobs et al., (1981), as a criterion to assess the accuracy of the students' writing.

3.5. Data Analysis Procedure

The statistical analyses of the data collected were conducted using the SPSS software program, particularly Version 26. Initially, the normal distribution was assessed using the Kolmogorov-Smirnov Test. Subsequently, in order to assess the null hypotheses, a one-way analysis of variance (ANOVA) was conducted. Additionally, the assessment of inter-rater reliability between the two raters was conducted using the Pearson correlation coefficient.

4. Results

This part presents the results obtained from our thorough data analysis methods, examining the influence of AI writing aid tools on the writing proficiency of Iranian Intermediate EFL learners. The acquired data were subjected to statistical analysis using SPSS software, specifically Version 26. The first assessment was exploring the normal distribution by means of the Kolmogorov-Smirnov Test. Furthermore, the inter-rater reliability between the two assessors was assessed using the Pearson correlation coefficient. Subsequently, the null hypotheses were examined using a one-way ANOVA, revealing possible variation across the groups.

4.1. Testing Normality Assumption

The Kolmogorov-Smirnov test was performed to identify whether there was a normal distribution across the experimental and control groups' student results. The Kolmogorov-Smirnov test findings in Table 2 showed that the test scores of all three groups of students (Pre-test, Post-test, and OPT) followed a normal distribution ($p > .05$).

Table 2

Tests of Normality of Data

Group		Kolmogorov-Smirnov ^a		
		Statistic	df	Sig.
ProWritingAid	OPT	.117	32	.200*
	Pre-test	.088	32	.200*
	Post-test	.088	32	.200*
Grammarly	OPT	.082	32	.200*
	Pre-test	.109	32	.200*
	Post-test	.145	32	.085
Control	OPT	.138	32	.140
	Pre-test	.117	32	.200*
	Post-test	.092	32	.200*

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

4.2. Inter-Rater Reliability of Raters

Two independent raters examined the pre-and post-test of writing. The degree of consensus amongst raters was analyzed using Pearson correlations. The pre-and post-test reliability coefficients are shown in Table 3; they are 0.883 and 0.918, respectively. This indicates that the raters are very consistent with one another, with a significance level of 0.05 ($p < 0.05$). From this, we might deduce that the two raters were very consistent with one another.

Table 3

Pearson Correlation; Inter-Rater Reliability of Raters

		Rater 2 pre-test	Rater 2 post-test
Rater 1 pre-test	Pearson Correlation	0.883**	
	Sig. (2-tailed)	.000	
	N	96	
Sig. (2-tailed)	Pearson Correlation		0.918**
	Sig. (2-tailed)		.000
	N		96

** . Correlation is significant at the 0.01 level (2-tailed).

4.3. Comparing the Pre-test of Groups

The descriptive statistics for the pre-test of writing among the three groups are illustrated in Table 4. The group known as Grammarly (M = 72.06, SD = 12.73) had the highest average score on the pre-test for writing. Subsequently, the ProWritingAid group (M = 70.18, SD = 12.56) and the control group (M = 70.66, SD = 11.48) were monitored.

Table 4

Descriptive Statistics; Pre-test of Writing by Groups

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
ProWritingAid	32	70.18	12.56	2.22	65.65	74.71
Grammarly	32	72.06	12.73	2.25	67.47	76.65
Control	32	70.66	11.48	2.06	66.44	74.87
Total	96	70.97	12.17	1.24	68.49	73.45

Prior to perusing the outcomes, it is essential to acknowledge that the assumption of homogeneity of variances was satisfied during the pre-test phase. According to the findings shown in Table 5, the results of Levene's test (Levene's F (2, 93) = .538, p > .05) suggest that there were no statistically significant variations seen in the variances across the groups.

Table 5

Test of Homogeneity of Variances for Pre-test

		Levene Statistic	df1	df2	Sig.
Pre-test	Based on Mean	.581	2	93	.561
	Based on Median	.538	2	93	.586
	Based on Median and with adjusted df	.538	2	92.556	.586
	Based on trimmed mean	.591	2	93	.556

Based on the findings shown in Table 6, which reports the results of a statistical analysis (F (2, 93) = .201, p > .05, $\eta^2 = .004$, indicating a small effect size), it can be inferred that there were no statistically significant disparities seen among the means of the three groups concerning the pre-test scores for writing. Therefore, it may be assumed that individuals had comparable writing skills prior to the onset of the major examination.

Table 6

One way ANOVA on Pre-test by Groups

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	60.741	2	30.370	.201	.818
Within Groups	13877.944	93	150.847		
Total	13938.684	95			

4.4. Exploring Research Questions

The descriptive data for the post-test of writing among the three groups are shown in Table 7. The group using Grammarly (M = 87.20, SD = 7.18) demonstrated the greatest average score on the writing post-test. Subsequently, the ProWritingAid group (M = 81.26, SD = 7.97) and the control group (M = 70.51, SD = 11.49) were monitored.

Table 7

Descriptive Statistics; Post-test of Writing by Groups

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
ProWritingAid	32	81.265	7.979	1.410	78.38	84.14
Grammarly	32	87.203	7.180	1.269	84.61	89.79
Control	32	70.516	11.498	2.065	66.29	74.73
Total	96	79.757	11.314	1.160	77.45	82.06

Prior to addressing the findings, it is important to acknowledge that the premise of homogeneity of variances was upheld throughout the post-test analysis of writing. The results of Levene's test are shown in Table 8. The test yielded significant findings (Levene's $F(2, 93) = 2.141, p > .05$), indicating that the assumption of homogeneity of variances was satisfied.

Table 8

Test of Homogeneity of Variances for Post-test

		Levene Statistic	df1	df2	Sig.
Post-test	Based on Mean	2.106	2	93	.122
	Based on Median	2.141	2	93	.118
	Based on Median and with adjusted df	2.141	2	82.814	.118
	Based on trimmed mean	2.165	2	93	.114

Based on the findings shown in Table 9, which indicates a statistically significant result ($F(2, 93) = 29.10, p < .05, \eta^2 = .385$, signifying a large effect size), it can be inferred that there were notable variations in the mean scores of the three groups on the post-test of writing.

Table 9

One way ANOVA on Post-test by Groups

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4829.818	2	2414.909	29.108	.000
Within Groups	7715.641	93	82.964		
Total	12545.458	95			

Table 10 highlights the post-hoc Tukey HSD test results, which concluded that;

A: The experimental group, consisting of participants who used ProWritingAid, had a notably superior performance on the post-test measuring writing proficiency compared to the control group (MD = 11.17, $p < .05$). Thus, the first null-hypothesis **was rejected**.

B: The experimental group, consisting of individuals using Grammarly, had a notably superior performance compared to the control group in the post-test evaluating writing proficiency (MD = 17.10, $p < .05$). Thus, the second null-hypothesis **was rejected**.

C: The group use Grammarly had a notably superior performance compared to the group utilizing ProWritingAid on the post-test evaluating writing proficiency (MD = 5.93, $p < .05$). Thus, the third null-hypothesis **was supported**.

Table 10

Post-Hoc Tukey HSD Test for Post-test by Groups

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
ProWritingAid	Grammarly	-5.937*	2.277	.028	-11.3612	-.5138
	Control	11.171*	2.277	.000	5.7482	16.5955
Grammarly	ProWritingAid	5.937*	2.277	.028	.5138	11.3612
	Control	17.109*	2.277	.000	11.6857	22.5330
Control	ProWritingAid	-11.171*	2.277	.000	-16.5955	-5.7482
	Grammarly	-17.109*	2.277	.000	-22.5330	-11.6857

*. The mean difference is significant at the 0.05 level.

4.4.1. Effect of ProWritingAid and Grammarly: Feedback Examples

In the table 11, some examples from students' writings were presented alongside the corrections and feedback provided by the AI writing assistance tools, ProWritingAid and Grammarly. By showcasing specific examples from students' compositions alongside the corrections and feedback generated by ProWritingAid and Grammarly, we aimed to illuminate the tangible influence of these tools on composition quality.

Table 11

ProWritingAid and Grammarly Feedback Examples

ProWritingAid Feedback	Grammarly Feedback
Sentence: "Access to quality education is a basic necessity for personal and societal development." Feedback: Unknown word; 'necessity' Suggested correct spelling: necessity.	Sentence: "The positive impacts of education is evident in both individual success and societal progress." Feedback: Change the verb form; 'is' Recommended using 'are' for subject-verb agreement.
Sentence: "Accessible and inclusive education systems break down barriers, creating equal opportunities for all members of society."	Sentence: "It serves as the catalyst for personal development, shaping minds, fostering critical thinking, and preparing individuals to navigate the complexities of the modern world."

Feedback: Avoid informal language in formal text; 'break down' Recommended using 'fail' or 'collapse'	Feedback: Clarity; Replace the phrase 'serves as the catalyst for' Recommended using 'catalyzes'
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5. Discussion

The current study was conducted to explore the effect of AI writing assistance tools on Iranian Intermediate EFL learners' writing performance. In addition, there was an attempt to investigate and compare the effect of feedback provision through ProWritingAid and Grammarly, as AI writing assistance tools, on writing ability of Iranian EFL learners. The study's findings indicate that the experimental group, which comprised participants who utilized ProWritingAid, demonstrated a notably superior performance on the post-test assessing writing proficiency when compared to the control group. The mean difference (MD) between the two groups was 11.17, and this difference was statistically significant ($p = .000$, $p < .05$). This result suggests that ProWritingAid may have a positive impact on enhancing writing skills among the participants. This may be explained by the ProWritingAid's exceptional ability to offer comprehensive feedback that covers grammar, style, and other aspects of writing. Students derived advantages from focused recommendations, which allowed them to tackle certain writing difficulties and enhance their general writing competence. Moreover, the experimental group composed of individuals using Grammarly exhibited a notably superior performance on the post-test evaluating writing proficiency compared to the control group. The MD between these two groups was 17.10, and this difference was statistically significant ($p = .000$, $p < .05$). This finding indicates that Grammarly, as an AI writing assistance tool, was effective in improving participants' writing proficiency. The Grammarly's extensive scope facilitates the improvement of sentence structures, the enhancement of word utilization, and the assurance of overall coherence. The simplistic design and real-time feedback of Grammarly enhance its effectiveness as a beneficial tool for writing assistance. Additionally, when comparing the two experimental groups, those who used Grammarly showed a notably superior performance on the post-test measuring writing proficiency in comparison to the group utilizing ProWritingAid. The MD between these groups was 5.93, and this difference was statistically significant ($p = .028$, $p < .05$). This outcome suggests that Grammarly may have a more pronounced positive effect on writing proficiency compared to ProWritingAid. This disparity may be explained by Grammarly's superior algorithms, which are highly effective

in detecting subtle linguistic subtleties, and its easy-to-use design, which makes it easier to incorporate feedback into the writing process.

The finding concerning the efficacy of AI-based feedback provision via ProWritingAid is in line with several previous studies (Wahyuda & Putera, 2022; Ariyanto et al., 2019; Handayani & Handayani, 2020; Rahma & Zen, 2023). These studies have consistently demonstrated the positive impact of ProWritingAid as an AI-powered writing assistance tool on improving writing proficiency and enhancing the quality of written work. For example, the study conducted by Wahyuda and Putera (2022) represents a significant contribution to the understanding of the efficacy of ProWritingAid in improving writing proficiency among eleventh-grade high school students. Employing a single-instance observational study and utilizing a paired t-test for data analysis, the researchers posited the effectiveness of the ProWritingAid application. This outcome strongly suggests that ProWritingAid has a positive and measurable impact on enhancing students' writing skills. In the same vein, Handayani and Handayani (2020) reviewed research on the advantages of AI writing aids, notably ProWritingAid, for English learners. The COVID-19 epidemic makes this more important. The study of students' writing challenges highlighted the need for unique teaching methods, revealing ProWritingAid's potential to solve these concerns. According to their extensive literature review, EFL students encounter unique hurdles in improving their writing skills. Teachers may have depended on traditional teaching methods that were inflexible in distance and online learning contexts, which were necessary during the COVID-19 epidemic. This highlights the need for creative and flexible writing instruction, especially in the context of a global disaster that has disrupted traditional classrooms. Rahma and Zen (2023) additionally contributed to learning how well ProWritingAid facilitates students to write. The investigation found that ProWritingAid could identify 21 writing error categories. These categories have several issues, including no pronouns, prepositions, or determiners. The application properly identifies a wide variety of grammatical and syntactical errors, giving students valuable feedback to improve their writing. The program may not cover every writing style and norm, as seen by the ignored capitalization and punctuation. Users must be aware of its limitations. Furthermore, Ariyanto et al. (2019) pointed out the benefits of ProWritingAid and instructor feedback in writing instruction. Teachers and students found this combination of methods to improve writing quality and save time useful and beneficial. Instructor input improves content, whereas

ProWritingAid focuses on grammar, maximizing writing improvement, as determined by their research.

Moreover, the discovery regarding the effectiveness of AI-driven feedback provision by means of Grammarly aligns with the investigations carried out by Chang et al. (2021), Hadiat et al. (2022), Fahmi and Cahyono (2021), Thi and Nikolov (2022), Ebadi et al. (2022), and Sistani and Tabatabaei (2023), as well as Miranty et al. (2021). These studies pointed out the increasing acknowledgment of the notable influence of Grammarly, an AI-based writing feedback tool, on improving EFL writing skills and student consent. Chang et al. (2021) examined whether AI-based writing feedback systems like Grammarly may help Chinese EFL students strengthen their writing. The utilization of a quasi-experimental approach facilitated a comparative evaluation of the efficacy of Grammarly as an adjunctive instrument for enhancing writing skills. Their investigation revealed a substantial disparity in writing post-test outcomes between the two groups. This result showed that Grammarly improves EFL students' writing skills statistically. They also emphasized student acceptance and participation with AI-powered merchandise. Similarly, Hadiat et al. (2022) combined questionnaires, interviews, and online classroom observations in a thorough study. They performed several data analysis methods to determine how Grammarly affects writing accuracy and student perceptions. Their research concluded that Grammarly raised descriptive writing accuracy. The study further discovered that many students appreciated employing Grammarly to write descriptive writings. Fahmi and Cahyono (2021) noted that EFL students prefer Grammarly's simplicity and straightforward feedback. Their research uncovered that English-language learners highly rated Grammarly. The technology provides clear, actionable feedback to students, as shown by their study. Effective and clear feedback enables students to optimize their writing. Grammarly excels at this. Furthermore, Thi and Nikolov (2022) provided valuable insights into the beneficial effects of incorporating Grammarly and teacher feedback on students' writing proficiency. A significant enhancement in writing accuracy was noticed among students who utilized Grammarly and received feedback from their teachers, as indicated by one of the primary findings of their research. Moreover, the observed decrease in language-related errors exhibited by learners was a significant result of their investigation. As well, Ebadi et al. (2022) further illustrated how Grammarly supports Iranian EFL students in correcting their writing. One of their most important findings was that Grammarly, whether used with teacher input or without it,

improved students' academic performance. They additionally displayed how teacher input and evaluation boost student performance. Even with instructor feedback, Grammarly improved performance. Further, Miranty et al. (2021) researched Grammarly's L2 writing effectiveness as a teaching tool. Their research identified that the experimental group students' writing scores enhanced significantly from the pre-test to the post-test. Nevertheless, they found no statistically significant distinction in writing scores between the experimental and control groups, which was noteworthy. Grammarly improved writing abilities, but its impact was similar to teacher corrections.

In more, two experimentation groups were contrasted to compare Grammarly and ProWritingAid's effectiveness. This study sought to reveal how well these tools boost writing. A significant finding was the post-test performance disparity between Grammarly and ProWritingAid. The aforementioned result suggests that Grammarly might boost writing competence more than ProWritingAid. This disagreement raises many questions. First and foremost, it focuses on choosing writing assistance technology that meets educational goals. The findings suggest Grammarly may be best for improving writing abilities. When picking writing education tools, instructors and students should examine their educational environment and objectives. Grammarly and ProWritingAid's differences in effectiveness may be due to their algorithms, feedback mechanisms, or mistake kinds. Additional research and a deeper look at these instruments may reveal the factors that affect writing proficiency results. Additionally, learners' preferences and adaptability must be considered. One learner may find one tool more user-friendly or suitable for their learning style. Many writing assistance tool selections and flexibility to choose may motivate and engage students throughout the writing process. In this case, Wahyuda (2022) analyzed whether Grammarly and ProWritingAid assisted MAN Batu students in writing English effectively. The findings suggested that these writing tools promote writing abilities and stressed the need to consider students' competency levels when selecting and using writing aids. The research also provides a nuanced picture of Grammarly and ProWritingAid's consequences for student writing proficiency. The observation that Grammarly functioned more effectively for trainees with lower English writing abilities while ProWritingAid operated better for groups with greater English writing skills is insightful.

6. Conclusion

In conclusion, our study meticulously examined the impact of ProWritingAid and Grammarly on the writing skills of Iranian Intermediate EFL pupils. The primary focus was to assess how innovative feedback, facilitated by these technological tools, influenced the enhancement of EFL learners' writing abilities, with a particular interest in determining the tool that exerted the most significant influence. The findings declared the constructive influence of both ProWritingAid and Grammarly in strengthening the writing skills of Iranian intermediate EFL learners. While ProWritingAid and Grammarly were effective in enhancing writing, the analyses indicated that Grammarly users exhibited superior writing capabilities.

These outcomes offer noteworthy implications for educators, language learners, and developers of AI writing assistance technology. Educators are encouraged to consider integrating AI writing aids, particularly Grammarly, into their writing teaching curricula, as these tools offer immediate and individualized feedback, a critical component in language learning contexts emphasizing writing skills. Language learners, especially those studying English, stand to benefit significantly from incorporating AI writing assistance tools into their self-study routines. These tools empower individuals to engage in writing activities, receive timely feedback, and foster the development of their writing skills.

Furthermore, this study sheds light on the crucial factors influencing the effectiveness of AI writing aid tools, emphasizing the importance of feedback quality and the comprehensiveness of suggestions. Developers in this field should consider these insights to refine and optimize their technologies. In summary, our research not only contributes to the existing knowledge on the efficacy of ProWritingAid and Grammarly in an EFL setting but also provides practical guidance for educators and learners seeking to harness the potential of AI writing assistance tools for improved writing proficiency.

While the study served valuable insights, several limitations should be acknowledged. Firstly, the research was conducted with a specific focus on intermediate-level male EFL learners aged between 15 and 18 from language institutions. The results may not be fully generalizable to a broader demographic or diverse educational settings. Moreover, the study's duration, consisting of eight sessions, may be considered relatively short for assessing the long-term impact of AI writing assistance tools on writing performance. Long-term effects and sustainability of the observed improvements could not be adequately

addressed within this timeframe. Additionally, the study focused solely on writing performance, neglecting potential impacts on other language skills or holistic language proficiency.

However, additional research opportunities exist to delve into several aspects. These include examining the utilization of these tools across different student factors such as varying proficiency levels, gender, and age. Furthermore, it would be helpful to investigate the long-term impacts of AI writing assistants on learners' writing abilities and justification attention. Additionally, it would be beneficial to conduct a comprehensive comparative analysis of diverse AI writing assistant tools to ascertain their effectiveness in specific areas of writing skills, such as grammar, style, and clarity.

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