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Investigating the Effects of AI and Teacher-Based Explicit Correction on Learner Autonomy and Grammatical Accuracy

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ABSTRACT

This study investigates the effectiveness of AI-based and teacher-based explicit correction on grammatical accuracy and learner autonomy among Arabian EFL learners at the university level. A total of 75 students were initially selected, but following a proficiency test, 54 homogenized EFL learners in terms of general English knowledge were divided into three groups: AI-based explicit correction (via ChatGPT), teacher-based explicit correction, and a control group with no feedback on grammar. The study employed a pretest-posttest design with grammar tests and an autonomy questionnaire administered before and after the intervention. Participants in both experimental groups were provided feedback on grammatical points like conditional type one, conditional type two, and active/passive voice through either AI tools or direct teacher feedback, while the control group received no feedback on the grammatical errors produced in writing texts. Results from the Kruskal-Wallis and ANOVA tests indicated that AI-based corrective feedback significantly improved both grammatical accuracy and learner autonomy compared to teacher-based feedback and the control group. These findings emphasize the potential of AI as an effective tool for enhancing language learning outcomes. The significance of the current study goes back to the role of AI and how it can play an influential role in both improving students' grammar and assisting them

to become more independent and self-directed learners, which is an increasingly important skill in today's world. The implications for pedagogy and future research in technology-enhanced language learning are also discussed.

1. Introduction

Languages serve as the primary tools for communication and comprehension between individuals and nations, and they provide the necessary instruments for creating certain bonds and relationships between human beings, regardless of time, space, or culture[1]. As languages evolve, effective teaching methods become crucial in fostering learners' proficiency and confidence in communication. For effective communication, corrective feedback is essential and is widely recognized in language education for its role in fostering learners' development. It serves as a crucial tool in helping students identify and rectify linguistic errors, ultimately enhancing their overall proficiency[2,3]. As it is stated, corrective feedback is regarded as a vital part of form-focused instruction (FFI) when the teacher tries to react against the learners' committed errors[4]. Among the different types of feedback, explicit correction has become more popular due to its directness and clarity. When a student makes a mistake and the teacher gives them the right response, this is known as explicit correction[5]. Teachers employ a range of techniques to draw students' attention to grammatical structures and forms. In applied linguistics research, Focus on Form (FoF) approaches are commonly associated with indirect instructional methods. These techniques aim to guide learners' attention incidentally, offering implicit input rather than explicit explanations. Implicit instruction avoids overt teaching of (meta)pragmatic rules; instead, it facilitates learners' unconscious inference of grammatical patterns through exposure and context[6].

In language learning, research suggests that explicit error correction is typically more effective than implicit instruction. For instance, a meta-analysis conducted by[7] revealed that explicit instruction outperformed implicit instruction in a number of studies. This is corroborated by Guo, K., Pan, M., Li, Y., et al.[8], who demonstrates that while implicit correction helps with learning later features, explicit correction is better for learning early developmental features.

It has been demonstrated that explicit instruction performs better than implicit methods in certain situations, such as teaching English verb forms, especially when tasks call for accuracy[9]. Nevertheless, the efficacy varies based on the linguistic complexity and the particular learning objectives. To put it another way, both approaches have advantages, but in structured learning environments, explicit error correction typically offers more pronounced advantages in terms of accuracy and metalinguistic awareness. Even though explicit correction has been shown to be successful in assisting students in recognizing and fixing grammatical errors, there are frequently difficulties associated with it. For example, if students experience excessive criticism or discouragement from repeated corrections, it may lower their motivation and communication willingness[10]. Moreover, continual correction can exacerbate stress and anxiety, which may impede language learning and lower student engagement in the classroom[11].

It is impossible to overlook the importance of feedback in fostering students' independence as learners. Learner autonomy, which includes the ability to take control of one's learning processes, including identifying and correcting mistakes, is becoming more widely acknowledged as a critical element of successful language acquisition[12,13]. Learners who gain autonomy are better able to identify their errors and choose methods to fix them, whether through guided instruction, peer review, or self-evaluation[4]. In addition to encouraging increased language proficiency, this self-directed approach to error correction encourages more in-depth reflection on the learning process. It improves learners' capacity for self-monitoring and problem-solving, both of which are critical for long-term language application and retention[5]. Encouraging students to fix their mistakes on their own over time increases the likelihood that they will internalize language rules and feel capable of controlling their learning, which further increases their autonomy[6].

The introduction of artificial intelligence (AI) presents new opportunities to explore alternative feedback techniques,

despite the continued prevalence of traditional teacher feedback in classrooms. AI can enhance the personalization of learning experiences by providing customized feedback based on individual learning patterns and needs[7]. Additionally, AI systems can deliver immediate feedback, which accelerates the learning process by allowing students to recognize and correct their errors promptly[8]. By offering personalized feedback and fostering motivation, AI-assisted instruction can improve self-regulated learning, encouraging students to learn independently[9]. Furthermore, studies have shown that tools like ChatGPT can boost motivation and engagement, empowering students to take control of their education[10]. Moreover, the study by Bartosh, O.P., Bartosh, T.P.,[11] confirmed the fact that integrating AI into an educational context has a positive effect on students' cognitive, emotional, and social engagement. Also, the studies like , which approved the positive associations between teacher AI literacy and both age and years of teaching experience, and that confirmed AI-assisted educational settings can improve resilience, revealed the positive role of AI[14,15].

However, it remains unclear to what extent AI-based explicit corrections can match or even surpass traditional teacher feedback in promoting learner autonomy and enhancing grammatical accuracy. This gap in understanding provides a significant research opportunity, especially as educators aim to effectively integrate technology into their teaching practices. Moreover, despite the potential advantages of AI-based feedback, empirical research examining its effectiveness in comparison to traditional teacher-based feedback remains scarce. Studies that specifically address the interaction between feedback types, learner autonomy, and grammatical accuracy are needed to provide educators with a clearer understanding of how best to support their students. Without such research, teachers may struggle to make informed decisions about incorporating AI tools into their instruction, potentially missing out on valuable opportunities to enhance learning outcomes. Based on the paucity of studies, this research aimed to investigate the comparative effects of AI-based explicit correction and teacher-based explicit correction on learner autonomy and grammatical accuracy. So, the following research questions were formulated:

RQ1: What are the effects of AI-based explicit correction and teacher-based explicit correction on the accuracy of learners' production of selected grammatical points?

RQ2: What are the effects of AI-based explicit correction and teacher-based explicit correction on EFL learners' autonomy levels?

2. Literature Review

This study covers the broad categories of feedback, with a particular focus on AI-based feedback. Feedback is often referred to as Focus on Form Instruction (FFI), which is an important topic in second language acquisition and pedagogy. FFI involves directing learners' attention to linguistic elements during communication, which primarily emphasizes meaning, as noted by Wang, X., Gao, Y., Wang, Q., et al.[16]. This approach is based on the idea that attention to form arises spontaneously during interaction and is meaning-centered, typically occurring in response to communication breakdowns. In other words, FFI emphasizes the significance of focusing on linguistic forms within meaningful communication, forming the basis for corrective feedback.

The theoretical foundations of FFI are rooted in several key hypotheses within second language acquisition. These include Long's Interaction Hypothesis[17], Krashen's Input Hypothesis[18], Swain's Output Hypothesis[19], and Schmidt's Noticing Hypothesis[20]. Long's Interaction Hypothesis posits that second language learning is a dynamic, complex, and non-linear process. Interaction is essential for L2 comprehension and production, as it facilitates the negotiation of meaning between participants, thereby promoting language development. In contrast, Krashen's Input Hypothesis suggests that comprehensible input—language that is slightly beyond the learner's current level (i+1)—is sufficient for language acquisition. Although this view has been influential, it has been critiqued for diminishing the importance of output and interaction in the language learning process, as highlighted by Swain.

In response to the limitations of input-focused approaches, Swain's Output Hypothesis highlights the importance of language production. Swain argues that output pushes learners to produce language that is more precise, coherent, and appropriate than what they could manage with input alone. Schmidt's Noticing Hypothesis further elaborates on the role of attention in language learning, proposing that learners must consciously notice linguistic forms in input for acquisition to occur. While noticing does not guarantee

acquisition, it is a necessary precursor that activates learners' awareness of language features, enabling them to process forms in short-term memory. These theories in sum approve the necessity for corrective feedback by emphasizing the roles of input, output, interaction, and noticing in language acquisition.

When it comes to corrective feedback, teacher-based correction has long been thought to be a more successful strategy for dealing with intricate language problems that call for detailed explanations and individualized feedback. According to studies, grammatical accuracy is greatly increased when teacher instruction and error correction are combined, as opposed to when correction is used alone[21]. This implies that improving learning outcomes requires the human element of teacher feedback, especially the capacity to offer context and specific instructions. The significance of explicit correction is further highlighted by the fact that control groups that do not receive feedback typically exhibit less improvement in grammatical accuracy[22]. Because of the contextual depth and adaptability of complex target forms and issues, teacher-based feedback is essential in education.

In addition to teacher feedback, the growing use of AI-based language learning correction tools has attracted a lot of attention lately. Numerous studies have compared the efficacy of AI feedback to more conventional teacher-based correction techniques. GPT-4 and other AI systems have shown a high degree of agreement with human corrections, especially when it comes to grammatical accuracy. Real-time, personalized feedback from these systems can boost learners' confidence in their English language proficiency and subskills and promote self-evaluation[9]. Additionally, AI feedback has been shown to have the ability to improve performance and lessen writing anxiety; in some cases, it can even surpass teacher feedback in specific areas, like lowering stress levels during the writing process[23]. This implies that while some students may find a more encouraging learning environment with AI, many still favor a more all-encompassing approach that combines AI and teacher feedback[24]. AI-based feedback seems to provide timely, individualized support and reduce stress, especially when it is accompanied by teacher feedback and guidance.

However, errors requiring contextual understanding—an area in which human teachers excel—can occasionally be difficult for AI tools to handle. They might not have the in-depth knowledge necessary for more contextually subtle errors, but they can offer precise and prompt feedback on simpler grammatical problems like verb tenses and subject-verb agreement[25]. Furthermore, the statistical character of AI systems can lead to overcorrection or inappropriate recommendations, especially in complex linguistic contexts[26]. Regardless of the strengths of AI tools, they struggle with nuanced language use and may produce inaccurate suggestions in complex contexts.

The impact of AI and teacher feedback on learner autonomy is a crucial topic of discussion in this comparison. It has been demonstrated that teacher feedback greatly improves students' capacity for self-correction as well as grammatical accuracy[24]. Students gain the critical thinking abilities required for self-regulation and error identification thanks to the individualized nature of teacher correction, which promotes deeper learning and longer-term retention of grammar rules[25]. In contrast, learners in control groups receiving no feedback generally show less improvement in autonomy and self-correction abilities, underscoring the importance of explicit corrective feedback in fostering these skills[26]. Teacher feedback seems to be vital in nurturing learner autonomy via self-correction, which is guided and critically reflected.

By offering instant, tailored feedback that promotes self-correction, Automated Writing Evaluation (AWE) tools like Grammarly and Pigai have been shown to dramatically increase the autonomy of EFL learners. By empowering students to recognize and fix grammar mistakes on their own, these resources promote a sense of independence in the learning process. Though AI tools are good at fixing specific grammar problems, they might not be able to provide advice on more general writing topics like organization and coherence, where teacher feedback is still very important. In the end, even though ChatGPT and other AI tools have shown notable progress in fixing common grammatical errors, such as verb tenses, plurals, and comparatives[27], they work best when paired with teacher feedback. The context and structural guidance that AI systems frequently lack are provided by teacher correction, which makes a blended approach the best way to support both learner autonomy and grammatical accuracy. It is becoming more and more obvious that both teacher-based and AI-based correction techniques complement one another in improving the language learning process,

as studies into their relative effects continue. To say differently, an integration of AI tools with teacher feedback seems to be influential in supporting autonomy and grammatical development.

Due to the discrepancies that exist in the above-mentioned studies, this study aims to address these gaps by comparing the effects of AI-based explicit correction and teacher-based explicit correction on learner autonomy and grammatical accuracy. This research aims to explore the dynamics of feedback mechanisms to provide insights that can enhance teaching practices and effectively integrate technology into language learning. Ultimately, the findings will help us better understand how various feedback methods can promote learner autonomy and improve language proficiency, preparing students for successful communication in an increasingly digital world. Therefore, this study aims to niche the existing research gaps and provide practical insights for integrating AI into feedback practices to better support language learners.

3. Method

This section contains the following sections. The participants section explains the number and manner of selecting the participants for the study. the instruments section list and elaborate on the data gathering tools. In the procedure section, the outline of the research plan is elaborated. And finally, the data analysis section deals with the manner of analyzing the data.

4. Participants

The participants of the study were composed of all the 75 male and female intermediate level learners of the Islamic University, Najaf, Iraq (32 females and 43 males) in the age range between 20 to 28. Non-random convenience sampling was used in this study because random selection of the students in universities was not possible due to the rules of permission. All of them were studying English Language Teaching in BA with Arabic as their L1. The learners had already passed five semesters, and they were considered third-grade students. A proficiency test was administered to ensure the homogeneity of groups. From the initial 75 students, 21 of them were excluded from the study as a result of high or low scores in the proficiency test, and 54 learners

remained as the final participants. Based on the results of the proficiency test, the final participants were 54 learners who were evenly divided into three groups of the first treatment group (n = 18), the second treatment group (n = 18), and the control group (n = 18). The recruitment criteria for the participants were willingness to participate voluntarily in the study, the level of general knowledge (intermediate level), and enrollment in the English Language Teaching BA program.

5. Instruments

To standardize the general English proficiency of the participants, the OQPT test was one of the tools utilized in this study. The findings of the so-called language test, which was required of learners at an intermediate level, showed that the 54 learners were homogeneous. The exam was administered two weeks prior to the start of the research. The exam had sixty items. It took sixty minutes for the test takers to complete the grammar, cloze exam, and vocabulary problems.

The other data gathering tool was a pretest and a posttest in grammar. Following piloting in the study's pretest and posttest, this measure was put into place to assess the learners' understanding of the target structures and see whether there were any notable differences in their comprehension of the target features. To guarantee that the findings could be compared, the pre-test and post-test had the same structure and substance. Grammatical points were the main emphasis of this study, and the textbook under investigation included a variety of grammatical points, including active/passive voice, conditional type one, and conditional type two. The textbook's content and the grammatical concepts discussed throughout the lesson served as the foundation for the exam design. This study focused on grammatical topics and production tests, and fill-in-the-blanks exercises using 45 items from the three grammatical rules that made up the tests. Test time allotted was fifty minutes, and the final score was forty-five. Given the significance of validity, the test was thought to have content validity because it was designed to evaluate the students' proficiency in grammar. The reliability coefficient, as determined by Cronbach's Alpha and piloting outcomes, was 78.

In addition to the instruments listed above for obtaining data, the other tool was the autonomy questionnaire. The

English version of Zhang and Li's autonomy questionnaire was used in order to evaluate learners' autonomy. The questionnaire has two parts. The first part contains 11 items and the second 10, total of 21 items. The first 11 items have five options on Likert-scale from never to always (A. never, B. rarely, C. sometimes, D. often, E. always). The second part of the questionnaire is in multiple-choice format. The participants chose the closest answer to their beliefs and their attitudes or ideas. The participants' choices in the questionnaire were the scores from A to E, which are respectively 1, 2, 3, 4, and 5. All the items of this instrument are directional and therefore, the range of scores is basically from 21 to 105. The participants were required to respond in 30 minutes. According to Zhang and Li, using Cronbach's Alpha, the reliability of this questionnaire was estimated to be 0.80. Furthermore, Zhang and Li report that this questionnaire enjoyed high validity. The reliability of the learner autonomy questionnaire in this study was estimated to be 0.84 using the Cronbach's alpha coefficient.

6. Data Collection Procedure

Following the ethical guidelines in research, the participants were assured of the confidentiality of the research and its objectives. It was imperative to hide the identity of both the students and the institution behind the research. The teachers were required to make the learners write their names during the implementation of the treatments. They were made anonymous for reasons of ethics. In order to clarify the homogeneity or heterogeneity of advanced language learners, 75 intermediate Arabian learners were subjected to the OQPT in a similar manner two weeks before the commencement of treatment. As a result of the administration of the proficiency test, 21 learners were removed from the study because they either obtained high or low scores on the test; that is, their proficiency level was based on one standard deviation above or below the mean. The remaining learners in the intact classes amounting to 54 students, continued the study. After this phase, the grammar production pretest along with the autonomy questionnaire was administered to the learners in the groups one week before the study.

At the treatment phase, the participants in the groups received instruction on specific grammatical points targeted for improvement. This instructional phase was essential to ensure that learners had a solid understanding of the grammatical concepts that would be assessed in their writing tasks. The teaching was structured to provide clear explanations, examples, and contextualized practice opportunities. The instructional sessions began with an overview of the selected grammatical points, which were determined based on the results of the pre-test. These points included key areas where learners commonly struggled. The instructor introduced each grammatical concept through direct instruction, using visual aids, handouts, and examples from authentic texts to demonstrate correct usage. After this initial phase, participants had the opportunity for independent practice through targeted writing exercises. They were required to produce sentences using the specified target forms within narrative writing. The EFL students were encouraged to integrate these grammatical points into their writing in meaningful ways. After completing these phases, which were consistent for all groups, the next steps for each group were initiated as follows:

After finishing the writings, the learners in the teacher explicit correction group were provided with oral and written explicit correction to the grammatical errors produced in the writing assignments. After reviewing the students' writings, the instructor provided verbal feedback, directly addressing errors by explaining why certain grammatical forms were incorrect and offering the correct usage. This interactive form of correction enables learners to ask questions and seek clarification on specific grammar points, fostering a deeper understanding of grammatical structures. Oral explicit correction also included examples and additional explanations to reinforce correct usage, thereby engaging the learner more actively in the correction process. In addition to providing oral feedback, the instructor annotated the students' texts with written comments. Each grammatical error was marked, and the correct grammatical forms were provided. This method of explicit written correction is especially helpful, as it enables students to visually compare their initial mistakes with the correct versions, creating a lasting reference that they can revisit. After receiving both forms of explicit correction, students in this group were required to rewrite their texts, integrating the corrected grammatical structures. This process emphasized active learning, as learners not only observed the corrections but also applied them, enhancing their grammatical accuracy over time.

Participants in the AI-based explicit correction group

attended a comprehensive orientation session designed to familiarize them with the AI feedback tool. The learners needed to be connected to the internet and consequently to ChatGPT to receive feedback on the writing texts. This session began with an overview of the AI system's capabilities and functionalities, explaining how it could assist them in improving their grammatical accuracy. The participants were guided through the user interface, highlighting key features such as text submission, feedback retrieval, and navigation through the correction suggestions. This initial introduction was crucial for ensuring that all participants felt comfortable using the technology throughout the study. The learners were required to write the same target forms used in the first group and transfer the texts to AI in order to get feedback. Errors were clearly indicated, and suggestions for correct forms or structures were offered. Similar to the teacher feedback group, the learners in the AI-feedback group were required to rewrite their texts, integrating the corrected grammatical structures and getting extra feedback on the grammatical forms, such as conditional type one and two, as well as active and passive voices. Finally, the participants in the control group received feedback only on content; it means that the instructor in the control group switched to focus on meaning, not on form, and ignored the learners' grammatical errors.

7. Data Analysis

At the end of the intervention period, post-tests in grammar and autonomy were administered to all participants, similar in format to the pre-test. This post-test assessed any improvements in grammatical accuracy and understanding of the targeted grammatical points. The results from the pre-test and post-test for the AI-based explicit correction group were subsequently compared to those of the teacher-based correction group and the control group, and they were analyzed through ANOVAs, allowing for a meaningful evaluation of the effectiveness of AI feedback on grammatical accuracy and learner autonomy.

8. Results

After the homogeneity test, a pretest in grammar was administered to all of the learners in the groups. **Table 1** shows the descriptive statistics of the three groups at pretest.

Table 1. Descriptive Statistics of Pretest.

	N	Minimum	Maximum	Mean		Std. Deviation	Variance
Teacher feedback	18	5.00	9.00	6.8889	0.35136	1.49071	2.222
AI feedback	18	6.00	10.00	6.6667	0.36155	1.53393	2.353
Control	18	5.00	9.00	6.5556	0.42181	1.78958	3.203

Table 1 reveals that the mean score of the teacher-based explicit correction group is 6.88 with the SD of 1.4, and the mean score of the AI-based explicit correction group is 6.66 with the SD of 1.5. Also, the mean of the control group is 6.55 with the SD of 1.7. As it is clear from **Table 1**, the means of the groups were slightly different. However, the differences among groups needed to be tested statistically; thus, the assumption of parametric test needed to be tested. One of the assumptions is that the data should be normally distributed. The results showed that the distribution of scores in Kolmogorov-Smirnov for pretest is normal for the two groups of AI-based explicit correction and control group, but not normal for the teacher-based explicit correction (sig < 0.05). Therefore, instead of parametric statistics, non-parametric statistics were run. In so doing, a Kruskal-Wallis test was used instead of an ANOVA Test. **Table 2** shows the results of mean ranks at pretest.

Table 2. Mean Ranks at Pretest.

	Groups	N	Mean Rank
Pretest	Teacher feedback	18	28.32
	AI feedback	18	27.14
	Control	18	26.93
	Total	54	

As **Table 2** reveals, at pretest, the teacher feedback group was the highest in rank (28.32) compared to the other two groups, but according to **Table 3**, this difference was not significant ($p > 0.05$). The result of the Kruskal-Wallis pretest is illustrated in **Table 3**.

Table 3. Results of Kruskal-Wallis at Pretest.

	Pretest
Chi-Square	0.329
df	2
Asymp. Sig.	0.803

As **Table 3** shows, since the *p*-value (0.803) is higher than the significance level (0.05), the assumption of the homogeneity of variances is also met. It means that the Arabian EFL learners were the same in grammar knowledge before the onset of the treatment. After the treatment, a posttest on grammar was conducted among the three groups under study. **Table 4** presents the results of descriptive statistics of the posttest in grammar.

Table 4. Descriptive Statistics of Posttest.

Posttest	N	Minimum	Maximum	Mean		Std. Deviation	Variance
Teacher feedback	18	11.00	25.00	19.7556	0.58979	1.49071	2.222
AI feedback	18	13.00	37.00	31.4333	0.52394	2.22288	4.941
Control	18	9.00	18.00	13.6667	0.46442	1.78958	3.882

Table 4 reveals that the mean scores of the students in teacher-based explicit correction group are 19.7 with the SD of 1.4 and the mean score of learners receiving AI-based explicit correction is 31.4 with the SD of 2.2. In addition, the mean of no feedback group as control group with the SD of 1.7 is 13.6. Similar to the procedure conducted for the pretest, and there is a need to run a homogeneity test for posttest of grammar. In terms of Shapiro-Wilk, the *p*-value of teacher-based explicit correction group with the df of 18 is 0.734 and the *p*-value of AI-based explicit correction group with the df of 18 is 0.093. Furthermore, the *p*-value of control group with the df of 18 is 0.332. Regarding Kolmogorov-Smirnov, the distribution of scores for AI-based explicit correction group, is far from normal (sig < 0.05). Then, there is a need to run Kruskal-Wallis test instead of ANOVA Test. The mean rank result of posttest is illustrated in **Table 5**.

Table 5. Mean Ranks at Posttest.

	Groups	N	Mean Rank
	Teacher feedback	18	30.48
Immediate posttest	AI feedback	18	41.53
	Control	18	14.22
	Total	54	

As **Table 5** reveals, at posttest, the AI-based explicit correction group had the highest rank (41.53); however, this difference was significant (*sig* < 0.05). Therefore, we can conclude that at the posttest, the AI-based explicit correction group performed better than the teacher-based explicit correction group and the teacher-based explicit correction group with the rank of 30.48 is better than the control group. **Table 6** illustrates the results of Kruskal-Wallis in the posttest.

As mentioned in **Table 6**, at posttest, the AI-based explicit correction group had the highest rank; thus, it can be concluded that at the posttest, the AI-based explicit correction group performed better than the teacher-based explicit correction group and the teacher-based explicit correction group is better than the control group. The results of Kruskal-Wallis showed that these differences are significant and the significance smaller than the *p* level among groups approved the differences among groups after pretest. Based on the findings, the first null hypothesis was rejected and the results revealed that the AI-based explicit correction group was better in the production of target forms in the writing courses.

Table 6. Results of Kruskal-Wallis in Posttest.

	Posttest
Chi-Square	28.686
df	2
Asymp. Sig.	0.000

The second research question in the current study was as follows:

RQ2: What are the comparative effects of AI-based explicit correction, teacher-based explicit correction, on EFL learners' autonomy and ability to correct grammatical errors in their writing?

To answer this research question and approve or reject the second null hypothesis, the above procedure was conducted. **Table 7** shows the results of descriptive statistics of pretest and posttest in autonomy.

Table 7 reveals that the mean scores of Arabian EFL learners in the teacher feedback group in terms of pretest is 29.7 with SD of 1.6, and the mean score of learners receiving AI-based feedback is 32.4 with the SD of 1.5. In addition, the mean of no feedback group as the control group with the SD of 1.5 is 28.9. Regarding posttest of autonomy, the mean score of EFL learners in the first treatment group is 59.3 with the SD of 1.4, and the mean of the learners in AI-based feedback is 81.2 with the SD of 1.8. Moreover, the mean of the learners in no feedback group is 42.6 with the SD of

1.5. Similar to the procedure conducted for the pretest and posttest of grammar, there is a need to run a homogeneity test for the pretest and posttest of autonomy. Since the p-value in both pretest and posttest of autonomy is higher than the significance level (0.05), it can be concluded that the data is normally distributed in autonomy tests. So, ANOVA can be conducted. **Table 8** shows the results of ANOVA on the posttest of autonomy.

Table 7. Descriptive Statistics of Pretest and Posttest.

	N	Minimum	Maximum	Mean		Std. Deviation	Variance
Pretest							
Teacher feedback	18	26.00	36.00	29.732	0.53212	1.62213	2.991
AI feedback	18	29.00	38.00	32.466	0.48743	1.53093	3.021
Control	18	30.00	33.00	28.994	0.39833	1.51005	2.871
Posttest							
Teacher feedback	18	34.00	63.00	59.364	0.3882	1.43214	3.410
AI feedback	18	32.00	89.00	81.274	0.4123	1.8325	2.912
Control	18	28.00	47.00	42.633	0.3906	1.50042	2.777

Table 8. Results of ANOVA on Posttest of Autonomy.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	342142.7	2	193181.3	3732.4	0.000
Within Groups	2145.104	51	46.332		
Total	346021.985	53			

Since the *p*-value (0.000) is lower than the significance level (0.05), it can be concluded that the groups are not the same in autonomy level after treatment, $F(2, 51) = 3732.4$, $p = 0.000$. Based on the mean scores, since the mean of the learners in AI-based explicit feedback is higher than the other groups, hence it can be concluded that AI-based feedback is effective in increasing the learners' autonomy level in writing courses. Based on the findings, the second null hypothesis was rejected at *p*-value less than 0.05.

9. Discussion

The objective of this study was to investigate the comparative effects of AI-based explicit correction and teacher-based explicit correction on learner autonomy and grammatical accuracy. Based on the results of Kruskal-Wallis, the group exposed to AI-based explicit feedback outperformed the other two groups in grammar accuracy, so the first null hypothesis was rejected.

The study's findings generally concur with the body of research on the usefulness of AI-based corrective feedback, especially when it comes to enhancing grammatical accuracy. Research has repeatedly shown that artificial intelligence (AI) tools like ChatGPT and Grammarly are very successful at giving learners fast, precise feedback on grammar, enabling them to improve their language production [9,21]. The study's results, however, are in contrast to those of [18] and [19], who discovered that teacher-based corrective feedback significantly improves grammatical accuracy, particularly when combined with explicit instruction. According to the current study, in some situations, AI-based feedback may be just as effective as human feedback. This discrepancy might result from the different needs of learners at different skill levels or possibly from the particular feedback mechanisms employed in this study, like the personalized and instantaneous nature of AI-based corrections [28].

The results of this study support Swain's Output Hypothesis, which highlights the significance of language production in learning, within the framework of second language acquisition (SLA) theory. Producing language, according to Swain, forces learners to improve their output, and AI systems' instantaneous corrective feedback appears to encourage this process. The findings support Swain's hypothesis because the learners in the AI group demonstrated a significant increase in both grammatical accuracy and autonomy after being given the chance to produce more accurate language through frequent corrections. This in harmony suggests that AI systems provide learners with a platform to experiment with language output and receive feedback that reinforces learning [29].

The second research question focused on learners' autonomy levels, and as the results of ANOVA indicated, the learners in the AI-based explicit correction group gained higher scores in comparison to the other two groups in autonomy. Research by Macías Borrego, M.[30] highlights the significance of AI feedback in promoting learner autonomy. They argue that Automated Writing Evaluation (AWE) systems foster greater independence among learners by providing immediate, personalized feedback. This aligns with the current study, which found that participants using AI tools outperformed those receiving feedback from teachers in terms of autonomy and self-regulation. The accessibility and promptness of AI tools may encourage students to take control of their educational journey by helping them identify and correct their own mistakes, thereby enhancing their sense of autonomy and self-efficacy.

Furthermore, the findings of this study are consistent with other research that emphasizes how AI tools can lower anxiety and foster a positive learning environment. According to Xu and Wang (2024), AI feedback can help students feel less stressed while writing by offering prompt, accurate corrections without the pressure of a human teacher's evaluation. This view is supported by the current study, which found that learners in the AI group not only displayed higher levels of autonomy but also better grammatical accuracy. This could be because AI tools offer a more relaxed and nonjudgmental feedback environment.

It is noteworthy that while the study confirms previous findings about AI's capability to correct grammar, it also highlights some limitations of AI feedback mentioned in research by Farrokhi, F., Sattarpour, S.[22] and Wang, D.[23]. These studies indicate that AI tools can struggle with contextually nuanced errors, especially when these errors require a deeper understanding of linguistic subtleties. This limitation should be noted, particularly for tasks that involve more complex grammatical structures or discourse-level challenges, even though the current study found AI feedback superior in the majority of areas. This suggests that while AI feedback is valuable for certain linguistic tasks, it may not yet be fully capable of replacing the more contextualized guidance provided by human teachers[23].

The study's conclusions, however, also differ in a few ways. According to earlier studies, teacher-based feedback is better at fostering learner autonomy because it is more individualized and teachers can offer more in-depth context and explanations[24,25]. However, because students in the AI group showed a higher capacity for self-correction and learning regulation, the current study discovered that AI-based feedback was actually more successful in boosting autonomy. This finding stands in contrast to earlier research, suggesting that the immediacy and non-judgmental nature of AI feedback may play a critical role in fostering autonomy, especially in more technologically inclined learners[30].

Furthermore, the findings support Long's Interaction Hypothesis, which holds that interaction, meaning negotiation, and feedback during communication all improve language acquisition. By giving students instant feedback on their language production, the AI-based feedback system may replicate some aspects of interaction and assist them in identifying and fixing mistakes in real time. The potential for AI tools to act as interactive partners in the learning process and support language acquisition in a manner similar to human interaction is highlighted by this congruence with the Interaction Hypothesis.

The study's findings are also consistent with those of Godwin-Jones, R., O'Neill, E., and Ranalli, J.[31], which contended that for the most thorough learning experience, students frequently favor a combination of AI and teacher feedback. Despite comparing the two forms of feedback separately, the current study's findings suggest that AI and teacher feedback may complement one another in language learning[32]. Although the AI feedback group performed better in terms of autonomy and grammatical accuracy, it is important to remember that teacher feedback offers more in-depth context and tailored advice. A blended approach, combining the immediacy and accessibility of AI tools with the contextual understanding and human touch of teacher feedback, may offer the most effective learning experience for students[33–36].

To sum up, the findings of this study align with much of the existing literature on AI-based feedback, but they also offer new insights into the comparative effectiveness of AI and teacher-based feedback. These results challenge some established beliefs regarding the superiority of teacher feedback, indicating that AI tools can be equally effective, or even more so, in certain contexts. However, it is important to acknowledge the limitations of AI feedback, especially when it comes to handling more complex linguistic tasks. Future

research should focus on exploring how AI and teacher feedback can be integrated effectively to create a comprehensive and supportive learning environment.

10. Conclusions

This study clarifies the relative effectiveness of teacher-based versus AI-based explicit corrective feedback in improving grammatical accuracy and promoting learner autonomy among intermediate EFL learners. The findings reveal that learners receiving AI-based feedback demonstrated significantly higher grammatical accuracy and greater autonomy compared to those in the teacher feedback group and the control group. This suggests that AI-based corrective feedback is more effective in both areas. The results indicate that AI feedback tools can be highly beneficial for language learning, offering real-time corrections while encouraging learner autonomy due to their accessibility, immediacy, and non-judgmental nature. Furthermore, the study emphasizes the capability of AI tools to create a safe and stress-free learning environment that supports learner independence. By enabling students to identify and correct their errors more autonomously, AI feedback appears to enhance their self-regulation skills. This is particularly relevant in today's digital learning landscape, where learners often seek flexible and personalized approaches to language acquisition.

This study has important implications for various aspects of technology-enhanced learning and language teaching. First, the results suggest that educational institutions and language instructors should consider incorporating AI-based feedback tools into their lesson plans. These resources can be particularly beneficial in online learning environments or in large classes, where it can be challenging for teachers to provide timely, personalized feedback to each student. AI systems can complement teacher feedback, allowing students to practice more independently and receive instant corrections. The findings indicate that AI-based tools can significantly enhance learner autonomy, a vital skill for lifelong learning. These resources empower students to actively manage their education and correct their errors, boosting their self-esteem and motivation for language acquisition. The results also have implications for developing learning management systems and language proficiency tests. AI-driven feedback can provide individualized, real-time support that improves

grammatical accuracy and reduces educators' workload, allowing them to focus on more complex aspects of language teaching.

It is clear that no study is without limitations. One of the limitations was the learners' level of knowledge, which was intermediate ones from a single university in Iraq. As a result, the findings may not fully apply to EFL learners in other settings, age groups, or proficiency levels. The short intervention period was another limitation that seems to affect the results. Additionally, in the current study, feedback was provided on a narrow range of grammatical structures, potentially overlooking more complex or context-sensitive language issues that AI might struggle to address.

While AI-based feedback is effective, it serves a different purpose than teacher feedback, and its best use may come from combining the two. A blended approach could leverage the immediate corrections of AI with the contextual insights from teachers, maximizing support for students. Future research should explore how to integrate AI and teacher feedback, especially for complex language tasks across various proficiency levels. Additionally, studies should examine the long-term effects of AI feedback on language learning, students' abilities to self-correct, and the psychological impacts of relying on automated tools. Overall, AI feedback is a valuable resource for enhancing grammar and autonomy, but it should be part of a wider educational framework that includes traditional teaching methods.

This study indicates that further research is necessary to understand how AI tools can effectively address subtle and context-sensitive linguistic errors. While AI feedback has the potential to enhance grammatical accuracy, it cannot fully replace human teachers because of its limitations in managing more complex language issues. The most effective way to support English as a Foreign Language (EFL) learners in achieving higher proficiency levels appears to be through a hybrid feedback model that integrates the strengths of both AI and human insight. Additionally, these findings provide guidance for educational institutions and policymakers in establishing ethical and effective standards for the use of AI in the classroom. It is essential to consider concerns regarding data privacy, the role of human teachers, and the risk of over-relying on AI tools as this technology becomes more prevalent in educational environments. AI can complement traditional language teaching methods, but it is crucial to

maintain a balanced approach that preserves the essential role teachers play in guiding students' learning.

Author Contributions

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Conflicts of Interest

The authors declare no conflicts of interest.

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