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## The Use of AI-Powered Grammarly in Enhancing EFL Prepositions Usage

Alba Vargas-Saritama\*<sup>ID</sup>, Verónica Espinoza-Celi<sup>ID</sup>  
 and Fernando Carrión-Robles<sup>ID</sup>  
 Universidad Técnica Particular de Loja,  
 Loja, Ecuador

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**Abstract.** Despite growing evidence supporting the use of Artificial Intelligence (AI)-powered automated written corrective feedback (AWCF) in English as a Foreign Language (EFL) writing, limited research has examined its effectiveness in learning context-dependent grammatical structures, especially English prepositions. This longitudinal quasi-experimental study investigated whether AI-powered Grammarly, supported by teacher mediation, improves EFL pre-service teachers' accuracy in using the English prepositions *in*, *on*, and *at*. Fifty first-year EFL pre-service teachers from a private university in southern Ecuador participated in this study. Two pre-existing groups received either Grammarly-supported instruction with teacher mediation or conventional grammar instruction over an academic term. Data were collected through pre- and post-test assessments, instructional performance tasks, a learner perception questionnaire, and classroom observations. The experimental group achieved significantly greater learning gains than the control group ( $t(31.9) = 2.91, p .007, d = 0.823$ ). A linear mixed effects model further revealed a significant effect of the instructional condition across the intervention ( $F(1, 216) = 136.30, p < .001$ ). Learners also reported highly positive perceptions of Grammarly, particularly regarding its usability, feedback clarity, and support for learning English prepositions. The study concludes that teacher-mediated Grammarly instruction was associated with greater accuracy in using *in*, *on*, and *at* and was positively perceived in terms of usability and feedback clarity.

**Keywords:** AI-powered Grammarly; EFL pre-service teachers; Feedback; Prepositions; Quasi-experimental study

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\*Corresponding author: Alba Vargas-Saritama; [abvargas@utpl.edu.ec](mailto:abvargas@utpl.edu.ec)

## 1. Introduction

Prepositions are fundamental grammatical elements in English because they express spatial, temporal, and abstract relationships, ensuring precision and coherence in communication (Greenbaum & Quirk, 1990). Despite their high frequency of use, English prepositions such as *in*, *on*, and *at* remain among the most challenging grammatical features for learners of English as a Foreign Language (EFL) because their meanings are highly context dependent and often involve subtle semantic distinctions (Lindstromberg, 2010). The inaccurate use of prepositions often reduces grammatical accuracy and clarity in written communication.

Recent advances in Artificial Intelligence (AI) have expanded the use of Automated Written Corrective Feedback (AWCF) in second language writing, and AI-powered tools, such as Grammarly, provide immediate, individualized feedback that enables learners to identify and revise grammatical errors during the writing process. Barrot (2023), Mekheimer (2025), and Murtisari et al. (2025) reported positive effects of AI-mediated feedback on grammatical accuracy, writing quality, revision behavior, and learner engagement. Nevertheless, existing research has focused primarily on overall writing performance or general grammatical improvement, with considerably less attention devoted to specific, context-dependent grammatical structures such as English prepositions (Ebadi et al., 2023).

Furthermore, although AI-generated feedback has demonstrated considerable pedagogical potential, literature suggests that automated feedback alone may not be sufficient to address complex grammatical features that require semantic interpretation and contextual reasoning. Rather than replacing teachers, AI tools appear to be most effective when integrated with teacher mediation, whereby instructors help learners interpret automated feedback, clarify grammatical concepts and promote deeper reflection during revision (John & Woll, 2020; Thi & Nikolov, 2022; Luo et al., 2025). However, literature regarding the effectiveness of this combined approach for improving English preposition use remains limited.

Previous research has primarily examined Grammarly in relation to overall writing performance, general grammatical accuracy, or grammatical forms other than prepositions. This evidence does not establish whether automated feedback combined with teacher mediation can support the learning of prepositions whose appropriate selection depends on polysemy, semantic distinctions, and contextual interpretation. Addressing this gap is important because identifying an incorrect preposition does not necessarily provide learners with the conceptual and contextual information required to apply the target forms accurately across different communicative situations.

To address this gap, the present study investigates the learning gains associated with teacher-mediated Grammarly instruction in EFL pre-service teachers' use of the English prepositions *in*, *on*, and *at*. It also examines learners' perceptions of this integrated instructional approach. The study contributes to AI-supported

language learning research by providing form-specific evidence on context-dependent preposition learning within a teacher-mediated Grammarly condition. Its conceptual contribution is to draw on the Noticing Hypothesis and metalinguistic awareness as complementary perspectives for interpreting how learners engage with automated feedback, while positioning teacher mediation as a key pedagogical mechanism supporting feedback interpretation and revision. This contribution is further supported by the integration of pre- and post-test outcomes, repeated performance measures, questionnaire responses, and classroom observations. The following research questions guided the study:

**RQ1:** To what extent does the integration of AI-powered Grammarly, supported by teacher mediation, improve EFL pre-service teachers' accuracy in the use of the prepositions *in*, *on*, and *at*?

**RQ2:** What are EFL learners' perceptions of Grammarly for learning English prepositions?

## 2. Literature Review

This section synthesizes the theoretical and empirical literature that underpins the present study, examining English preposition learning, the challenges faced by EFL learners, corrective feedback, AI-assisted grammar instruction, and the existing evidence on AI-supported language learning.

### 2.1 Challenges Faced by EFL Learners in Mastering Prepositions

According to Tyler and Evans (2003), prepositions are a fundamental grammatical category in English because they express spatial, temporal, and abstract relationships that contribute to clarity and precision in communication. Among the most frequently used prepositions are *in*, *on*, and *at*, mastery of which is essential for grammatical competence in EFL learning. However, despite their high frequency, they are widely recognized as one of the most challenging grammatical categories for EFL learners to master. Tyler and Evans (2003) argue that prepositions are organized as semantic networks composed of prototypical and extended meanings rather than isolated definitions. Therefore, learners cannot rely solely on memorization or direct translation, as a single preposition may convey multiple related meanings in different contexts.

Alhammad (2023), Šeškauskienė and Juknevičienė (2020), and Zhang and Murao (2024) identified *in*, *on*, and *at* as particularly problematic for EFL learners, documenting persistent difficulties in prepositional selection among Saudi, Lithuanian, and Japanese learners, respectively. Their findings also showed that error patterns varied according to learners' linguistic backgrounds. These challenges stem largely from the conceptual distinctions encoded by the prepositions, as *in* typically denotes enclosure, *on* expresses contact with a surface, and *at* refers to a specific point in space or time. Such distinctions become especially difficult when equivalent conceptual mappings are absent or differently represented in learners' first languages.

Several factors contribute to these challenges. Jarvis and Pavlenko (2008) identify cross-linguistic influence as a major source of difficulty, whereby learners transfer semantic and conceptual patterns from their first language into English. Alhammad (2023), and Zhang and Murao (2024) showed that cross-linguistic differences in spatial categorization contributed to inappropriate preposition selection among Arabic-speaking Saudi and Japanese learners. Pan and Hu (2022) further explain that the polysemous nature of English prepositions requires learners to associate multiple related meanings with a single linguistic form rather than establish direct one-to-one correspondences between L1 and L2 structures.

This semantic and cross-linguistic complexity helps explain why such errors may persist after formal instruction. These challenges underscore the need for instructional support that helps learners identify and address prepositional errors, with technology-mediated feedback offering one potential approach to enhance grammatical accuracy in EFL writing.

## **2.2 Automated Written Corrective Feedback and AI-Powered Grammarly**

Automated Written Corrective Feedback (AWCF) has emerged as an important pedagogical approach in EFL writing, providing timely, individualized feedback during text production and revision. Unlike conventional written corrective feedback, which is commonly delivered after task completion, AWCF allows learners to identify, correct, and reflect on linguistic errors while composing, creating ongoing opportunities for revision and form-focused learning. Mujtaba et al. (2021) found that collaborative processing of teacher-provided written corrective feedback supported greater improvement in L2 writing accuracy and revision than individual processing. Although their study did not examine automated feedback, it underscores the importance of learners' active engagement with corrective feedback.

In an AWCF context, Barrot (2023) similarly reported that repeated cycles of error detection, self-correction, and revision contributed to improved L2 writing accuracy. The evidence from these studies positions active feedback processing and revision, rather than automated correction alone, as central to the pedagogical value of AWCF. Within this evolving landscape of AI-mediated writing support, Grammarly has become one of the most widely adopted AWCF tools in EFL education. Unlike conventional grammar checkers, Grammarly combines automated error detection with contextualized suggestions and metalinguistic explanations that encourage learners to reconsider their linguistic choices rather than simply accept corrections (Almashy et al., 2024; Bahari, 2026). Consequently, learners receive adaptive support while revising their texts, making Grammarly particularly valuable for addressing context-dependent grammatical features (Murtisari et al., 2025).

Almashy et al. (2024) found that Grammarly outperformed other CALL tools in correcting local grammatical features, particularly prepositions. Bahari (2026) similarly reported that AI-driven writing support improved learners' grammatical accuracy while reducing cognitive demands during expository writing. Mekheimer (2025), Mujeeb et al. (2026), and Murtisari et al. (2025)

documented improvements in writing quality, revision behavior, and learner engagement, indicating that Grammarly may facilitate more effective self-revision when learners actively process automated feedback rather than passively accept the suggested corrections. Kitbamrung and Chinokul (2026) reported improved writing performance following instruction that combined Google Translate with Grammarly. Through a single-session document analysis, Yawiloeng (2025) identified the types of writing errors present in 27 EFL students' texts before and after Grammarly use and recommended the tool as a supplement to EFL writing instruction.

Most studies on Grammarly have evaluated broad outcomes such as overall writing performance, grammatical accuracy, revision behavior, and learner engagement (Bahari, 2026; Mekheimer, 2025; Mujeeb et al., 2026; Murtisari et al., 2025). Although Almashy et al. (2024) examined Grammarly's correction of prepositional errors, their study focused on the tool's corrective performance rather than learners' acquisition of specific prepositions over time. Consequently, limited evidence is available on whether Grammarly-mediated AWCF supports the learning of context-dependent forms such as *in*, *on*, and *at*, whose polysemous meanings and subtle semantic distinctions remain persistent sources of difficulty for EFL learners (Tyler & Evans, 2003; Pan & Hu, 2022). Examining this issue is necessary to determine whether Grammarly supports not only immediate error correction but also enhances learners' accurate use of these frequently confused prepositions.

### **2.3 Theoretical Mechanisms Underlying AI-Mediated Grammar Learning**

The effectiveness of AI-mediated grammar learning can be understood as a sequence of interconnected cognitive processes through which learners attend to, interpret, and regulate the corrective feedback. Rather than serving solely as an error correction mechanism, Automated Written Corrective Feedback (AWCF) facilitates grammatical development by directing learners' attention to linguistic forms, promoting metalinguistic reflection, and fostering self-regulated revision.

The first mechanism is noticing. Schmidt (1990) proposed that conscious attention to linguistic forms is essential for converting input into intake. In AI-mediated environments, corrective feedback increases the salience of linguistic errors, enabling learners to recognize discrepancies between their production and target language forms. Supporting this view, Barrot (2023) found that AWCF improved writing accuracy through repeated cycles of error detection and revision. ElEbyary et al. (2024) further showed that automated feedback provided by Grammarly, and E-rater elicited learners' error detections, although teacher feedback produced greater noticing than either automated feedback condition.

However, mere noticing is insufficient for lasting learning. Learners must interpret corrective feedback and relate it to the underlying grammatical rules, thereby engaging in metalinguistic reflection. Alam et al. (2026) found that Meta AI-generated metalinguistic feedback produced greater reductions in linguistic errors than direct and indirect feedback and the control condition. This result suggests that explanatory feedback may provide greater support for error

reduction than feedback that only identifies or corrects errors. Repeated engagement with AI-generated feedback may also foster self-regulated learning by encouraging learners to monitor, evaluate, and revise their writing. Using ProWritingAid, Al-Othman (2024) reported that automated feedback supported planning, self-monitoring, and self-evaluation, suggesting that it can provide metacognitive support for reflective regulation during writing tasks. Herda et al. (2026) and Zhai (2026) similarly found that AWCF promoted learner autonomy by encouraging students to assume greater responsibility for monitoring and improving their writing.

Barrot (2023), Alam et al. (2026), Al-Othman (2024), Herda et al. (2026), and Zhai (2026) associate AI-mediated feedback with processes involving noticing, metalinguistic reflection, and self-regulated learning. However, their studies do not establish how these processes support the acquisition of specific grammatical forms. Muñoz and Nassaji (2026) reported benefits of corrective feedback for learning complex linguistic structures, but evidence specific to the highly context-dependent prepositions *in*, *on*, and *at* remains limited. Further investigation is needed to determine how engagement with automated feedback may contribute to sustained accuracy in using these prepositions.

## **2.4 Integrating Grammarly and Teacher Mediation for Effective Preposition Learning**

John and Woll (2020), and Koltovskaia et al. (2026) note that automated grammar checkers can identify linguistic errors and provide immediate feedback but offer limited support for explaining context-dependent language use and errors shaped by semantic complexity or first-language transfer. These limitations are particularly relevant to English prepositions, whose accurate use requires an understanding of conceptual and contextual relationships rather than the selection of isolated linguistic forms. Drawing on the sociocultural account proposed by Poehner and Leontjev (2020), teacher mediation can complement automated feedback by scaffolding learners' interpretation of suggested corrections and gradually supporting more independent performance. In AI-supported environments, this mediation is particularly relevant when learners need to interpret feedback involving contextual or semantic distinctions beyond surface-level correction.

Thi and Nikolov (2022) found that Grammarly and teacher feedback fulfilled distinct but complementary functions: automated feedback facilitated error detection, whereas teacher feedback provided contextualized explanations. Mohammadi et al. (2023) similarly reported that combining teacher feedback with automated writing evaluation produced greater improvements in writing performance than either form of feedback used independently. Luo et al. (2025), Soori et al. (2026), and Zhao (2025) also reported gains in grammatical accuracy, writing quality, and learner engagement when AI-generated feedback was combined with teacher mediation. Ebadi et al. (2023) specifically reported that Grammarly-supported instruction improved learners' use of English articles, while Soori et al. (2026) documented broader benefits from combining automated

feedback with explicit teacher guidance. This pedagogical rationale underpins the instructional design used in the present study.

### 3. Methodology

This section outlines the methodological procedures employed in the study, providing details of the research design, participants, instruments, intervention, data collection, and data analysis.

#### 3.1 Research Design

This longitudinal mixed-methods quasi-experimental design was employed to investigate the effectiveness of AI-powered Grammarly, supported by teacher mediation, in improving EFL pre-service teachers' accuracy in the use of the prepositions *in*, *on*, and *at*. Participants were allocated either to an experimental group which received Grammarly-supported instruction combined with teacher mediation, or to a control group which received conventional grammar instruction. The intervention was implemented over one academic term, enabling participants' development to be examined through pre- and post-test assessments together with repeated instructional activities.

The first research question linked the instructional condition (teacher-mediated Grammarly instruction versus conventional instruction) with the participants' preposition accuracy. Pre- and post-test scores and the five activity records provided the performance measures; baseline and within-group comparisons, Welch's comparison of gain scores, and the linear mixed-effects model addressed complementary aspects of this question. The second research question examined participants' perceptions through a nine-item questionnaire and classroom observation checklist; questionnaire responses were analyzed using frequencies, percentages, and exact binomial tests, while observation records were analyzed descriptively.

#### 3.2 Participants and Context

Participants were 50 first-year EFL pre-service teachers (37 females and 13 males) aged between 18 and 24 years who were enrolled in Reading and Writing I, an introductory course in the English Language Teacher Education program at a private university in southern Ecuador. They attended two English classes per week during the academic semester in which the study was conducted. This study included all students enrolled in two pre-existing parallel groups, with one group serving as the experimental group ( $n = 25$ ) and the other as the control group ( $n = 25$ ). Because the groups had already been established by the university's academic schedule, random assignment of individual participants was not feasible.

To strengthen internal validity and ensure comparability between groups, both were taught by the same instructor, followed the same course syllabus, received the same instructional content targeting the English prepositions *in*, *on*, and *at*, and were allocated the same amount of instructional time throughout the intervention. The only planned difference between the instructional conditions was the integration of Grammarly and teacher-mediated interpretation of its automated feedback in the experimental group. Furthermore, no significant

differences were found between the groups in the pre-test, supporting their initial comparability before the intervention. The study adhered to established ethical principles for research involving human participants. All participants provided informed consent before data collection and were informed about the purpose of the study, the voluntary nature of their participation, their right to withdraw at any time without academic consequences, and the confidential treatment of the collected data. Participation involved no foreseeable physical, psychological, social, or academic risks to the participants. All data were anonymized to protect participants' confidentiality and privacy throughout the research process.

### 3.3 Intervention and Data Collection Procedure

The intervention was conducted over one academic term and followed three stages. First, both groups completed a pre-test assessing their knowledge and use of the target prepositions. Second, the intervention was implemented through five Grammarly-supported instructional activities conducted in a university language laboratory. Students in the experimental group completed Grammarly-supported activities targeting the use of *in*, *on*, and *at*, whereas the control group completed equivalent activities using conventional teacher feedback. Each session lasted for approximately 45 minutes. Teacher mediation was incorporated throughout the intervention to support learners' interpretation of Grammarly's feedback and clarify grammatical concepts. Specifically, the instructor explained Grammarly's automated corrections, discussed the contextual meanings of the target prepositions, answered participants' questions, and guided students in interpreting and revising their writing based on the automated feedback.

The same teaching process was followed across the five instructional sessions to ensure consistency throughout the intervention. In the control group, students completed the same instructional activities and received explicit grammar explanations, guided practice, and teacher-written corrective feedback after task completion, without using Grammarly. Both groups were taught the same content under the same conditions and differed only in the use of Grammarly and its real-time automated feedback. Teacher mediation was systematically incorporated throughout the intervention to ensure consistent implementation across the five instructional activities.

Third, after completing the five instructional sessions, both groups completed the post-test. Participants in the experimental group subsequently completed the perception questionnaire. The observation checklists completed during the five sessions were then compiled for subsequent descriptive analysis.

### 3.4 Instruments

This section describes the instruments used to assess preposition accuracy, monitor performance across the intervention, and document participants' perceptions and classroom engagement.

#### 3.4.1 Pre-test and post-test

A researcher-developed grammar test was designed to assess students' accuracy in using the English prepositions *in*, *on*, and *at* in temporal and spatial contexts in

the target language. The instrument consisted of five equally weighted sections, each contributing two points to a maximum score of 10. The sections included sentence-completion tasks, categorization exercises, picture-based multiple-choice items, matching activities, and contextualized grammar tasks. Together, these sections assessed learners' ability to recognize and accurately apply the target prepositions across a range of temporal and spatial contexts. Content validity was established through expert review by three university EFL professors with expertise in English language teaching, grammar instruction, and language assessment. The experts evaluated the instrument in terms of content relevance, alignment with the study objectives, clarity of instructions, linguistic accuracy, and the appropriateness of the tasks for assessing the target prepositions.

Their recommendations were incorporated to refine the wording of the instructions and several test items prior to administration. The internal consistency of the five sections comprising the instrument was assessed using Cronbach's alpha. The analysis indicated good internal consistency ( $\alpha = .802$ ), supporting the reliability of the instrument for measuring learners' accuracy in the use of the target prepositions. Expert judgments were documented as qualitative recommendations rather than numerical ratings; so a content-validity index was not calculated.

#### *3.4.2 Activity Performance Records*

Learners' performance was monitored through five instructional activities distributed across the 16-week intervention period. The activities were administered at approximately three-week intervals. Each activity required learners to complete contextualized grammar and writing tasks targeting the English prepositions *in*, *on*, and *at*, including sentence-completion exercises, picture-based descriptions, and short contextualized writing tasks. The same activities were implemented in both the experimental and control groups to ensure comparability. In the experimental group, participants completed the activities using Grammarly and revised their writing based on its immediate automated feedback before submission.

In the control group, participants completed the same activities without Grammarly and received conventional teacher feedback after task completion. The activities were implemented at different stages of the course to monitor students' progress and examine the consistency of the instructional effects throughout the intervention. Each activity was scored on a 10-point scale using the same scoring criteria for both groups, with higher scores indicating greater accuracy in using the target prepositions. Performance scores were subsequently analyzed to compare the instructional conditions and examine performance trends across the five activities.

#### *3.4.3 Perception Questionnaire and Classroom Observations*

At the end of the intervention, participants in the experimental group completed a researcher-designed questionnaire consisting of nine dichotomous (Yes/No) items. The questionnaire explored participants' perceptions of Grammarly as a tool for improving the use of English prepositions in writing, focusing on its usability, perceived usefulness, clarity of automated feedback, contribution to

grammar learning, confidence in writing, and support for understanding and applying the target prepositions (*in*, *on*, and *at*). Several items also examined participants' perceptions of the combined use of Grammarly's automated feedback and teacher guidance during the revision process. The questionnaire was reviewed by the same panel of three EFL experts who evaluated the pre- and post-test. Considering that the questionnaire comprised dichotomous items addressing distinct aspects of students' perceptions, rather than a single underlying construct, a global internal-consistency coefficient was not calculated. The reviewers assessed item clarity, content relevance, and alignment with the second research question, and their recommendations were incorporated before administration.

The teacher-researcher conducted classroom observations during each of the five instructional sessions to complement the survey data. The observations were recorded using a structured observation checklist focusing on learners' interactions with Grammarly, their responses to teacher mediation, their engagement with automated feedback, and their application of feedback-based revisions during instructional activities involving the target prepositions. The observation checklist was reviewed by the expert panel for clarity, content relevance, and alignment with the behaviors examined during the intervention, and the reviewers' recommendations were incorporated before its use. Inter-observer agreement was not calculated because the observation records were not produced through independent parallel coding.

### 3.5 Data Analysis

Quantitative data were analyzed using Jamovi (Version 2.7.24). Descriptive statistics, including means, standard deviations, frequencies, and percentages, were calculated to summarize participants' performance and questionnaire responses. Before inferential analyses, the relevant statistical assumptions were examined. Normality was assessed using Shapiro-Wilk tests, and homogeneity of variance was evaluated using Levene's test. Pre-test scores showed no significant departures from normality in either the experimental group ( $W = .982$ ,  $p = .926$ ) or the control group ( $W = .966$ ,  $p = .538$ ), and no significant violation of homogeneity of variance was identified at baseline ( $p > .05$ ).

For the paired pre-test-post-test comparisons, the difference scores showed no significant departure from normality in the experimental group ( $W = .990$ ,  $p = .994$ ), whereas a significant departure from normality was observed in the control group ( $W = .905$ ,  $p = .023$ ). Therefore, a Wilcoxon signed-rank test was additionally conducted for the control group as a sensitivity analysis, confirming that the pre-test-post-test improvement remained statistically significant ( $p < .001$ ). For the between-group comparison of gain scores, Levene's test indicated unequal variances ( $p < .001$ ); consequently, Welch's independent-samples t-test was used.

To address the first research question, inferential analyses were conducted to examine differences between the experimental and control groups. An independent-samples t-test was first used to compare pre-test scores and assess

baseline comparability between groups. Paired-sample t-tests were then conducted separately for each group to examine within-group changes from pre-test to post-test. Given the departure from normality in the control group's difference scores, the Wilcoxon sensitivity described above was used to verify the robustness of the corresponding pre-post result. Gain scores were calculated by subtracting pre-test scores from post-test scores, and Welch's independent-sample t-test was used to compare gain scores between groups because the homogeneity-of-variance assumption was not met. Cohen's *d* was calculated to estimate the magnitude of within-group and between-group differences.

To examine learners' performance across the five instructional activities, a linear mixed-effects model was fitted with instructional condition (experimental vs. control), activity (Activities 1-5), and the Condition  $\times$  Activity interaction as fixed effects, while 'participant' was included as a random intercept to account for repeated measurements. This analysis examined whether performance differed between instructional conditions, whether scores varied across activities, and whether the pattern of performance across activities differed between groups. Given the complementary inferential analyses conducted to address the first research question, the between-group comparison of gain scores was treated as the primary analysis, while the within-group comparisons and the linear mixed-effects model provided supporting evidence. The intervention effects were interpreted based on the convergence of the statistical results and the magnitude of the observed effect sizes rather than on isolated *p*-values.

To address the second research question, responses to the perception questionnaire were analyzed using frequencies, percentages, and two-sided exact binomial tests. For each item, the observed proportion of Yes responses was compared with a null proportion of .50, and 95% Clopper-Pearson confidence intervals were calculated. Given the multiple item-level comparisons, the potential for an increased Type I error rate was acknowledged. The questionnaire analyses were therefore considered exploratory and were interpreted primarily in terms of the overall response pattern rather than the statistical significance of individual items. Statistical significance was established at the .05 level.

Classroom observation data were analyzed descriptively to complement the quantitative findings. The checklist records from the five instructional sessions were organized by session and reviewed to identify recurring patterns in learners' interactions with Grammarly's automated feedback and teacher mediation. The analysis focused on observable behaviors recorded in the structured checklist, including reviewing automated suggestions, revising responses, requesting teacher clarification, and discussing alternative prepositional choices. These recurring patterns were used to contextualize the quantitative performance results and provide complementary evidence of learners' engagement with the AI-supported instructional process.

## 4. Results and Findings

This section presents the findings of the study, organized according to the research questions and integrating quantitative and qualitative evidence where appropriate.

### 4.1 Effects of AI-Powered Grammarly Supported by Teacher Mediation on Learners' Use of English Prepositions

As shown in Table 1, no statistically significant difference in pre-intervention preposition accuracy in using English prepositions was found between the experimental and control groups,  $t(48) = -0.69$ ,  $p = .494$ ,  $d = 0.20$ , supporting the comparability of the groups at baseline

**Table 1: Pre-Intervention Preposition Accuracy of the Experimental and Control Groups**

| Group        | n  | M    | SD   | t     | df | p    | D    |
|--------------|----|------|------|-------|----|------|------|
| Experimental | 25 | 5.58 | 1.93 |       |    |      |      |
| Control      | 25 | 5.91 | 1.42 | -0.69 | 48 | .494 | 0.20 |

*Note: Independent-sample t-test comparing pre-intervention preposition accuracy between the experimental and control groups. Cohen's d indicates the standardized mean difference.*

### 4.2 Learners' Progress in English Preposition Accuracy Throughout the Intervention

Table 2 shows statistically significant pre-test–post-test improvements in both instructional conditions, with large within-group effect sizes. Because the control group's difference scores departed from normality, a Wilcoxon signed-rank sensitivity analysis was conducted and confirmed the control group's improvement,  $p < .001$ . Descriptively, the experimental group obtained a larger mean gain than the control group; the inferential comparison of gain scores is presented in Table 3.

**Table 2: Pre-test and Post-test Performance in English Preposition Accuracy**

| Group        | n  | Pre-test<br>M (SD) | Post-test<br>M (SD) | Gain M<br>(SD) | Paired-<br>sample t-tests | df | p      | Cohen's d |
|--------------|----|--------------------|---------------------|----------------|---------------------------|----|--------|-----------|
| Experimental | 25 | 5.58<br>(1.93)     | 7.73<br>(1.19)      | 2.15<br>(1.88) | -5.72                     | 24 | < .001 | 1.14      |
| Control      | 25 | 5.91<br>(1.42)     | 6.88<br>(1.38)      | 0.97<br>(0.77) | -6.27                     | 24 | < .001 | 1.25      |

*Note. Gain scores were calculated by subtracting pre-test scores from post-test scores. Paired sample tests were conducted separately for each group. Cohen's d values are reported as absolute values.*

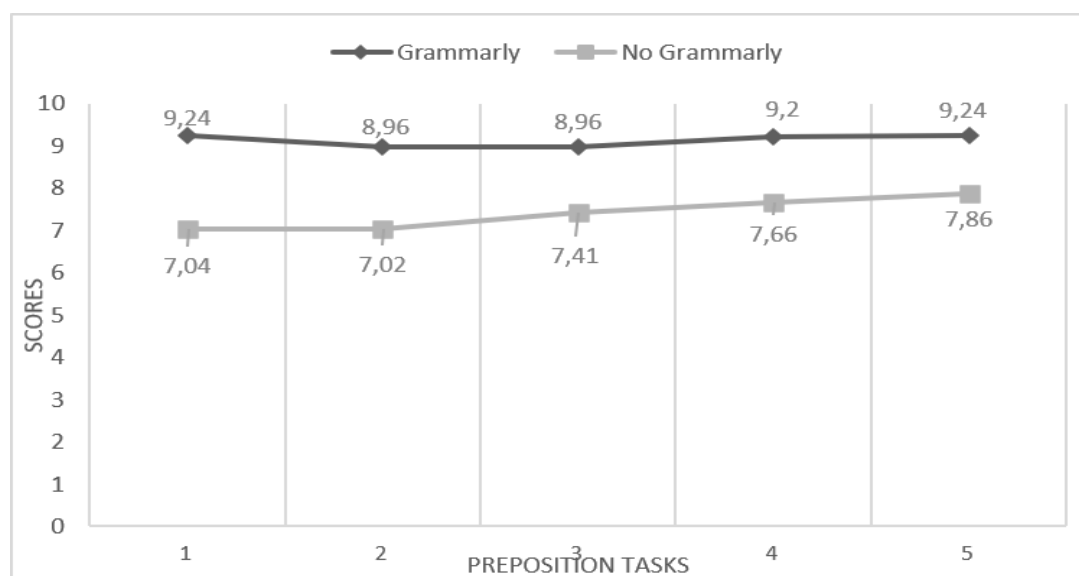
Table 3 shows that the experimental group achieved significantly greater learning gains than the control group, with a large between-group effect. As the primary inferential comparison, this result indicates that the magnitude of improvement differed between the two instructional conditions.

**Table 3: Comparison of Learning Gains Between Experimental and Control Groups**

| Comparison                                | t    | df   | p    | Cohen's <i>d</i> |
|-------------------------------------------|------|------|------|------------------|
| Welch's independent sample <i>t</i> -test | 2.91 | 31.9 | .007 | 0.823            |

Note. Gain scores represent the difference between post-test and pre-test scores. Welch's independent sample *t*-test was used to compare learning gains between groups.

As shown in Figure 1, scores ranged from 8.96 to 9.24 in the experimental group and from 7.02 to 7.86 in the control group, with the experimental group scoring higher across all five activities. The linear mixed model used to evaluate the activity and group patterns is reported in Table 4.



Note. Scores across the 5 instructional preposition tasks

**Figure 1: Learners' performance across the intervention**

As reported in Table 4, the linear mixed-effects model indicated a significant overall effect of instructional condition. In contrast, neither the activity effect nor the interaction between instructional condition and activity was statistically significant. There was thus no evidence of systematic performance change across activities or variation in the between-group difference over the five sessions. The analysis does not distinguish between possible explanations for this pattern, including comparable task difficulty, stable performance, or other instructional factors.

**Table 4: Linear Mixed Model Results for Performance Across Instructional Activities**

| Effect               | <i>F</i> | <i>df</i> | <i>p</i> |
|----------------------|----------|-----------|----------|
| Condition            | 136.30   | 1, 216    | < .001   |
| Activity             | 1.90     | 4, 216    | .111     |
| Condition × Activity | 1.07     | 4, 216    | .371     |

Note. *F* denotes the *F* statistic from the linear mixed model; *df* = numerator and denominator degrees of freedom.

To complement these performance-based results, classroom observations documented how participants engaged with Grammarly-supported instruction across the five sessions. They were observed reviewing Grammarly's automated suggestions and revising their responses accordingly. The observational records also documented instances in which students sought clarification from the instructor when automated suggestions were unclear or when the contextual use of *in*, *on*, and *at* required further explanation. In these instances, the instructor clarified the meaning and appropriate use of the target prepositions and guided participants in interpreting the automated feedback before revision. Participants were also observed discussing alternative prepositional choices during the activities. Thus, while the mixed-model analysis established the pattern of performance across sessions, the observational data documented the instructional processes accompanying participants' engagement with the Grammarly-supported activities

#### 4.3 EFL learners' perceptions of Grammarly-supported preposition learning

Table 5 indicates relatively balanced prior familiarity with Grammarly and an overall favorable pattern across the post-intervention perception items, for which positive responses ranged from 72% to 100%. The strongest endorsement concerned using Grammarly to improve English writing, whereas confidence in presenting written work (76%) and perceived support for understanding preposition rules (72%) received comparatively lower ratings. This variation suggests that participants evaluated the tool's usability and immediate writing support more favorably than its support for confidence and explicit rule understanding. Because the item-level analyses were exploratory and based on self-report, they were interpreted as evidence of perceived usefulness rather than direct learning outcomes.

**Table 5: Survey Results on Learners' Perceptions of Grammarly**

| Statement                                                             | Yes (%)   | No (%)   | p      | 95% CI        |
|-----------------------------------------------------------------------|-----------|----------|--------|---------------|
| Before the intervention, I had heard about Grammarly.                 | 11 (44%)  | 14 (56%) | .690   | [.244, .651]  |
| Using Grammarly to improve English writing is a good idea.            | 25 (100%) | 0 (0%)   | < .001 | [.863, 1.000] |
| Grammarly was easy to use.                                            | 24 (96%)  | 1 (4%)   | < .001 | [.796, .999]  |
| Grammarly provided understandable feedback.                           | 22 (88%)  | 3 (12%)  | < .001 | [.688, .975]  |
| Grammarly helped me improve my English writing.                       | 22 (88%)  | 3 (12%)  | < .001 | [.688, .975]  |
| Grammarly improved my confidence in presenting written work.          | 19 (76%)  | 6 (24%)  | .015   | [.549, .906]  |
| The free version of Grammarly is useful for checking grammar.         | 23 (92%)  | 2 (8%)   | < .001 | [.740, .990]  |
| Grammarly helped me better understand prepositions.                   | 22 (88%)  | 3 (12%)  | < .001 | [.688, .975]  |
| Grammarly helped me better understand grammar rules for prepositions. | 18 (72%)  | 7 (28%)  | .043   | [.506, .879]  |

*Note.*  $n = 25$ . Percentages reflect observed frequencies. Exact two-sided binomial tests compared the proportion of Yes responses with .50; 95% CIs are Clopper-Pearson intervals. Item-level analyses were exploratory.

## 5. Discussion

This section discusses the findings in relation to the research questions and the existing literature, highlighting their theoretical and pedagogical implications.

### 5.1 AI-powered Grammarly and Teacher Mediation in English Preposition Learn

The findings indicate that integrating AI-powered Grammarly with teacher mediation was associated with greater improvement in EFL pre-service teachers' accuracy in using the English prepositions *in*, *on*, and *at*. Although both groups showed significant pre-test-post-test improvement, the between-group analysis confirmed significantly greater learning gains among learners receiving Grammarly-supported instruction. The linear mixed model further showed a significant overall effect of instructional condition, with the experimental group achieving higher performance across the five instructional activities. However, neither the differences across activities nor the interaction between instructional condition and activity reached statistical significance, providing no evidence that performance changed systematically across activities or that the difference between the groups varied significantly across sessions.

The results therefore indicate an overall performance advantage for the experimental condition rather than progressive improvement across individual activities. Nevertheless, the analysis does not determine whether the nonsignificant activity pattern reflected comparable task difficulty, stable performance over time, or other instructional factors. This overall advantage may be associated with the combined instructional support provided through immediate automated feedback, opportunities for revision, and teacher-mediated guidance. This interpretation is particularly relevant given the multiple meanings and context-dependent uses of English prepositions (Tyler & Evans, 2003).

Although repeated practice may have contributed to the improvement observed in both groups, it does not fully account for the greater gains observed in the experimental group, as participants in both groups practiced the same target prepositions across the intervention. A key distinction in the experimental group was the availability of immediate automated feedback during task completion, combined with opportunities for revision and teacher-mediated interpretation of that feedback. This instructional combination may have enabled learners to identify and address prepositional errors at the time they occurred and to reflect on the contextual appropriateness of their linguistic choices.

Previous research has similarly shown that automated corrective feedback can facilitate error detection and revision (Barrot, 2023; Shadiev & Feng, 2024), while the combination of automated and teacher feedback can provide complementary support for learners' writing development (Mohammadi et al., 2023; Thi & Nikolov, 2022). Thus, the experimental group's greater gains may be associated not simply with repeated practice, but with the combination of immediate automated feedback, feedback-based revision, and teacher mediation.

These findings demonstrate that integrating AI-powered Grammarly with teacher mediation significantly improved EFL pre-service teachers' accuracy in using the English prepositions *in*, *on*, and *at*. Learners who received Grammarly-supported instruction achieved significantly greater learning gains than those who received traditional instruction. Furthermore, the absence of a significant interaction between the instructional condition and activity suggests that the advantage associated with Grammarly was observed across the five instructional activities rather than being limited to a specific task. However, this finding should be interpreted with caution, as the non-significant activity effect may also reflect similarities in task difficulty or relatively stable performance across the intervention.

Together, these findings support the effectiveness of integrating AI-powered Grammarly with teacher mediation for improving participants' accurate use of English prepositions. This improvement may be explained by repeated cycles of automated feedback, guided revision, and teacher-mediated reflection, which encouraged participants to identify, correct, and gradually internalize the appropriate use of target prepositions. These results are particularly noteworthy given the complexity of English prepositions, whose multiple meanings and context-dependent use make them especially difficult for EFL learners to master (Tyler & Evans, 2003); these results are likely associated with the instructional conditions experienced by participants during the intervention.

Throughout the intervention, participants repeatedly practiced the target prepositions (*in*, *on*, and *at*) in grammar and writing activities, received immediate automated feedback from Grammarly, revised their texts based on the suggested corrections, and consolidated their understanding through guided discussions with the instructor. This iterative learning process provides continuous opportunities to identify, correct, and reflect on prepositional errors, thereby reinforcing learners' understanding of the target forms. Consistent with previous research, AWCF can support repeated cycles of error detection, self-correction, and revision during the writing process (Barrot, 2023). These findings may also be interpreted through Schmidt's (1990) Noticing Hypothesis, which posits that conscious attention to linguistic forms is a prerequisite for language learning. By highlighting inaccurate uses of the target prepositions, Grammarly may have encouraged participants to notice discrepancies between their own language use and the target forms, thereby supporting conscious attention to prepositional choices during revision.

Classroom observations provided complementary evidence of the processes underlying participants' engagement with automated feedback. Across the instructional sessions, participants were observed reviewing Grammarly's suggestions, revising their responses, seeking teacher clarification when automated feedback was unclear, and discussing alternative prepositional choices. These showed that participants did not simply accept automated corrections but actively engaged with the feedback through revision, questioning, and teacher-supported interpretation. This pattern is consistent with metalinguistic awareness, as participants actively analyzed linguistic forms,

interpreted corrective feedback, and related suggested corrections to underlying grammatical rules. Alam et al. (2026) found that Meta AI-generated metalinguistic feedback produced greater reductions in linguistic errors than direct and indirect feedback. Although their study did not directly measure learners' reflections, the findings support the potential value of explanatory feedback for directing attention to linguistic form. This process can also be linked to Schmidt's (1990) Noticing Hypothesis, according to which conscious attention to linguistic forms is essential for language learning. In the present study, participants' review of Grammarly suggestions, discussion of alternative prepositional choices, and requests for teacher clarification were consistent with these processes of conscious attention and metalinguistic reflection.

The observational evidence also highlights the particular role of teacher mediation in the Grammarly-supported instructional process. Although Grammarly provided immediate corrective feedback, participants sometimes required instructor guidance to understand why specific corrections were appropriate and how the meanings of prepositions varied across contexts. This is particularly relevant because English prepositions involve conceptual distinctions that cannot always be explained through the application of grammatical rules or direct translation.

From a sociocultural perspective, Poehner and Leontjev (2020) argue that guided interaction helps learners construct meaning and internalize linguistic concepts. Likewise, Mohammadi et al. (2023) and Thi and Nikolov (2022) reported that combining automated corrective feedback with teacher mediation can produce stronger learning outcomes than either source of feedback alone. While the quantitative findings showed improvements in preposition accuracy, the questionnaire provided complementary evidence of how participants perceived the combined Grammarly-supported and teacher-mediated intervention.

This finding also raises an important consideration regarding the use of Grammarly in contexts where teacher mediation is not readily available. Although the present study highlights the value of teacher guidance in helping learners interpret context-dependent feedback, it does not establish whether Grammarly alone would provide sufficient support for learning these grammatical forms. This issue is particularly relevant for autonomous or self-directed learning contexts, where learners may interact with automated feedback without immediate pedagogical guidance. Future research should therefore examine whether alternative forms of scaffolding, such as embedded metalinguistic explanations, worked examples, or peer collaboration, can support learners in interpreting automated feedback when direct teacher mediation is unavailable.

## **5.2 Learners' perceptions of Grammarly use in English preposition learning**

The questionnaire revealed an overall pattern of favorable perceptions of Grammarly-supported preposition learning. Despite relatively balanced prior familiarity with Grammarly, participants generally perceived the tool as usable, accessible, and helpful for receiving feedback on their writing. Responses were

comparatively less favorable regarding confidence in presenting written work and support for understanding preposition rules, indicating that acceptance was positive but not uniform across all aspects evaluated. These perceptions are consistent with previous research indicating that immediate automated feedback can encourage learners to review and refine their linguistic choices (Murtisari et al., 2025; Mekheimer, 2025). Nevertheless, because the questionnaire measured self-reported perceptions, these responses should not be interpreted as direct evidence that Grammarly improved writing performance or grammatical understanding.

Three-quarters of the participants perceived Grammarly as supporting their confidence in presenting written work. This perceived support may be related to the opportunity to review and revise texts before submission, which allowed learners to identify and correct grammatical inaccuracies independently. As Zhai (2026) explains, AI-assisted feedback can encourage learners to monitor and regulate their writing processes, while Mujeeb et al. (2026) argue that continuous interaction with automated feedback can increase learners' engagement and sense of control over their language production.

However, these aspects alone do not fully explain participants' positive perceptions. Classroom observations provided additional context by showing that participants discussed Grammarly's automated feedback with the instructor to clarify grammatical rules and resolve uncertainties regarding the contextual use of English prepositions. Rather than relying exclusively on automated suggestions, learners had opportunities to interpret feedback through teacher-guided interaction. Mohammadi et al. (2023) and Thi and Nikolov (2022) emphasize that combining automated and teacher feedback allows learners to benefit from immediate corrective feedback while receiving pedagogical guidance for its interpretation.

Although participants perceived Grammarly as supporting their confidence, the study did not determine whether this perception corresponded to greater independent grammatical competence. The present study did not assess learners' performance after prolonged withdrawal of Grammarly support and therefore cannot determine whether continued use of the tool may lead to dependency on automated feedback. From a pedagogical perspective, AI-supported practice could be complemented with opportunities for learners to apply the target grammatical forms without automated assistance, allowing instructors to monitor the extent to which grammatical knowledge is transferred to independent performance.

Future research should examine whether sustained engagement with Grammarly promotes the internalization and independent use of grammatical knowledge or increases reliance on automated corrective feedback. Although the survey provided useful evidence of participants' overall perceptions of Grammarly, its dichotomous response format limited the depth of information obtained about participants' individual learning experiences. Therefore, the survey findings should be interpreted primarily as indicators of general acceptance and perceived

usefulness rather than as detailed accounts of how learners experienced AI-mediated grammar learning.

## 6. Limitations

Although the findings support the value of Grammarly-assisted instruction, they should be interpreted within the scope of the present study. The intervention was implemented through a quasi-experimental design using pre-existing groups and focused exclusively on the English prepositions *in*, *on*, and *at* in writing among first-year EFL pre-service teachers from a single Ecuadorian university. The findings should be interpreted with caution beyond comparable grammatical targets, learner populations, and educational contexts.

The study also examined Grammarly as a pedagogical tool integrated with teacher mediation rather than evaluating the accuracy of its automated feedback. In addition, the intervention relied on Grammarly's free version, limiting the applicability of the findings to the platform's full functionality. Future research should examine AI-supported grammar instruction across different grammatical targets, language skills, proficiency levels, and educational contexts while comparing the pedagogical contributions of Grammarly's free and premium versions and exploring how teacher mediation shapes learners' interpretation and uptake of AI-generated feedback.

## 7. Conclusion

The teacher-mediated Grammarly instructional condition was associated with greater gains in EFL pre-service teachers' accuracy in using the English prepositions *in*, *on*, and *at*. Participants in the experimental group achieved greater scores and higher performance across the instructional activities than those receiving conventional instruction. The combined provision of immediate automated feedback, revision opportunities, and teacher guidance was associated with this performance advantage; the design does not isolate the contribution of any single component.

Participants generally perceived Grammarly as accessible, easy to use, and useful for receiving feedback on English preposition use. They also perceived the feedback as clear and as supportive of writing, confidence, and preposition learning. These self-reported perceptions suggest the potential value of integrating automated feedback into pedagogically guided instruction, but they do not constitute direct evidence of conceptual understanding.

The findings have pedagogical implications for EFL grammar instruction. Within the conditions examined, Grammarly complemented teacher-guided revision by providing immediate feedback, while classroom observations documented requests for instructor clarification when suggestions or contextual meanings were unclear. Accordingly, automated feedback may be most useful when incorporated into instructional designs that preserve opportunities for contextual explanation and critical evaluation rather than being treated as a stand-alone replacement for teacher expertise.

### Conflict of Interest

The authors declare that they have no conflicts of interest.

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### 9. Use of AI

AI was used to support language editing, improve grammar, enhance clarity, and refine the academic writing style of this manuscript. The AI tools did not contribute to the study design, literature selection, data collection, data analysis, statistical procedures, interpretation of findings, or formulation of conclusions. All scientific content, methodological decisions, data interpretation, and final revisions were conducted and verified by the authors, who assume full responsibility for the accuracy and integrity of the manuscript.

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