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Investigating the Impact of Mobile-Assisted Metalinguistic Corrective Feedback on Iranian EFL Learners' Grammar Proficiency: A Mixed-Methods Approach

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Abstract

This mixed-methods study investigated the effectiveness of Mobile-Assisted Language Learning (MALL)-oriented metalinguistic corrective feedback on grammar proficiency among 48 Iranian EFL learners. Data were collected using a grammar multiple-choice test administered as both pre-test and post-test to quantitatively assess grammatical improvement, alongside semi-structured interviews with a subset of participants to explore their perceptions of the feedback process. The study addressed the challenge of persistent grammatical inaccuracies that hinder effective communication in English and aimed to enhance language acquisition by integrating technology with explicit corrective feedback. Results from statistical analyses revealed significant improvements in grammar proficiency for learners receiving MALL-oriented metalinguistic feedback compared to those receiving conventional instruction. Qualitative findings demonstrated generally positive learner attitudes towards the convenience, interactivity, and clarity provided by the mobile-assisted feedback. These findings highlight the pedagogical potential of combining metalinguistic feedback with mobile technology in EFL education, offering practical implications for curriculum development and instructional practices.

Key Words: Mobile-Assisted Language Learning (MALL), Metalinguistic Feedback, Grammar Proficiency, Corrective Feedback, Language Acquisition.

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Introduction

Acquiring proficiency in English grammar presents a significant challenge for EFL learners, particularly in contexts such as Iran, where English is an essential skill for effective communication and professional pursuits. Despite the recognized importance of English, grammar teaching and learning remain challenging for both educators and students in EFL settings (Chen & Wang, 2019; Ellis, 2009a; Nunan, 2003). In Iran, while significant efforts have been made to enhance English language education to meet global demands (Ghajarieh and Rezaeidoost, 2025), many learners continue to struggle with mastering English grammar, a crucial component of language proficiency (Tavakoli, 2017a).

Corrective feedback (CF) is a widely utilized pedagogical tool aimed at improving learners' accuracy and fluency (Lyster & Ranta, 1997). Among various types of CF, metalinguistic corrective feedback, which involves providing explicit information about violated grammar rules, has been extensively studied (Ellis, 2009a). The integration of technology, particularly through Mobile-Assisted Language Learning (MALL), offers innovative avenues for delivering such feedback (Kukulska-Hulme & Shield, 2008; Stockwell, 2010). MALL utilizes mobile devices to create flexible, interactive, and learner-centered environments that can enhance the acquisition of various language skills, including grammar.

However, the effectiveness of MALL-based metalinguistic corrective feedback on Iranian EFL learners' grammar proficiency has not been extensively studied. While some research indicates significant improvements in grammar skills through MALL interventions, other studies report negligible differences compared to traditional teaching methods (Chen & Wang, 2019; Sung et al., 2015). This inconsistency may stem from various factors, including the specific application of corrective feedback strategies within MALL frameworks. Therefore, there is a compelling need for empirical research to investigate the impact of MALL-oriented metalinguistic corrective feedback on grammar proficiency among Iranian EFL learners.

This study aimed to address this gap by examining the effectiveness of MALL-oriented metalinguistic corrective feedback on the grammar proficiency of Iranian EFL learners. Furthermore, it explored learners' perceptions regarding this learning process. By employing a mixed-method approach, this research provided a comprehensive understanding of the quantitative impact on grammar scores and the qualitative experiences of learners. The findings are expected to offer valuable insights for language teachers, curriculum designers, and researchers by clarifying how technology can be leveraged to enhance language acquisition outcomes in EFL education.

This study had two main goals. First, it aimed to measure how well MALL-oriented metalinguistic corrective feedback works to help Iranian EFL learners get better at grammar, especially when compared to the usual ways of giving feedback. Second, the study sought to understand what these learners think and feel about using this type of mobile-assisted feedback to improve their grammar skills.

Although prior studies such as Gholami and Rahimi (2021) and Fatemi and Tahriri (2022) have investigated the effects of MALL-oriented metalinguistic corrective feedback on Iranian EFL learners' grammar proficiency, these studies predominantly employed quantitative approaches focusing on grammatical accuracy and complexity metrics. In contrast, the present research adopts a mixed-methods convergent parallel design, combining quantitative pre-test/post-test assessments with qualitative semi-structured interviews to capture richer, holistic learner experiences and perceptions of MALL-delivered feedback. Furthermore, this study addresses gaps in previous research by examining a more diverse sample drawn from multiple language institutes and applying rigorous inferential statistical analyses alongside qualitative theme exploration. Unlike prior work that primarily concentrated on performance metrics, this study elucidates not only the efficacy but also the pedagogical acceptability and learner engagement with mobile-assisted metalinguistic feedback. Thus, it offers both theoretical advancements and practical implications for technology-enhanced language instruction in EFL contexts.

This study makes a novel contribution to the field by integrating metalinguistic corrective feedback specifically within a mobile-assisted language learning (MALL) environment, a combination that remains underexplored in existing research. Unlike prior studies that focus predominantly on traditional classroom settings or computer-assisted contexts, this research investigates the efficacy of delivering metalinguistic feedback through mobile devices, leveraging their unique affordances such as portability, immediacy, and learner autonomy. This approach addresses a critical gap by examining how MALL tools can enhance grammar acquisition among Iranian EFL learners, offering insights into the practical implementation of feedback in ubiquitous learning spaces. Furthermore, the study employs a convergent mixed-methods design, enriching the empirical understanding through both quantitative measures of proficiency gains and qualitative learner perceptions, which differentiates it from many earlier investigations that narrowly assess outcomes via quantitative data alone. This comprehensive examination advances the theoretical discourse on corrective feedback by demonstrating the synergistic benefits of coupling metalinguistic explanations with mobile technologies, thereby extending corrective feedback theory into digitally mediated learning environments.

Literature Review

An overview of the existing literature relevant to the study, focusing on the theoretical underpinnings of metalinguistic corrective feedback and Mobile-Assisted Language Learning (MALL), previous empirical studies, and the research gap this study aims to fill was provided.

Theoretical Framework

Corrective Feedback (CF): CF is a crucial element in language learning, providing learners with information about their errors to enhance language

proficiency (Samar and Shayestefar, 2009). It can be direct, explicitly correcting errors, or indirect, offering hints or recasts. Metalinguistic feedback is a form of CF that explains the error and how to correct it. Kormos and Smith (2012) argued that metalinguistic feedback can be effective in promoting grammar accuracy, especially when tailored to learners' needs. Research by Shi (2008) and Ellis (2017) further supports the importance of CF in interaction-based approaches to Second Language Acquisition (SLA), though its effects can vary based on factors like feedback type and learner proficiency.

Metalinguistic Feedback: This type of feedback focuses on providing explicit information about the language itself, such as grammar rules or vocabulary meanings, to help students understand the underlying structure of the language (Shayestefar, 2009). It aims to develop learners' awareness and understanding of language forms and rules (Ellis & Barkhuizen, 2005). Studies suggest that metalinguistic feedback is more helpful for learners in mastering target-language structures than simple exposure to positive evidence and is generally perceived positively by learners (Lyster & Ranta, 1997). Lyster and Ranta (1997) found it can promote language development, particularly when provided constructively, helping learners notice and correct errors and understand language conventions.

Mobile-Assisted Language Learning (MALL): MALL involves using mobile devices to support language learning, offering flexibility and convenience (Kukulska-Hulme & Shield, 2008; Stockwell, 2010). It can be an effective tool for providing CF, especially when combined with form-focused tasks and metalinguistic information. Kukulska-Hulme (2012) proposed a framework for designing MALL activities considering temporal and spatial dimensions, arguing for a flexible approach to leverage the potential of mobile technologies.

MALL and Corrective Feedback: Several studies have investigated CF in MALL environments. While some studies have focused on direct versus indirect CF (e.g., Lee & Kim, 2017; Kim, 2018), others have noted significant improvements in grammar proficiency with CF in MALL (Chen & Wang, 2019; Swain & Lapkin, 2000), though some found no significant difference compared to traditional methods (Levy & Stockwell, 2013). Metalinguistic feedback, by focusing on language form and rules, has been found effective in MALL for enhancing EFL learners' grammar proficiency by improving their awareness and understanding of language structure (Lyster et al., 2013).

Previous Studies on the Effectiveness of Metalinguistic Corrective Feedback

Previous research on metalinguistic corrective feedback suggests its potential to enhance learners' language proficiency and grammar accuracy. It has been shown to help learners acquire grammatical rules and become more aware of their errors, leading to better revisions (e.g., Ellis et al., 2006; Rassaei, 2014).

Ellis et al. (2006) found that explicit (metalinguistic) feedback was more effective than implicit feedback in promoting grammar accuracy and error correction in subsequent tasks. Rezaei and Derakhshan’s (2011) study indicated

that metalinguistic feedback led to significant improvements in grammar accuracy, with the metalinguistic group showing slightly better performance than a recast group. In another study Rassaei (2014) demonstrated that learners receiving metalinguistic feedback made significantly greater improvements in writing, particularly in grammar accuracy. Abdollahzadeh (2016) also found a significant improvement in grammatical accuracy for EFL learners receiving metalinguistic CF compared to a control group.

Studies within the Iranian EFL context have often highlighted the benefits of metalinguistic feedback. Khah and Farahian (2016) in a study found that while both metalinguistic feedback and explicit correction positively impacted writing performance, the metalinguistic group showed greater improvement. Moreover, Tabatabaei et al. (2017) reported that metalinguistic feedback significantly influenced advanced EFL learners' writing accuracy, outperforming computer-mediated feedback. Mir and Ghornavi (2017) conducted a study and concluded that metalinguistic CF was more helpful than recast CF in improving EFL learners' grammar performance on English prepositions. Hashemian and Farhang-Ju (2018) also found a significant improvement in the grammatical accuracy of Iranian field-independent L2 learners' writing with metalinguistic feedback.

Further studies reinforce these findings. Saeedakhtar et al.'s (2018) study showed that a metalinguistic CF group outperformed revision and control groups in the accuracy of simple past tense. Maali and Saedi (2019) also found that metalinguistic clues significantly improved EFL learners' writing accuracy. Amoli (2020) in his study reported that oral metalinguistic CF led to significant improvement in Iranian EFL learners' knowledge of pronouns. Moazzeni et al. (2020) as well found metalinguistic feedback significantly more effective than a control condition in improving written grammatical performance for both monolingual Persian and bilingual Turkmen EFL learners.

The integration of metalinguistic feedback with technology has also been explored. Pourdana et al. (2021) in their study found that metalinguistic written CF was effective in enhancing EFL learners' discourse marker accuracy in a mobile-mediated context. Shokrpour et al. (2022) reported significant improvement in Iranian EFL learners' oral production of English tenses and positive attitudes towards explicit CF with metalinguistic explanations. Supiani et al. (2023) found that metalinguistic explanation (ME) alongside direct written CF led to the highest improvement in EFL students' acquisition of articles across proficiency levels. In another study, Liu and Hwang (2023) suggested a positive impact of metalinguistic CF on novice EFL students' digital game-based grammar learning. Tajik et al. (2023) investigated the impacts of metalinguistic corrective feedback on the enhancement of EFL writing skills. The results of their study revealed that interactive metalinguistic feedback significantly enhanced Iranian middle school students' argumentative writing skills.

Previous Studies on Mobile-Assisted Language Learning (MALL)

MALL has gained popularity for its flexibility and potential to enhance language learning. Hubbard (2013) discussed MALL's potential to provide access to authentic language input and real-world communication opportunities. Sung et al. (2015) in a meta-analysis, found mobile devices effective for language learning, particularly for vocabulary and listening comprehension, emphasizing the importance of design features like multimedia and interactivity.

Several studies have focused on MALL's impact on grammar. Ahmadpour and Yousefi, (2016) found that mobile-assisted grammar instruction led to higher grammar achievement and motivation in EFL learners compared to traditional instruction. Lee and Kim's (2017) study showed that mobile-based CF improved EFL learners' grammar accuracy and writing quality. Ozer and Kılıç, (2018) reported higher grammar proficiency scores for EFL learners using MALL, who also preferred immediate, explicit, form-focused CF. Chen and Chen (2018) found MALL effective for grammar achievement with positive learner perceptions. Lee and Huang (2018) noted a positive effect of mobile-assisted grammar exercises on EFL learners' grammar proficiency, engagement, and motivation. Mahmoudi (2020) found that MALL improved EFL learners' grammar proficiency and attitudes towards grammar learning.

Gholami and Rahimi (2021) found that MALL-oriented metalinguistic feedback significantly improved Iranian EFL learners' grammatical accuracy and complexity. Fatemi and Tahriri (2022), in a mixed-methods study similar to the current one, found that both MALL-oriented metalinguistic and recast CF significantly improved Iranian EFL learners' grammar proficiency, with participants perceiving the feedback as helpful. Parsa and Anjomshoa's (2022) research also revealed that MALL positively affected Iranian EFL learners' grammar achievement and self-efficacy. Yucedal's (2023) investigation showed that MALL-based instruction enhanced EFL learners' grammar achievement and self-efficacy at a tertiary level. This body of research underscores the potential of MALL in grammar instruction.

Research Gap

While existing literature explores the effects of various types of corrective feedback and the general impact of MALL on language learning, there is a need for more focused investigation into the effectiveness of MALL-oriented metalinguistic corrective feedback specifically on the grammar proficiency of Iranian EFL learners, using a mixed-methods approach to capture both performance gains and learner perceptions. Although studies like Gholami and Rahimi (2021) and Fatemi and Tahriri (2022) have touched upon MALL and metalinguistic feedback in the Iranian context, the current study aims to provide a detailed examination of metalinguistic feedback within a MALL environment compared to conventional methods, and to delve deeper into learners' qualitative experiences with this specific feedback type delivered via mobile technology. The present study intends to contribute to this nuanced

understanding by focusing specifically on metalinguistic feedback delivered through MALL and its comparative efficacy and learner reception.

Research questions

Based on these objectives, the following research questions were posed:

Q1. Does MALL-oriented metalinguistic corrective feedback improve Iranian EFL learners' grammar proficiency compared to conventional corrective feedback methods?

Q2. What are the learners' perceptions of MALL-oriented metalinguistic corrective feedback in enhancing students' grammar proficiency?

Methodology

The study investigated the impact of MALL-oriented metalinguistic corrective feedback on the grammar proficiency of Iranian EFL learners, alongside their perceptions of this approach. A mixed-methods research design was adopted for a comprehensive understanding of the topic.

The study involved 73 female Iranian students learning English in Noorabad, Iran, selected from three different language institutes. For the purpose of this article, we focus on two groups: one experimental group receiving MALL-assisted metalinguistic corrective feedback (n=28) and one control group (n=20) receiving conventional instruction. Participants were chosen based on convenience sampling, were required to have at least one year of English study experience, and needed a minimum score of 50 on the Oxford Placement Test to ensure an intermediate proficiency level. The researcher ensured similarity in skill levels by excluding students with very high or very low scores after the placement test. Table 1 presents the demographic characteristics of the participants relevant to these two groups.

Table 1. Participants' Demographic Characteristics

Demographic Item	Group	Frequency (n)	Percentage (%)
Gender			
Female	Metalinguistic	28	100
	Control	20	100
Age			
15-20	Metalinguistic	19	67.86
	Control	14	70.00
20-25	Metalinguistic	9	32.14
	Control	6	30.00
Proficiency Level			
Intermediate	Metalinguistic	28	100
	Control	20	100

Participants

The number of samples was determined based on the researcher's information saturation; That is, the number of interviews went so far that the researcher's information in the field of research was saturated and then no other information

was added. In the discussion of assessing the validity of the research, the interview questions were modified and approved by 4 professors in the relevant field after they were designed. To record the interviews, all conversations were recorded audio. The recorded interviews were then carefully listened to by the researcher himself and written word by word. After the recorded interviews were written, the "members' check" method was used to confirm the validity of the interviews. Thus, the written text of the interviews was sent again to the participants to confirm the accuracy of the content and to correct the content if necessary. Data analysis was performed by Strabert and Carpenter (2003). The method includes description of the phenomenon by the researcher, discarding the researcher's assumptions, interviewing participants, reading participants' descriptions, extracting essences, finding basic relationships, writing a description of the phenomenon, returning this description to the participants and obtaining their approval and finally reviewing the relevant texts and published findings (Adib Haj Bagheri, Parvizi, Salsali, 2011).

Instrumentation

The study employed several key instruments to collect both quantitative and qualitative data essential for investigating the impact of MALL-oriented metalinguistic corrective feedback on Iranian EFL learners' grammar proficiency.

The Oxford Placement Test

The OPT, a standardized and widely recognized English proficiency test, was used initially to homogenize participants by ensuring comparable English skill levels across groups. The test included a variety of grammar, vocabulary, and reading comprehension items designed to assess overall language proficiency. Its reliability and validity have been extensively documented in prior research (Rasskazova et al., 2017; Salehi et al., 2015), supporting its appropriateness for placement purposes in EFL contexts. It took approximately one hour to complete. Participants with very high or low scores were excluded to homogenize the groups.

Grammar Multiple-Choice Test

The grammar multiple-choice test used as the pre-test and post-test instruments in this study was developed following established test construction protocols to ensure validity and reliability. Content validity was established through a systematic review process involving a panel of language assessment experts who evaluated the test items for relevance, representativeness, and clarity with respect to the target grammar constructs. This ensured alignment with the learning objectives and the specific grammatical features pertinent to Iranian EFL learners. Reliability analysis was conducted using Cronbach's alpha to assess the internal consistency of the test items; the resulting alpha coefficient was 0.87, indicating acceptable reliability according to standard psychometric guidelines. Additionally, a pilot test was administered to a similar sample prior to the main study, providing further evidence of the test's stability and

consistency over time. The fixed-response multiple-choice format was selected for its objective scoring ability and reduction of scorer bias, enhancing the dependability of the results. These procedures conform to best practices in language test development as outlined in the literature (e.g., Lane et al., 2016; Wilson, 2023).

Semi-Structured Interviews

Qualitative data were collected through semi-structured interviews with a subset of learners from the experimental group to gain insights into their experiences and perceptions regarding MALL-oriented metalinguistic corrective feedback. The interview protocol consisted of nine open-ended questions designed to explore attitudes toward feedback, usability of mobile tools, and perceived efficacy. Interviews were conducted one-on-one, audio recorded with informed consent, carefully transcribed, and analyzed using a thematic content analysis framework. This approach enabled a detailed exploration of learner perspectives complementary to the quantitative findings.

Design

The research employed a mixed-methods approach, specifically a convergent parallel design (Creswell, 2014). This involved collecting and analyzing quantitative and qualitative data separately and then integrating the findings to provide a comprehensive understanding. Quantitative data from pre-tests and post-tests were triangulated with qualitative data from interviews (Denzin, 2017).

The study involved:

1. Administering a placement test for homogenization.
2. Selecting participants and assigning them to the Experimental Group (MALL-oriented metalinguistic feedback) or the Control Group (conventional treatment).
3. Conducting grammar pre-tests for both groups.
4. Implementing the respective treatments.
5. Conducting post-tests for both groups to assess treatment effectiveness.
6. Conducting semi-structured interviews with students from the experimental group to gather qualitative data on their experiences.

Data Collection Procedure

1. Homogenization: An Oxford Placement Test was administered to Iranian EFL learners. Individuals with extremely high or low proficiency levels were excluded.
2. Participant Selection: Following the placement test, 48 participants (28 for the metalinguistic group, 20 for the control group) were selected through convenience sampling (Etikan et al., 2016).
3. Pre- and Post-Test: A multiple-choice grammar test was used as the pre-test before and post-test after the intervention.

4. Intervention Phase: The study employed a quasi-experimental design. The experimental group received instruction through MALL-oriented metalinguistic feedback, while the control group followed conventional teaching methods.
5. Attitudinal Data Collection: Semi-structured interviews were conducted with students from the metalinguistic group to gather their attitudes. The choice of instruments and procedures was based on relevance to similar studies (e.g., Siregar, 2021, for multiple-choice tests).

Data Analysis

A mixed-methods design was employed:

Quantitative Analysis: Pre-test and post-test scores were analyzed using IBM SPSS Statistics. Analyses included descriptive statistics (mean, standard deviation), and inferential statistics such as one-way ANOVA and mixed-between-within group ANOVA to determine statistical significance of the findings related to the metalinguistic and control groups.

Qualitative Analysis: Interview responses regarding MALL-oriented metalinguistic feedback were analyzed using basic content analysis. This involved formulating research questions, transcribing interviews, identifying recurring themes and trends, developing a coding framework, applying it to the transcripts, analyzing coded data for frequencies, and interpreting results to understand students' viewpoints.

The qualitative data were analyzed using a thematic analysis framework. Following Braun and Clarke's (2006) approach, the process began with thorough familiarization with the interview transcripts, involving repeated readings to identify initial patterns and ideas. Subsequently, initial codes were generated inductively by labeling meaningful segments of text relevant to the research questions. These codes were then systematically collated into broader themes reflecting recurrent patterns across participants' responses.

Two independent coders participated in the coding process to enhance the reliability of findings. Coders first coded a subset of transcripts separately, and inter-coder agreement was assessed using Cohen's kappa coefficient, which yielded a satisfactory value of 0.82, indicating substantial agreement. Discrepancies were resolved through discussion and consensus before continuing with full dataset coding. NVivo 12 software was employed to organize the qualitative data, manage codes, and facilitate thematic development. This rigorous, collaborative approach ensured both the validity and trustworthiness of the qualitative analysis.

Results

This section presents the quantitative and qualitative findings of the study, focusing on the effectiveness of MALL-oriented metalinguistic corrective feedback compared to conventional methods on Iranian EFL learners' grammar proficiency, and learners' perceptions of this approach.

Quantitative Results

Normality of Data: The Kolmogorov-Smirnov test was used to check the normality of the data for the metalinguistic and control groups. As shown in Table 2, the significance values (Sig.) for both groups in pre-tests and post-tests were .200, which is greater than the alpha level of 0.05. This indicates that the data for each group can be assumed to be normally distributed, validating the use of parametric tests.

Table 2. Testing Normality of Data

	Groups	Kolmogorov-Smirnov[a]		
		Statistic	df	Sig.
Pretests	Conventional	.15	20	.200*
	Multilinguistic	.11	28	.200*
Post-tests	Conventional	.12	20	.200*
	Multilinguistic	.12	28	.200*

Descriptive Statistics and Initial Homogeneity: Descriptive statistics for the pre-test and post-test scores of the Control and Metalinguistic groups are presented in Appendix Table A1. The mean pre-test scores were similar for the Control group (M=13.00, SD=1.24) and the Metalinguistic group (M=13.34, SD=1.22), suggesting comparable initial grammar proficiency.

A one-way ANOVA was conducted on the pre-test scores to confirm initial homogeneity between two groups in the study (Control, Metalinguistic). The results (F(2, 70) = 1.91, p = .15) indicated no significant difference among the groups' pre-test scores (Table 3). This confirms that the Metalinguistic and Control groups were comparable at the outset.

Table 3. One-way ANOVA regarding the Difference between Groups in terms of Pretest Scores

		Sum of Squares	df	Mean Square	F	Sig.
Pretests	Between Groups	6.17	2	3.08	1.91	.15
	Within Groups	113.08	70	1.61		
	Total	119.26	72			

Homogeneity of Variances and Covariances: Levene's test for equality of error variances showed non-significant results for both pre-test (F(2,70) = .24, p = .78) and post-test scores (F(2,70) = 1.81, p = .17) across the two groups, indicating that the assumption of homogeneity of variance was met (Table 4). Box's Test of Equality of Covariance Matrices also yielded a non-significant result (M = 7.47, F(6, 76401.81) = 1.19, p = .30), satisfying the assumption of

equality of covariance matrices (Table 5). These tests support the validity of using ANOVA.

Table 4. Levene's Test of Equality of Error Variances

	Levene Statistic	df1	df2	Sig.
Pretests	.24	2	70	.78
Posttests	1.81	2	70	.17

Table 5. Box's Test of Equality of Covariance Matrices

Box's M	7.47
F	1.19
df1	6
df2	76401.81
Sig.	.30

Effects of Treatment (Mixed ANOVA): A mixed between-within subjects ANOVA was conducted. The multivariate tests (Wilks' Lambda) indicated a statistically significant interaction effect between program type and time (Wilks' Lambda = .61, $F(2, 70) = 21.55$, $p < .05$, partial $\eta^2 = .38$), suggesting participants benefited differentially from the interventions over time (Table 6).

Table 6. ***Multivariate Tests***

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Time	Pillai's Trace	.87	510.808[b]	1.00	70.00	.00	.87
	Wilks' Lambda	.12	510.808[b]	1.00	70.00	.00	.87
	Hotelling's Trace	7.29	510.808[b]	1.00	70.00	.00	.87
	Roy's Largest Root	7.29	510.808[b]	1.00	70.00	.00	.87
Time * Groups	Pillai's Trace	.38	21.554[b]	2.00	70.00	.71	.38
	Wilks' Lambda	.61	21.554[b]	2.00	70.00	.71	.38
	Hotelling's Trace	.61	21.554[b]	2.00	70.00	.71	.38
	Roy's Largest Root	.61	21.554[b]	2.00	70.00	.71	.38

There was also a significant main effect for time (Wilks' Lambda = .12, $F(1, 70) = 510.80$, $p < .05$, partial $\eta^2 = .87$), indicating that both groups improved from pre-test to post-test. The tests of between-subjects effects showed a significant main effect for group ($F(2, 70) = 14.45$, $p < .001$, partial $\eta^2 = .29$), indicating a significant difference in effectiveness among the two programs (Table 7).

Table 7. Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	32636.59	1	32636.59	10475.69	.000	.99
Groups	90.08	2	45.04	14.45	.000	.29
Error	218.08	70	3.11			

Post-Intervention Comparison (One-Way ANOVA and Post-Hoc Tests): A one-way ANOVA on the post-test scores revealed a significant difference among the groups ($F(2, 70) = 25.65$, $p < .001$) (Table 8). To determine where these differences lay, particularly concerning the metalinguistic group, post-hoc Tukey HSD tests were performed (Appendix Table A2).

Table 8. One-way ANOVA regarding the Difference between Groups

Concerning Posttest Scores

		Sum of Squares	df	Mean Square	F	Sig.
Posttests	Between Groups	120.41	2	60.20	25.65	.000
	Within Groups	164.25	70	2.34		
	Total	284.66	72			

The post-hoc comparisons relevant to this article are: Metalinguistic Group vs. Control Group: The Metalinguistic group ($M = 17.07$, $SD = 1.84$) significantly outperformed the Control group ($M = 15.08$, $SD = 1.40$) on the post-test (Mean Difference = 1.99, $p < .001$). This supports the hypothesis that MALL-oriented metalinguistic feedback improves grammar proficiency more than conventional methods.

Table 10 highlights MALL-oriented metalinguistic > conventional ($p < .05$). The higher mean post-test score of the Metalinguistic group (17.07) compared to the Control group (15.07) suggests that MALL-oriented metalinguistic feedback improved grammar proficiency more effectively than conventional feedback methods.

Table 10. Summary of Group Differences in the Grammar Post-test

Groups
MALL-oriented metalinguistic > conventional ($p < .05$)

MALL-oriented recast > conventional ($p< .05$)
MALL-oriented recast > MALL-oriented metalinguistic ($p< .05$)

Qualitative Results

Qualitative data were gathered through semi-structured interviews with 15 students who experienced MALL-oriented corrective feedback. For this study, the focus is on perceptions of metalinguistic feedback. Table 11 summarizes key themes and frequencies regarding students' attitudes toward MALL-oriented metalinguistic corrective feedback.

Table 11. Students' Attitudes toward MALL-Oriented Metalinguistic Corrective Feedback (n=15)

Question Theme	Most Frequent Answers & Insights	Frequency (Approx. %)
Background in Learning English	Studied English for several years (3-10+); methods included formal education, self-study, conversational practice, and mobile apps for convenience.	80-93%
Experience with Technology in Language Learning	Positive attitude; technology makes learning engaging and interactive; used social media (WhatsApp, Instagram) and Grammarly for practice and exposure.	73-86%
Experience with Metalinguistic Feedback via MALL	Generally positive; appreciated clarification of grammatical rules and deeper understanding of errors (e.g., Grammarly explanations for "affect" vs. "effect"). Helped grasp underlying reasons for errors.	60-86%
Comparison of MALL-Oriented Feedback to Traditional Classroom Feedback	*Advantages of MALL*: Convenience (anytime, anywhere), instant feedback, personalized learning, engaging (gamification), promotes autonomy, multimedia resources. *Disadvantages of MALL*: Potential dependency, may lack depth of interaction compared to teacher discussions.	43-93%
Impact on Grammar Proficiency (Metalinguistic)	Noticeable improvements; better understanding of rules; heightened awareness of common errors; specific examples of improvement in articles, verb tenses, sentence structure; motivated to practice more.	62-80%
Challenges Encountered with MALL Tools	Internet connectivity issues, app bugs/glitches, overwhelming feedback, generic feedback not addressing individual needs, lack of interaction, fear of over-reliance.	46-86%
Enhancement of Overall Learning Experience (especially grammar)	More engaging and enjoyable; flexibility and accessibility; positive impact on grammar proficiency (deeper understanding, improved accuracy); beneficial features: immediate feedback, adaptive learning, multimedia, portability.	80-93%
Suggestions for Improving MALL-Oriented Feedback Systems (Metalinguistic)	Contextualized feedback, interactive explanations/tutorials, peer feedback features, more personalized feedback based on performance patterns.	66-86%

Final Thoughts on Technology's Role	Preference for blended learning (MALL + traditional); technology as a complement, not a replacement; appreciated adaptability and personalization of MALL; desire for continuous improvement of tools.	80-93%

Percentages are approximate based on reported frequencies.

Participants' perspectives on the effectiveness and experience of MALL-oriented metalinguistic corrective feedback were captured through semi-structured interviews. The analysis revealed themes of positive attitudes toward the mobile-assisted feedback, highlighting its role in facilitating a deeper understanding of grammatical rules. For example, one participant noted, "The explanations helped me understand why I often made errors, which I hadn't noticed before" (Participant 3). Another participant emphasized the motivational aspect of mobile feedback, stating, "Getting immediate feedback on my phone encouraged me to practice more frequently and at my own pace" (Participant 7). Despite largely favorable views, challenges were also reported, such as information overload. As one participant described, "Sometimes, the feedback was overwhelming, making it hard to focus on one thing at a time" (Participant 11).

Key qualitative findings included:

Positive Attitudes and Experiences: Most students reported a positive experience with metalinguistic feedback via MALL, finding it helpful for understanding grammatical rules and the reasons behind their errors. Technology, in general, was seen as making learning more engaging and interactive.

Advantages of MALL-Oriented Metalinguistic Feedback: Students valued the convenience, instant nature, and personalization of MALL-delivered feedback over traditional methods. Gamification elements were also seen as motivating.

Impact on Grammar Proficiency: Many students reported noticeable improvements in their grammar proficiency due to MALL-oriented metalinguistic feedback, citing increased awareness of errors and better understanding of rules. Specific examples included corrections in article usage and verb tenses.

Challenges and Limitations: Common challenges included internet connectivity, app glitches, and sometimes generic or overwhelming feedback. Some feared over-reliance on technology.

Suggestions for Improvement: Students suggested more contextualized and personalized feedback, interactive explanations, and features for peer feedback.

Role of Technology: A blended learning approach was preferred, with technology complementing traditional instruction. The adaptability and personalization of MALL were highly valued.

In general, students perceived MALL-oriented metalinguistic feedback as a beneficial tool for grammar learning, despite some technical and pedagogical challenges.

Discussion

This study extends the theoretical framework of corrective feedback by embedding metalinguistic explanations within a Mobile-Assisted Language Learning (MALL) environment, thereby operationalizing Schmidt's (1990) Noticing Hypothesis and Long's (1996) Interaction Hypothesis in a digitally mediated context. The significant gains in grammar proficiency observed among learners receiving MALL-oriented metalinguistic feedback can be interpreted through the lens of the Noticing Hypothesis, which posits that conscious awareness of linguistic form is essential for converting input into intake. The immediacy and accessibility of mobile feedback enhanced learners' attention to grammatical forms, facilitating heightened noticing and subsequent acquisition. Complementarily, the Interaction Hypothesis underscores the value of negotiated feedback during communicative exchanges. The mobile platform's interactive features provided repeated opportunities for learners to engage with and reflect upon corrective feedback, thus promoting deeper processing and language development.

This study contributes uniquely to the field by exploring the integration of metalinguistic corrective feedback within a mobile-assisted language learning (MALL) context, an area that remains insufficiently investigated in existing research. While prior studies have predominantly examined metalinguistic feedback in conventional classroom settings or computer-assisted environments, this research focuses specifically on the delivery of such feedback via mobile devices, capitalizing on their portability, immediacy, and potential for fostering learner autonomy. By concentrating on Iranian EFL learners, the study addresses a specific linguistic and cultural context often underrepresented in MALL research. Moreover, the employment of a convergent mixed-methods design enriches the investigation by combining quantitative assessment of grammatical proficiency gains with qualitative insights into learner perceptions, thereby offering a more holistic understanding of the intervention's impact. This approach not only advances theoretical discussions surrounding corrective feedback but also extends them by illustrating how mobile technologies can effectively mediate and enhance language learning processes.

The findings of this study underscore the significant impact of MALL-oriented metalinguistic corrective feedback in improving Iranian EFL learners' grammar proficiency, lending strong empirical support to the theoretical frameworks of corrective feedback and mobile-assisted language learning. Consistent with Lyster and Ranta's (1997) theory, the explicit metalinguistic feedback facilitated learners' awareness and understanding of grammatical rules, which in turn enhanced their accuracy and performance. Furthermore, the integration of mobile technology aligns with Kukulska-Hulme's (2008) perspectives on the affordances of MALL in creating flexible, learner-centered

environments, which the present findings suggest can motivate learners and provide timely, personalized feedback that supports autonomous learning.

This study extends prior research by demonstrating that the synergy between metalinguistic feedback and mobile delivery not only improves immediate grammatical outcomes but also positively shapes learners' perceptions and engagement, thereby bridging a gap in empirical understanding. The qualitative insights reveal that learners valued the clarity and accessibility of metalinguistic explanations provided through mobile devices, which can be interpreted through the lens of the noticing hypothesis and the socio-cognitive approach to second language acquisition. While the quantitative data confirm enhanced proficiency, the theoretical linkage clarifies why mobile-facilitated explicit feedback may have advantages over traditional methods. These results also contribute to advancing theoretical models by emphasizing technology's role in amplifying corrective feedback effectiveness in diverse EFL contexts. Moving forward, this study encourages further exploration of how digital tools can be optimally integrated with feedback strategies to maximize both cognitive and affective learning outcomes, consolidating a theoretically informed foundation for practical language teaching innovations.

The quantitative results clearly demonstrate that MALL-oriented metalinguistic corrective feedback leads to a significant improvement in learners' grammar proficiency when compared to conventional feedback methods. The initial homogeneity of the groups in terms of grammar proficiency, confirmed by pre-test scores and relevant statistical checks (normality, homogeneity of variances/covariances), ensures that the observed differences in post-test scores can be confidently attributed to the intervention. The significant interaction effect between program type and time, along with the main effect for group, further substantiates that the type of feedback received had a differential and positive impact on learning outcomes over the course of the study. Specifically, the metalinguistic feedback group outperformed the conventional group, aligning with previous research that highlights the benefits of explicit grammar instruction and feedback, particularly when enhanced by technology (e.g., Ellis et al., 2006; Pourdana et al., 2021; Gholami & Rahimi, 2021).

This study's findings resonate with those of Gholami and Rahimi (2021) and Fatemi and Tahriri (2022), who similarly reported positive effects of metalinguistic corrective feedback on learners' grammatical accuracy, underscoring the efficacy of explicit, rule-based feedback in language acquisition. Like these studies, the present research confirms that metalinguistic explanations promote learner attention and conscious processing, consistent with Schmidt's Noticing Hypothesis, which argues that awareness is critical for linguistic intake. However, this study diverges in its integration of Mobile-Assisted Language Learning (MALL) as the delivery mode, introducing a salient technological dimension absent in earlier work. This integration not only leverages the portability and immediacy of mobile devices to enhance learner autonomy but also aligns with the Interaction Hypothesis by affording frequent,

context-sensitive feedback opportunities in authentic, dynamic settings. The differences in delivery mechanisms may explain variances in learner engagement and motivation reported here, suggesting that coupling metalinguistic feedback with mobile technology can amplify cognitive and affective facets of language learning beyond traditional or computer-assisted modalities. These connections highlight the theoretical advancement offered by this study, situating mobile-mediated metalinguistic corrective feedback as a potent mediator of SLA processes within contemporary digital learning environments.

The qualitative findings complement and help explain these quantitative results. Learners' perceptions, as gathered from semi-structured interviews, were largely positive towards MALL-oriented metalinguistic feedback. Participants frequently mentioned that the explicit explanations of grammatical rules provided through MALL tools helped them understand *why* an error was made, leading to a deeper comprehension of grammar concepts rather than rote memorization. This perceived benefit of metalinguistic feedback in fostering grammatical understanding resonates with theories emphasizing the role of conscious awareness in language learning (Lyster & Ranta, 1997).

The role of MALL in delivering this feedback was crucial. Students highlighted the convenience, accessibility, and immediate nature of feedback provided through mobile applications. These features allowed for personalized learning experiences, where learners could practice and receive corrections at their own pace and outside traditional classroom hours. The interactive and sometimes gamified nature of MALL tools was also cited as a motivating factor, making grammar practice more engaging. These aspects support the notion that MALL can create a more learner-centered and effective learning environment (Kukulska-Hulme & Shield, 2008).

However, the qualitative data also brought forth challenges associated with MALL implementation. Issues such as unreliable internet connectivity, technical glitches with applications, and the occasional feeling of being overwhelmed by or receiving generic feedback were reported by students. These challenges underscore the practical hurdles that need to be addressed for the successful integration of MALL in EFL contexts and suggest a need for robust technological infrastructure and well-designed applications that offer adaptive and truly personalized feedback. The concern about potential over-reliance on technology also points to the importance of fostering learners' autonomy and critical thinking skills alongside the use of MALL tools. Additionally, the study’s sample was limited to female learners selected through convenience sampling, limiting generalizability.

The pedagogical implications drawn from both quantitative and qualitative data are noteworthy. The study supports the integration of MALL-oriented metalinguistic feedback into EFL curricula to enhance grammar proficiency. Educators should be trained to effectively utilize these technologies and to design activities that leverage the strengths of metalinguistic feedback delivered via MALL. Furthermore, learners’ suggestions for improvement, such as the need for more contextualized and

interactive explanations, provide valuable directions for the development of future MALL applications. The preference for a blended learning approach, combining MALL with traditional instruction, suggests that technology is best viewed as a powerful supplement rather than a complete replacement for teacher-led interaction.

Conclusion

This study investigated the effectiveness of MALL-oriented metalinguistic corrective feedback on Iranian EFL learners' grammar proficiency and explored their perceptions of this approach. The mixed-method design yielded comprehensive insights, confirming the significant benefits of integrating mobile technology with explicit corrective feedback strategies.

The quantitative findings unequivocally demonstrated that MALL-oriented metalinguistic corrective feedback significantly improves learners' grammar proficiency compared to conventional feedback methods. Participants receiving metalinguistic feedback through MALL achieved significantly higher post-test scores, highlighting the efficacy of this approach in fostering grammatical understanding and application. This aligns with theories suggesting that explicit, rule-based feedback, when delivered effectively, can enhance learning outcomes. The use of MALL appears to amplify this effectiveness by providing immediate, accessible, and engaging learning opportunities.

The qualitative data further illuminated learners' positive attitudes towards MALL-oriented metalinguistic feedback. Students perceived this method as instrumental in clarifying complex grammatical points and providing a deeper understanding of their errors. The convenience and interactivity offered by mobile applications were highly valued, contributing to increased motivation and a more learner-centered educational experience.

Overall, this mixed-methods study provides robust empirical evidence that MALL-oriented metalinguistic corrective feedback significantly outperforms conventional feedback methods in enhancing the grammar proficiency of intermediate Iranian EFL learners. The quantitative results revealed substantially larger gains in the experimental group, while the qualitative data highlighted learners’ appreciation for the immediacy, clarity, and portability of rule-based explanations delivered via mobile devices.

Pedagogical and Institutional Implications

The findings carry direct, actionable implications for multiple stakeholders in EFL education:

For language teachers

Teachers are encouraged to incorporate instant-feedback mobile applications that provide explicit metalinguistic explanations (e.g., apps offering rule reminders, mini-tutorials, or coded error tags with hyperlinks to concise grammar notes) as a systematic supplementary tool. Rather than replacing oral or written teacher feedback, such apps can serve as an extension of classroom

instruction, enabling learners to receive timely, consistent, and repeatable metalinguistic information outside class hours. Practical implementation may involve assigning mobile-based grammar tasks after form-focused lessons, requiring learners to screenshot corrective feedback containing metalinguistic clues and reflect on them in the subsequent session, thereby bridging mobile practice with face-to-face negotiation of form.

For curriculum designers and materials developers

Grammar syllabi should move toward blended models that explicitly integrate MALL-oriented metalinguistic feedback loops. This can be achieved by (a) embedding mobile-compatible grammar tasks in textbooks (with QR codes linking to metalinguistic explanations), (b) designing cyclical curricula in which classroom explicit instruction is immediately followed by mobile practice with automated metalinguistic feedback, and (c) including "feedback literacy" objectives that train learners to interpret and act on metalinguistic clues provided by apps. Such integration capitalizes on the portability and immediacy of mobile technology documented in the present study and addresses learners' expressed preference for blended rather than purely digital learning.

For institutional administrators and technology coordinators

Institutions should prioritize investment in reliable, pedagogically oriented mobile platforms that support customizable metalinguistic feedback (rather than generic grammar-checkers). Key selection criteria include: (a) capacity to deliver explicit rule explanations rather than simple right/wrong signals, (b) offline functionality to overcome connectivity issues reported by participants, (c) analytics dashboards allowing teachers to monitor individual error patterns, and (d) data privacy compliance. Professional development programs should train instructors in selecting, customizing, and pedagogically exploiting these tools, ensuring that technological adoption is driven by second-language acquisition principles rather than novelty alone.

Limitations

The present study is subject to several limitations that constrain the generalizability of its findings. First, the sample consisted exclusively of female intermediate-level EFL learners recruited via convenience sampling from private language institutes in one midsized Iranian city (Noorabad). This gender- and context-specific recruitment prevents extrapolation to male learners, mixed-gender classrooms, public-school settings, rural areas, or EFL populations in other countries. Gender differences in technology acceptance and feedback preferences documented in prior research (Cai et al., 2017; Rassaei, 2015) suggest that results may not fully apply to male students. Second, participants reported recurrent technical difficulties, including unstable internet connections and application glitches, which likely reduced the actual dosage and consistency of MALL-oriented metalinguistic feedback received. Consequently, the observed superiority of the experimental treatment may

represent a conservative estimate; in environments with reliable high-speed internet and standardized devices, the effect could be larger, whereas in low-resource contexts it might diminish or disappear.

Additional limitations include the use of a multiple-choice recognition measure rather than productive tasks, limiting claims about transfer to spontaneous language use, and the absence of a delayed post-test, leaving the long-term retention of gains unknown. Taken together, these methodological and contextual constraints indicate that the findings are most directly applicable to urban, female, intermediate Iranian EFL learners studying in private institutes with moderate mobile/internet access. While the sizeable effect size (partial $\eta^2 = .38$) and convergent qualitative data strengthen confidence in the pedagogical mechanism—timely, explicit, portable metalinguistic explanation—caution is warranted when extending the results beyond the specified population and infrastructural conditions. Future research employing gender-balanced samples, probabilistic sampling, productive outcome measures, delayed post-testing, and controlled technological environments is recommended to enhance external validity.

Suggestions for further research

To make the suggestions for future research more specific and academically robust, the study should be expanded to focus on methodological rigor and the broadening of the research scope across different contexts and skills. Methodologically, it is crucial to move beyond immediate testing by implementing longitudinal studies with delayed post-tests (e.g., at three and six months). This will specifically measure the durability and retention of learning, determining if the metalinguistic feedback (MLF) leads to stable restructuring of the interlanguage rather than just transient improvement. Furthermore, future work must expand to productive language skills—specifically investigating the effect of MLF on revision quality and error reduction in writing, and on online processing and accuracy during spontaneous speaking tasks, which involves navigating the fluency-accuracy trade-off.

The research should also explicitly address contextual and pedagogical variation. This includes conducting comparative experimental designs to determine the relative efficacy of different MLF modalities (e.g., explicit rule-based vs. inductive questioning feedback), which offers high pedagogical relevance. Concurrently, studies must explore the impact of individual differences by investigating MLF effectiveness among specific demographic groups, such as university-level learners (focusing on complex stylistic errors) and addressing potential gender-based differences. Finally, research should practically address the challenges of the heterogeneous classroom by examining the success of differentiated MLF for mixed-ability groups.

In conclusion, this study contributes to the growing body of evidence supporting the use of MALL-oriented metalinguistic corrective feedback as a valuable strategy for enhancing grammar proficiency among EFL learners. By embracing such innovative, technology-enhanced approaches, educators can

create more effective, engaging, and learner-responsive language learning environments.

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