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PAPER

Enhancing EFL Speaking Fluency and Reducing Anxiety through Mobile-Assisted Language Learning

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ABSTRACT

Mobile-assisted language learning (MALL) has emerged as an effective method for improving EFL learners' speaking abilities while alleviating affective barriers such as fear. This study investigated the effects of a MALL intervention with adaptive feedback on speaking fluency and anxiety alleviation through an explanatory sequential mixed-methods approach. Quantitative results from pre- and post-tests indicated that learners in the MALL group greatly surpassed those in the control group, demonstrating marked improvements in speech rate, accuracy, and fluency, alongside diminished anxiety levels. Qualitative interviews underscored that attributes such as autonomous practice, flexibility, and fast feedback enhanced learners' confidence and readiness to communicate. The amalgamation of quantitative and qualitative studies suggests that technology-mediated learning might concurrently enhance cognitive skill development and emotional preparedness. These findings enhance the theoretical amalgamation of self-regulated learning and emotional support frameworks in mobile speech training and provide practical guidance for the development of adaptable, learner-centered digital solutions. The study highlights MALL's capacity to establish equitable and efficient learning environments that improve speaking proficiency and communicative confidence in EFL settings.

KEYWORDS

adaptive feedback, EFL learners, mobile-assisted language learning (MALL), speaking anxiety, speaking fluency

1 INTRODUCTION

Recently, the incorporation of technology in language acquisition has emerged as a crucial element of educational innovation, propelled by swift improvements in mobile devices and internet connectivity. Mobile-assisted language learning (MALL) offers learners extensive access to real language input, tailored practice, and interactive feedback, facilitating engagement in learning outside the typical

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classroom environment. MALL is globally acknowledged for its capacity to improve linguistic proficiency while promoting learner autonomy, adaptability, and motivation. In environments where English is acquired as a foreign language, such as Indonesia, mobile technology is especially beneficial for overcoming restricted possibilities for genuine conversation and the limitations of conventional teaching methods [1], [2].

Notwithstanding the expanding corpus of studies on MALL, considerable deficiencies persist in comprehending its dual influence on speaking fluency and anxiety. Numerous studies have indicated enhancements in learners' oral proficiency subsequent to mobile-based interventions [3]–[6], while others have emphasized their capacity to alleviate language learning anxiety [7], [8]. Nonetheless, the majority of current investigations concentrate on cognitive advancements or emotional advantages separately, leading to a deficiency of integrative research that investigates these dimensions collectively inside a cohesive methodological framework. This study gap is crucial, as fluency and anxiety are interconnected elements that affect learners' communicative performance and overall success in language acquisition [9].

This study is theoretically grounded in self-regulated learning and affective frameworks within second language acquisition. Self-regulated learning theory emphasizes metacognitive planning, monitoring, and self-evaluation, processes that align with the functionalities of mobile technology in facilitating language learning experiences [10], [11]. At the same time, the concept of foreign language anxiety explains how emotional factors may impede or enhance communication skills [12]. By synthesizing these perspectives, the research positions mobile-assisted language learning as a cognitive and affective intervention that enhances speaking competence while reducing emotional barriers to participation.

Furthermore, the study offers both theoretical and practical contributions to the field of technology-enhanced language learning. Theoretically, it advances the integration of self-regulated learning (SRL) and affective frameworks into a unified empirical model, offering new insights into how cognitive skill development interacts with emotional preparedness in language acquisition. Practically, it delivers evidence-based recommendations for designing adaptive, learner-centered mobile technologies that strengthen speaking performance while reducing communicative anxiety. The originality of this work lies in its dual focus on fluency and anxiety within a mixed-methods design, presenting a comprehensive perspective on a critical yet underexplored intersection in the MALL literature. By addressing this gap, the study reinforces the relevance of integrating cognitive and affective dimensions in mobile-assisted language learning, positioning the research as a timely response to current demands for more holistic digital learning models.

2 LITERATURE REVIEW

The Self-Regulated Learning (SRL) theory, grounded in social cognitive theory, elucidates how learners strategize, oversee, and assess their language acquisition by amalgamating metacognition, motivation, and behavioral regulation to foster autonomy and adaptability, particularly through technological support that offers feedback and self-evaluation [13], [14]. Conversely, Foreign Language Anxiety (FLA) theory emphasizes emotional obstacles that impede communicative competence, as increased anxiety diminishes the willingness to talk and adversely impacts performance [15]. Integrating SRL and FLA views includes both cognitive and affective aspects of language acquisition, which are essential for MALL initiatives.

Empirical research indicates that MALL improves oral fluency, coherence, vocabulary, and pronunciation accuracy, while also increasing motivation [16] and alleviating speaking anxiety by offering adaptable, self-directed practice settings [17]. These findings validate MALL's promise while highlighting a deficiency in examining the correlation between performance and anxiety.

Notwithstanding encouraging evidence, a research gap remains in investigations that concurrently analyze speaking fluency and anxiety within a unified framework, as the majority depend on either quantitative or qualitative methodologies, thereby constraining the triangulation of objective performance and learners' perceptions [18]. Limited research incorporates self-regulated learning concepts into mobile-assisted language learning designs while systematically evaluating their effects on linguistic and emotional outcomes, obstructing a thorough comprehension of how mobile technologies affect skill acquisition and emotional preparedness. This study uses an explanatory, sequential mixed-methods strategy to address this gap, integrating pre- and post-tests of fluency and anxiety with qualitative interviews to contextualize the findings. This method illustrates how adaptive feedback mechanisms based on self-regulated learning principles can improve fluency and alleviate anxiety, providing a refined view of the pedagogical potential of mobile-assisted language learning [19].

Current trends in MALL research show a shift toward the use of more advanced technologies such as intelligent personal assistants, gamification features, and adaptive analytics to personalize learning and support autonomous speaking practice [20]. There is also increasing emphasis on mixed method approaches that capture both quantifiable learning outcomes and learners lived experiences [21]. Building on these developments, the present study positions speaking fluency and anxiety reduction as interconnected goals within a conceptual framework informed by self-regulated learning, foreign language anxiety, and technology-enhanced language learning. In this framework, MALL operates as a mediational tool that offers adaptive feedback, promotes autonomous practice, and provides flexible learning environments, thereby supporting both cognitive development and emotional readiness for communication.

Guided by this conceptual grounding, the study examines the effects of a mobile-assisted language learning intervention featuring adaptive feedback on EFL learners' speaking fluency and anxiety using an explanatory sequential mixed-methods design. Three research questions are addressed: (1) To what extent does MALL enhance speaking fluency compared with conventional instruction? (2) To what extent does MALL reduce speaking anxiety measured by a validated scale? (3) How do learners perceive their experiences with MALL in relation to fluency improvement and anxiety reduction? Addressing these questions requires integrating quantitative performance and anxiety measures with qualitative accounts of learner experiences, enabling a comprehensive evaluation of the intervention's effectiveness.

3 METHOD

3.1 Research design

This study employed an explanatory sequential mixed-methods design, integrating quantitative and qualitative approaches to comprehensively examine the impact of MALL on EFL learners speaking fluency and anxiety reduction. In the

first phase, quantitative data were collected and analysed to identify measurable differences in fluency performance and anxiety levels between the experimental and control groups. In the subsequent phase, qualitative data were obtained through semi-structured interviews to explore learners perceptions, strategies, and emotional responses to the intervention, thereby providing contextualized explanations for the quantitative outcomes. The use of a mixed-methods design enabled methodological triangulation and enhanced the internal validity and interpretive depth of the findings [22], [23].

To operationalize the intervention, participants in the experimental group engaged with MALL applications, specifically ELSA Speak and Duolingo, to complete structured weekly speaking tasks that required the recording of monologues and dialogues. These applications generated adaptive feedback based on multiple performance indicators, including pronunciation accuracy, speech rate, hesitation frequency, pausing patterns, and grammatical correctness. Learner output was continuously analyzed by the system, and feedback was automatically adjusted according to individual performance profiles. For example, inaccurate pronunciation or frequent hesitations triggered immediate corrective feedback and targeted pronunciation drills, while grammatical errors prompted explicit corrective prompts and modeled examples. Across successive attempts, feedback evolved from explicit error identification to more implicit guidance, encouraging learners to self-monitor, refine their output, and gradually reduce reliance on system support. This iterative feedback mechanism facilitated repeated practice, self-paced revision, and autonomous learning, supported by periodic instructor guidance.

In contrast, the control group participated in conventional classroom-based speaking activities that relied on teacher-led instruction and peer interaction without the integration of mobile technologies or automated feedback. Feedback in this condition was delivered in a delayed and non-adaptive manner, typically at the group level, which limited opportunities for individualized, immediate, and iterative practice. This clear differentiation in instructional conditions enabled a systematic comparison of learning outcomes between the two groups and highlighted the added value of adaptive, data-driven feedback in mobile-assisted speaking instruction. The research design frameworks are presented in Table 1.

Table 1. Research design frameworks

Phase	Data Type	Purpose	Data Collection Tools	Analysis Approach
Phase 1	Quantitative	Measure change in fluency and anxiety between groups	Speaking fluency test, FLCAS questionnaire	Descriptive stats, t-test, ANCOVA
Phase 2	Qualitative	Explore participant experiences and contextual factors	Semi-structured interviews	Thematic analysis
Integration	Mixed	Triangulate findings and identify convergences/ divergences	Data convergence mapping	Joint display analysis

3.2 Data sources and types

Two primary data types were gathered: quantitative and qualitative. The quantitative data comprised pre- and post-test scores assessing speaking fluency (speech rate in words per minute, pause frequency per minute, and grammatical accuracy

as error-free T-units) and speaking anxiety levels using an adapted version of the Foreign Language Classroom Anxiety Scale (FLCAS). The qualitative data were obtained from comprehensive semi-structured interviews with a targeted sample of experimental group participants to document their lived experiences, perceived enhancements, and obstacles associated with the MALL intervention. This dual data source methodology facilitates a comprehensive comprehension of the phenomenon being examined [24].

3.3 Data collection techniques and instruments

Speaking fluency was assessed through a structured oral performance test consisting of two components: (a) a two-minute individual monologue and (b) a three-minute paired dialogue. All performances were audio-recorded and subjected to detailed analysis using standardized second language fluency measures, including speech rate, pause frequency, and linguistic accuracy, in line with established fluency research protocols [25]. These indicators were selected to capture both temporal and accuracy-related dimensions of oral fluency.

Speaking anxiety was measured using an adapted version of the Foreign Language Classroom Anxiety Scale (FLCAS), comprising 20 items rated on a five-point Likert scale, where lower scores reflected reduced anxiety levels [26], [27]. The instrument demonstrated satisfactory reliability and was administered before and after the intervention to examine changes in learners' affective states.

Qualitative data were collected through semi-structured interviews designed to elicit in-depth insights into learners' experiences with mobile-assisted speaking practice. The interview protocol addressed key themes such as learner autonomy, perceived improvements in fluency, emotional responses to adaptive feedback, changes in speaking anxiety, challenges encountered during mobile practice, and suggestions for instructional improvement. Follow-up questions were employed to clarify how adaptive feedback was perceived across repeated practice attempts, particularly in relation to pronunciation refinement, hesitation reduction, and confidence development. All interviews were audio-recorded, transcribed verbatim, anonymized, and analyzed thematically to complement and elucidate the quantitative findings. The speaking tasks, adapted FLCAS questionnaire, and interview protocol are publicly available at https://bit.ly/497XRLs. The instruments used are presented in Table 2.

Table 2. Instruments used in the study

Instrument Name	Measurement Focus	Format	Item/Metric
Speaking Fluency Test	WPM, pause frequency, EFT	Oral performance tasks	"Deliver a 2-min monologue on a given topic"
Adapted FLCAS (Horwitz et al.)	Speaking anxiety	20 Likert-scale items	"I get nervous when I have to speak without preparation"
Semi-Structured Interview Protocol	Experience, challenges	10 open-ended questions	"Describe how the app affected your speaking fluency"

3.4 Inclusion and exclusion criteria

Eligibility criteria mandated that participants be undergraduate students in the English Education program, have completed both pre- and post-test evaluations, and

have attended a minimum of 80% of the intervention sessions. Participants in the qualitative phase were selected from the experimental group based on either significant improvement or negligible change in their quantitative scores, thus ensuring a diversity of opinions. The exclusion criteria comprised inadequate test data, absence during critical intervention times, or withdrawal of consent at any point [28].

3.5 Unit of analysis and participants

The unit of analysis in this study was the individual learner. Participants were 100 undergraduate students enrolled in the English Education program at UIN Datokarama Palu, Indonesia, all of whom were taking a compulsory Interactional Speaking course. The students were divided into two intact class sections already established by the department's course scheduling system, a division adopted to maintain ecological validity, avoid disrupting the official timetabling, and prevent cross-group contamination among learners who regularly interact. Accordingly, 50 students formed the experimental group, which received the MALL intervention, and 50 formed the control group, which continued with conventional instruction without mobile-assisted components. Ethical approval was granted by the university's research ethics committee, and participation was entirely voluntary, with all students providing informed consent after being briefed on the study's aims, procedures, and their right to withdraw at any time without penalty. To support deeper interpretation of the quantitative findings, ten students from the experimental group were purposefully selected for the qualitative phase to capture diverse speaking performance outcomes and learning experiences.

3.6 Data analysis procedures

Quantitative data analysis was performed with Jamovi statistical software. Descriptive statistics were computed, and the assumptions of normality and homogeneity were assessed using the Shapiro-Wilk and Levene tests. Paired-sample t-tests evaluated intra-group variations, whereas independent-sample t-tests contrasted post-test scores across groups. An analysis of covariance (ANCOVA) was used to adjust for pre-test disparities, with effect sizes computed using Cohen's d and partial eta squared. The qualitative data analysis adhered to the [29] thematic analysis methodology, which encompassed iterative coding, categorization, and theme formulation. The synthesis of quantitative and qualitative results transpired during the interpretation phase, revealing convergences and divergences to produce a holistic comprehension of the influence of MALL on fluency and anxiety.

4 RESULTS

4.1 Quantitative results

The quantitative findings demonstrated clear disparities in speaking fluency and anxiety reduction between the experimental group, which received the MALL intervention, and the control group, which followed conventional instruction. The experimental group showed substantial gains in words per minute and fewer pauses, while the control group exhibited only marginal improvements. Speaking anxiety,

as measured by the FLCAS, also decreased significantly more in the experimental group. Taken together, these results indicate that MALL not only enhances learners' speaking performance but also creates a less stressful environment that supports greater confidence and sustained skill development.

To ensure consistent and objective evaluation of learners' oral performance, speaking assessments were scored using a rubric comprising speech rate (words per minute), pause frequency (pauses per minute), and grammatical accuracy (percentage of error-free T-units). These indicators were integrated into a composite fluency score ranging from 0 to 100. Both the pre-test and post-test required students to complete a two-minute monologue and a three-minute dialogue. Monologue topics included familiar, communicative themes such as "My memorable experience," "The role of technology in daily life," and "A person who inspires me," while dialogue tasks involved everyday interactions such as planning activities, expressing opinions, and resolving simple problems. This task design ensured comparability across testing sessions and elicited natural samples of spontaneous speech.

Speaking fluency. Table 3 illustrates that both groups commenced with virtually equivalent speaking fluency scores in the pre-test, signifying comparable baseline proficiency. Post-intervention, the experimental group that received adaptive feedback exhibited a significant enhancement of 17.60 points, increasing from a mean score of 64.80 to 82.40. The gain was statistically significant ($t = 9.87$, $p < .001$) with a substantial effect size (Cohen's $d = 1.22$), demonstrating both robust statistical and practical significance. Conversely, the control group improved by merely 5.10 points, increasing from 65.10 to 70.20, a shift that was very moderate and less likely to possess educational importance. The results underscore the efficacy of adaptive feedback in markedly improving students' speaking fluency relative to conventional education.

Table 3. Speaking fluency scores (Pre- and post and group comparisons)

Group	N	Pre-Test Mean (SD)	Post-Test Mean (SD)	Mean Gain	t (Post-Test)	p-Value	Cohen's d	Effect Size
Experimental	50	64.80 (5.92)	82.40 (6.15)	+17.60	9.87	<.001	1.22	Large
Control	50	65.10 (6.10)	70.20 (6.85)	+5.10				

Speaking anxiety. Table 4 indicates that both groups commenced with comparable levels of speaking anxiety in the pre-test, with mean scores of 85.20 for the experimental group and 84.80 for the control group. Following the intervention, the experimental group that received adaptive feedback exhibited a notable decrease of 19.90 points, declining from 85.20 to 65.30. The alteration was statistically significant ($t = 10.15$, $p < .001$) and exhibited a considerable effect size (Cohen's $d = 1.27$), signifying a substantial practical influence on diminishing speaking fear. Conversely, the control group experienced a negligible reduction of 5.30 points, decreasing from 84.80 to 79.50, which is relatively minor and unlikely to yield significant educational consequences. The data indicate that adaptive feedback significantly diminished speaking anxiety in learners relative to traditional education.

Table 4. Speaking anxiety scores (FLCAS)

Group	N	Pre-Test Mean (SD)	Post-Test Mean (SD)	Mean Reduction	t (Post-Test)	p-Value	Cohen's d	Effect Size
Experimental	50	85.20 (7.50)	65.30 (6.90)	–19.90	10.15	<.001	1.27	Large
Control	50	84.80 (8.00)	79.50 (7.85)	–5.30				

Fluency and accuracy metrics. Regarding specific language metrics (refer to Table 5), both groups initially exhibited comparable speaking performance in terms of words per minute, pause frequency, and correctness. Post-intervention, the experimental group demonstrated notable enhancement, with their speaking pace rising from 85.2 to 105.8 words per minute, an increase of 20.6 words. Furthermore, the frequency of pauses diminished by over fifty percent, down from 6.5 to 3.2 pauses per minute. The accuracy, quantified as error-free T-units (EFT), significantly increased from 64% to 82%, reflecting enhanced speech delivery speed, improved fluency, and heightened linguistic precision. The control group exhibited relatively minor improvements, with their speaking rate increasing from 84.9 to 90.5 words per minute, pauses diminishing from 6.4 to 5.5 per minute, and accuracy enhancing from 65% to 70%. The experimental group's significant advancement in all metrics indicates that adaptive feedback was exceptionally efficient in improving both fluency and accuracy, whereas traditional education produced more constrained enhancements.

Table 5. Detailed fluency and accuracy metrics

Group	N	WPM Pre	WPM Post	Pause/Min Pre	Pause/Min Post	Accuracy (% EFT) Pre	Accuracy (% EFT) Post
Experimental	50	85.2	105.8	6.5	3.2	64%	82%
Control	50	84.9	90.5	6.4	5.5	65%	70%

Assumption tests and ANCOVA. Table 6 displays the outcomes of normality and homogeneity assessments performed on the pre-test and post-test speaking scores for both the experimental and control groups. The Shapiro-Wilk test produced p-values over 0.05 for all datasets, signifying that the score distributions did not significantly diverge from normality. Furthermore, Levene's test for equality of variances yielded p-values beyond 0.05 for both the pre- and post-test comparisons, indicating that the variances among the groups were statistically identical. Collectively, these results affirm that the fundamental assumptions for parametric analysis, including ANCOVA, were adequately fulfilled, hence substantiating the validity of subsequent statistical comparisons across groups.

Table 6. Normality and homogeneity tests

Variable	Shapiro-Wilk p	Levene's p
Pre-test (Exp)	0.232	0.418
Pre-test (Control)	0.261	0.418
Post-test (Exp)	0.149	0.512
Post-test (Control)	0.194	0.512

Table 7 displays the ANCOVA results, evaluating the intervention's impact on post-test speaking scores while adjusting for pre-test scores. The study demonstrated a statistically significant difference between the experimental and control groups, $F(1, 97) = 95.82$, $p < .001$, with a substantial effect size (partial $\eta^2 = 0.494$). This signifies that around 49% of the variance in post-test scores may be ascribed to the intervention. The results indicate that, even after adjusting initial disparities in speaking proficiency, the experimental group markedly surpassed the control group. This significant enhancement highlights the profound effect of adaptive feedback on

improving students' speaking performance, illustrating the intervention's effectiveness in facilitating language learning outcomes.

Table 7. ANCOVA results (Post-test DV, Pre-test Covariate)

Source	SS	df	MS	F	p-Value	Partial η^2
Pre-test (covariate)	128.54	1	128.54	12.45	.001	0.112
Group	987.32	1	987.32	95.82	<.001	0.494
Error	1008.76	97	10.39			

Effect size visualization. Figure 1 displays a bar chart depicting Cohen's d values for both intra-group and inter-group comparisons. The chart illustrates the extent of change in speaking scores from pre-test to post-test in the experimental group, indicating a substantial impact of size. The comparison of post-test results between groups reveals a significant effect, highlighting the considerable disparity between the experimental and control groups. The data visually corroborate the statistical results, demonstrating that the MALL intervention significantly influenced students' speaking performance. The substantial effect sizes indicate both statistical and practical importance, demonstrating that the intervention substantially enhanced language acquisition results.

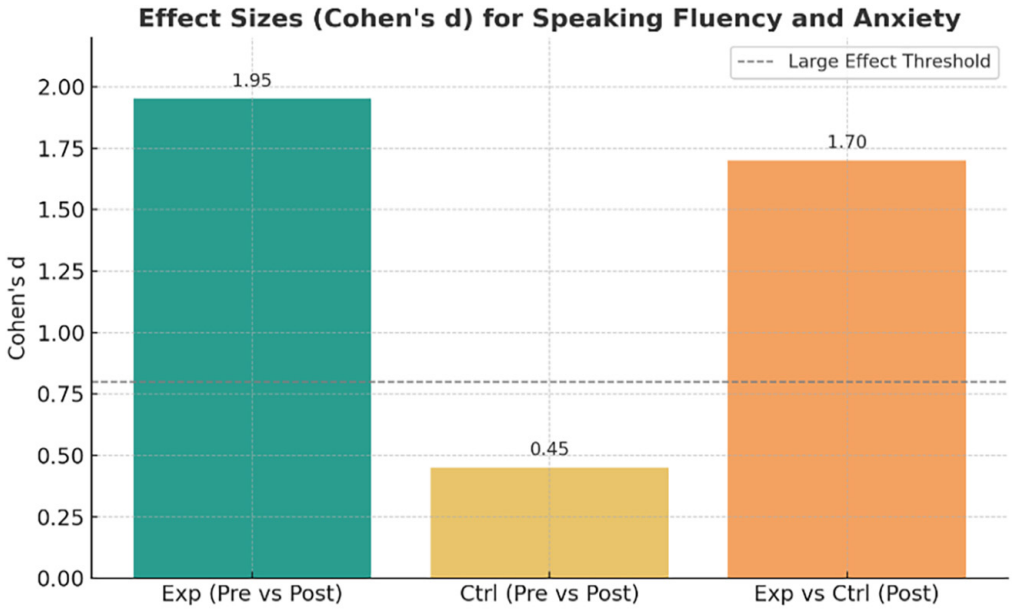

Fig. 1. Effect size visualization

4.2 Qualitative results

The thematic analysis of student interviews identified five principal topics about the use of MALL to enhance speaking skills. Initially, students conveyed a favorable experience with MALL, valuing its flexibility, ease, and autonomy, which enabled them to practice at any time and take charge of their learning. Secondly, advancements in speaking fluency were apparent through improved vocabulary, pronunciation, and heightened confidence, demonstrating that the app effectively facilitated both linguistic and emotional dimensions of learning. Third, anxiety alleviation was

identified as a significant advantage, as students reported diminished fear of errors and decreased peer pressure during individual practice, while some continued to encounter spontaneous anxiety in the classroom. Fourth, students faced challenges, including technological difficulties like poor internet and motivational issues arising from the absence of deadlines, which occasionally impeded persistent engagement. Students ultimately proposed enhancements, advocating for offline capabilities, increased interactive speaking exercises, and the incorporation of teacher feedback to boost personalization and engagement. The data indicate that although MALL significantly enhances speaking development, overcoming technical and motivational obstacles can further improve its efficacy. The thematic analysis of students' experiences is presented in Table 8.

Table 8. Thematic analysis of students' experiences (n = 10)

Theme	Sub-Themes	Representative Quotes
1. Positive Experience with MALL	– Flexibility and convenience – Autonomy in practice	"I used the app every day because I could practice anytime." (S1) "Recording and listening to my own voice helped me feel in control." (S5) "I liked that I could practice whenever I wanted, even outside class." (S7)
2. Improvement in Speaking Fluency	– Vocabulary expansion – Pronunciation enhancement – Confidence boost	"I can speak more smoothly now, and I learned many new words from the app." (S3) "I feel my pronunciation is better because the app corrects me." (S6) "The app helped me gain confidence to speak in front of others." (S10)
3. Anxiety Reduction	– Lower fear of mistakes – Reduced peer pressure – Persistent classroom anxiety	"I feel less nervous because I can practice alone before speaking in class." (S3) "The app gave me time to prepare and avoid embarrassment." (S2) "I still feel nervous when the teacher calls me without warning." (S9) "Practicing on the app first made me less shy in class." (S8)
4. Challenges	– Technical problems (internet) – Motivation issues (no deadlines)	"Sometimes the internet was slow, so I could not practice well." (S4) "I skipped practice when I felt lazy because there was no deadline." (S8) "I got frustrated when the app froze or didn't load my recordings." (S1)
5. Suggestions for Improvement	– Offline mode – More interactive speaking tasks – Teacher feedback integration	"It would be great if the app had offline mode and more live speaking options." (S10) "I wish the app gave feedback from teachers, not just automated corrections." (S6) "More interactive games would make practice fun." (S7)

4.3 Integrated mixed methods findings

The integration of quantitative and qualitative findings provides strong evidence for the effectiveness of MALL in enhancing university students' speaking performance. The experimental group showed substantial fluency gains, with words

per minute increasing from 85.2 to 105.8 and pause frequency decreasing from 6.5 to 3.2 per minute, compared with modest improvements in the control group (WPM: 84.9 to 90.5; pauses: 6.4 to 5.5). ANCOVA results confirmed a significant and large adjusted group effect (partial $\eta^2 = .494$, $p < .001$). The reduction in pause frequency aligns with learners' reports of increased confidence and improved control over speech production, suggesting that fluency gains were accompanied by greater cognitive ease. As one participant stated, "I can articulate more fluently now, and I acquired numerous new vocabulary from the app" (S3), while another noted, "Recording and listening to my voice enabled me to feel empowered" (S5).

MALL also significantly reduced speaking anxiety. FLCAS scores declined by 19.9 points in the experimental group, compared with a 5.3-point reduction in the control group ($p < .001$, $d = 1.27$). This quantitative decrease corresponds closely with qualitative accounts highlighting private rehearsal and reduced peer pressure as key factors. Learners emphasized that autonomous practice lowered fear of making mistakes and increased preparedness, as reflected in statements such as, "I experience reduced anxiety as I can rehearse independently prior to speaking in class" (S3) and "The app afforded me the opportunity to prepare and circumvent humiliation" (S2). These findings indicate that adaptive mobile practice fostered a psychologically safe environment that supported confident engagement with speaking tasks.

Accuracy improvements further illustrate the pedagogical value of MALL, with error-free T-units increasing from 64% to 82% in the experimental group, compared to a smaller rise from 65% to 70% in the control group. Students attributed these gains to corrective feedback and repeated practice opportunities, although challenges remained, particularly in spontaneous speaking situations (S9) and in cases of unstable internet access. Overall, the convergent evidence suggests that MALL enhances fluency, accuracy, and confidence by linking repeated, low-risk practice with adaptive feedback, while underscoring the need to complement app-based rehearsal with interactive classroom speaking activities to support transfer to real-time communication contexts. The joint display of quantitative and qualitative results is presented in Table 9.

Table 9. Joint display of quantitative and qualitative results

Outcome Area	Quantitative Result	Qualitative Evidence	Interpretation
Fluency	WPM increased from 85.2 to 105.8 and pause frequency decreased from 6.5 to 3.2 pauses/min in the experimental group; ANCOVA showed large group effect (partial $\eta^2 = .494$, $p < .001$)	"I can speak more smoothly now, and I learned many new words from the app" (S3) "Recording and listening to my own voice helped me feel in control" (S5)	Consistent evidence that MALL enhanced speech rate, reduced hesitation, and supported more coherent delivery
Anxiety Reduction	FLCAS scores dropped by 19.9 points in the experimental group versus 5.3 points in the control group ($p < .001$, $d = 1.27$)	"I feel less nervous because I can practice alone before speaking in class" (S3) "The app gave me time to prepare and avoid embarrassment" (S2)	Both data sources indicate that private, self-paced practice helped reduce performance-related stress
Accuracy	Error free T units rose from 64% to 82% in the experimental group compared to 65% to 70% in the control group	"I feel my pronunciation is better because the app corrects me" (S6)	Quantitative accuracy gains align with learners' perception of improved grammar and pronunciation from corrective feedback
Challenges	Not directly captured quantitatively	"I still feel nervous when the teacher calls me without warning" (S9) "Sometimes the internet was slow, so I could not practice well" (S4)	Highlights limitations of MALL including persistent live-speaking anxiety and technical barriers

5 DISCUSSION

The mixed-methods findings demonstrate that integrating MALL with adaptive feedback significantly enhances EFL learners' speaking fluency and reduces speaking anxiety. Addressing the first research question, the quantitative results indicate that the experimental group achieved substantially greater improvements in speech rate, fluency smoothness, and linguistic accuracy than the control group. These gains suggest that adaptive mobile practice offers a more effective environment for oral language development than conventional instruction, primarily by enabling individualized, repeated practice supported by immediate and targeted feedback.

In response to the second research question, the findings show a marked reduction in speaking anxiety among learners who used MALL, as reflected in significantly lower post-intervention FLCAS scores. This reduction can be attributed to key features of adaptive feedback identified in both the quantitative and qualitative data, including private practice conditions, opportunities for repeated rehearsal, and reduced exposure to peer evaluation. These features created a low-risk learning environment that allowed learners to focus on linguistic improvement rather than fear of making mistakes, thereby supporting emotional readiness for oral communication.

The qualitative findings addressing the third research question further reinforce these results. Learners reported increased confidence, diminished fear of errors, and a stronger sense of autonomy in managing their speaking practice. Students emphasized that adaptive feedback helped them identify specific pronunciation and grammatical issues, monitor progress across multiple attempts, and evaluate improvements over time. These experiences align with the observed fluency gains and indicate that learners actively engaged in reflective practice rather than passively receiving feedback.

Viewed through the lens of self-regulated learning theory, the findings illustrate how adaptive mobile feedback supported metacognitive planning, monitoring, and self-evaluation [30]. Learners planned improvement goals based on feedback, monitored performance through repeated recordings, and evaluated progress by comparing successive attempts. Simultaneously, the reduction in speaking anxiety aligns with the Foreign Language Anxiety framework, which emphasizes the role of controlled, low-pressure environments in alleviating affective barriers to communication [31]. The findings demonstrate that adaptive feedback functions as both a cognitive scaffold and an affective regulator within mobile-assisted speaking practice.

The results corroborate and extend prior research identifying MALL as an effective means of enhancing oral performance and reducing language anxiety [16]. While improvements in accuracy are consistent with findings on voice-recognition feedback [32], this study advances the literature by demonstrating the interdependence of fluency development and anxiety reduction within a single adaptive learning model, particularly in contexts with limited opportunities for authentic oral interaction.

Despite these contributions, the study is subject to limitations, including its single-institution context, reliance on self-reported anxiety measures, and occasional technological constraints. Future research should examine the long-term sustainability of fluency and anxiety outcomes, expand implementation across diverse settings, and explore enhanced mobile features such as offline access and increased teacher mediation.

From a pedagogical perspective, the findings suggest that integrating mobile applications such as ELSA Speak and Duolingo into EFL instruction can promote fluency development while reducing affective barriers. Providing learners with opportunities for repeated, low-pressure practice supported by adaptive feedback

fosters self-regulation, confidence, and willingness to communicate, especially when combined with supportive classroom practices and teacher guidance.

6 CONCLUSION

This study confirms that MALL with adaptive feedback significantly enhances EFL learners' speaking fluency while effectively reducing speaking anxiety. Employing a mixed-methods design, the findings demonstrate substantial gains in speech rate, accuracy, and fluency smoothness, alongside marked reductions in anxiety that exceeded those achieved through conventional instruction. These outcomes are directly attributable to the affordances of adaptive mobile practice, including opportunities for self-paced rehearsal, immediate corrective feedback, and flexible learner control, which collectively foster greater confidence and communicative ease.

From a theoretical perspective, the study advances understanding of how self-regulated learning processes and affective support can be operationalized within mobile-based speaking instruction. The findings provide empirical evidence that adaptive feedback simultaneously facilitates metacognitive planning, monitoring, and self-evaluation while mitigating anxiety through low-risk, learner-controlled practice environments. Practically, the results underscore the value of integrating adaptive, learner-centered mobile technologies into EFL curricula to promote equitable development of both linguistic competence and speaking confidence. For educators and policymakers, this research highlights the potential of mobile-assisted approaches to create inclusive, psychologically supportive learning environments. Future research should examine the long-term sustainability of these gains and explore the scalability of such interventions across diverse educational contexts.

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