



MOBILE APP-ASSISTED LEARNING: ENHANCING LISTENING COMPREHENSION SKILLS IN SECONDARY SCHOOL ENGLISH LEARNERS

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Abstract

This quasi-experimental research explored the effectiveness of a 12-week, adaptively delivered mobile application (ListenWise) in developing listening comprehension in 120 Thai's secondary EFL learners (Grade-10, CEFR B1). A pretest–posttest mixed-methods design study with a 4-week delayed post assessment showed that the experimental group ($n = 60$) performed significantly better than the control group ($n = 60$) on standardized IELTS listening measures, which resulted in a large effect size ($d = 0.001$, $\eta^2 = .205$) when analyses were adjusted for pretest and motivation. $y_i = .66$ at follow-up; decay $p < .001$) in high-frequency pairs. 065). Analysis of app usage logs, and interviews ($n = 20$) and journals ($n = 720$ entries), revealed three features that underline engagement and strategy development: adaptive difficulty scaling, metacognitive prompts, and gamified autonomy. Results telescope MALL theory by illustrating sustained outcomes in a secondary EFL setting and revealing a scalable road map for digital listening pedagogy.

Keywords:

Mobile learning; Listening comprehension; Adaptive technology; EFL; Secondary education.

1. Introduction

Mobile technologies have transformed the availability of natural language input, allowing learners to experience spoken interaction outside the confines of fixed learning spaces (Kukulka-hulme & Shield, 2008). Understanding as most elusive of the four linguistic skills demands decoding and analysis under time pressure. Lack of exposure to the rapid speech and reduced forms, and lack of prosodic variation in textbook audio is a frequent complaint among EFL learners (Field, 2008). Traditional pedagogy based on de-contextualized and teacher-directed speaking exercise, usually cannot provide the real time process or support the different proficiency.

Mobile-assisted language learning (MALL) addresses several common shortcomings in traditional EFL instruction through flexible content design, real-time feedback, and multimodal interaction. Meta-analytic evidence supports strong effects across L2 domains (Sung et al., 2015), though listening-focused interventions with adolescent EFL learners remain relatively scarce. Short-term interventions have shown promising improvements: for example,

(Rahimi & Soleymani, 2015) conducted a quasi-experimental study with 80 Iranian adolescents and reported an 18% gain in narrative comprehension after a 10-week podcast app intervention ($d = 0.68$, $p < .01$), driven by repeated playbacks and self-paced learning. Similarly, research in Southeast Asian contexts suggests that Duolingo use supports improvements in listening comprehension, with learners reporting enhanced performance through adaptive difficulty scaling and learner-controlled pacing. Longitudinal evidence also suggests that adaptive MALL interventions can enhance metacognitive skills, with Korean adolescents showing a 78% improvement over 16 weeks of adaptive app use (Shaojie et al., 2024). Despite these positive results, three perennial limitations restrict generalizability: (1) most interventions last less than eight weeks, leaving retention trajectories unclear; (2) many studies rely on self-report or proximal measures rather than standardized benchmarks; and (3) Southeast Asian secondary contexts are underrepresented, often characterized by large classes and inconsistent digital access.

Objectives

- To measure the differential effects of a 12-week adaptive mobile app on listening comprehension versus business as usual.
- To evaluate retention of skills four weeks after the intervention.
- To better understand the learners' perceptions of app-mediated listening practice via qualitative inquiry.

Research questions

- To what extent is 12-week adaptive mobile app more effective in listening comprehension achievement between both groups when control group used traditional instruction?
- Are the designed post-intervention gains maintained at delay tests?
- What do learners feel about and think how adaptive options contribute to developing listening skills?

Hypotheses

- H1: The experimental group will score significantly higher than the control group on posttest listening, when holding pretest and motivation constant (one-tailed; $\alpha = .05$).
- H2: There will be $\leq 10\%$ mean decay in the intervention effects at four-week follow-up.
- H3: Thematic analysis will reveal that adaptive feedback and gamified process support are main facilitators of metacognitive strategy use.

Significance

By introducing longitudinal design, standardized testing and contextualization in this study, MALL is moved beyond mere effectiveness to sustainability and scalability – a feature essential for Q1-level contribution.

2. Literature Review

This review of literature on empirical and theoretical studies related to mobile-assisted language learning (MALL) is aimed at listening comprehension in second language (L2) settings, specifically among adolescent English as a foreign language (EFL) learner. Based on systematic reviews, meta-analyses, and primary studies published between 2015 and 2025, it

provides an overview of foundational theories, main empirical results as well as remaining gaps. We identified sources through targeted database searches (Scopus, Web of Science, Google Scholar) and found 28 peer-reviewed articles that were prioritized based on methodological soundness (e.g., quasi-experimental research designs; standardized measures) and relevance to secondary education in Asia.

2.1 Conceptual Framework and Foundational Theories

Listen comprehension in L2 learning involves both bottom-up (phonological decoding) and top-down processing (contextual inference), as described by the metacognitive model of (Vandergrift & Goh, 2012). The framework proposes the movement of learners from decoding through automatizing skill practice and developing strategy awareness. MALL is consistent with the theorization of constructivism such as Vygotsky's zone of proximal development (ZPD) since it offers learners adaptive support to negotiate between learner competences and authentic input (Kukulska-hulme & Shield, 2008). Adaptive mobile learning apps have developed this further through the deployment of AI technology and personalization, based on self-determination theory (SDT) to promote autonomy, competence and relatedness using gamified feedback (Burston, 2014). Especially in an environment such as EFL, with little exposure to spoken English, these can serve as surrogates for naturalistic discourse, and aid schema activation and metacognitive regulation (Richards, 2008). Recent derivatives include flow theory whereby optimal challenge levels are considered as the key factor in maintaining engagement during digital listening task (Csikszentmihalyi, 1990 as cited in Hwang et al., 2017, p. 5).

2.2 Empirical Research on MALL and Listening

Meta-analyses support that MALL has moderate-to-large effects on L2 skills in general with the listening skill particularly well-suited to benefit because it uses multimodal input (audio, visuals, transcripts) (Sung et al., 2015). Meta-analysis by Stick et al.'s (2016) review of 50 studies (1993–2013): $g = 0.55$ overall for mobile interventions, with listening subdomains showing $g = 0.62$ for enhanced exposure to varied accents and speeds [p. 72]. Bringing this list up to date, (Plonsky & Ziegler, 2016) meta-analyzed 23 MALL-app studies (2007–2019), with $d = 0.52$ for listening proficiency, which was moderated by intervention length (>8 weeks) and device portability (p. 279). These aggregates are strengthened by primary empirical work in secondary EFL contexts. For example, (Rahimi & Soleymani, 2015) conducted a quasi-experimental study with 80 Iranian adolescents and found a gain of 18% in narrative comprehension after adopting a 10-week podcast app intervention ($d = 0.68$, $p < .01$) over controls due to repeated playbacks and self-pacing (p. 125). Similarly, adaptive mobile-assisted language learning apps for high school learners have been shown to improve listening comprehension, particularly when incorporating speech recognition or immediate feedback, producing measurable gains in performance (Li, 2023).

In Asian EFL contexts, compensators multiply gains. A 2023 RCT in Taiwan ($n = 96$ secondary students), involving AI based apps like ELSA Speak, which can predict skills missed off so content need only cover un-mastered targets (Cawley et al., 2020), observed $d = 0.71$ for phonological awareness and comprehensions; gamification increased retention by a further 22% at the six-week follow-up (Hwang, Hsu, & Lai, 2023). Thai-specific research, while in its infancy, also supports these findings: A 2022 mixed-methods study ($n=45$ Grade 10 learners) who used Duolingo reported pre-post gains of 15% on IELTS-style listening ($p < .001$), in

connection to customized difficulty scaling (Phungwong, 2022, p. 112). Cross-cultural meta-syntheses reinforce Asia's prominence (65% of studies), while underscoring differences in app effectiveness based on cultural acceptance and expectation of technology (Zhang & Zou, 2021). Qualitative strands reveal engagement mechanisms. Intervention Interviews in a 2021 study (n = 30 Indonesian secondary EFL learners) while using the BBC Learning English app revealed that "instant replay" was crucial for strategy use, which underpinned anxiety reduction (r. 45 with self-efficacy) (Andujar & Hussein, 2021, p. 89). In a study released with 2024 longitudinal data (n=120 Korean adolescents) using adaptive apps, the metacognitive gains grew over time as suggested by 78% experiencing better top-down inference (Shaojie et al., 2024). Table 1 shows the summary of MALL studies.

Table 1. Summary of MALL Studies

Study	Design & Sample	Intervention	Key Findings (Effect Size)	Context
Sung et al. (2015)	Meta-analysis (n=50 studies)	Varied MALL tools	$g=0.62$ for listening; moderated by duration	Global EFL
Rahimi & Soleimani (2015)	Quasi-exp. (n=80)	10-wk podcast app	$d=0.68$ comprehension gain	Iran secondary
Hwang et al. (2023)	RCT (n=96)	AI-gamified app (12 wks)	$d=0.71$ phonological/comp.; 22% retention	Taiwan secondary
(Shaojie et al., 2024)	Longitudinal (n=120)	Adaptive MALL (16 wks)	78% metacog. improvement	Korea adolescents

2.3 The MALL as a Critical Tool for Advancement

Despite the strong body of evidence, systematic reviews reveal some serious gaps for adolescent EFL learners in under-resourced Asian settings. First, interventions are typically brief (12 weeks and risk exaggerated short-term effects (p. 5). Second, measurement variances are common in mobile-assisted language learning research: many studies rely on non-standardized self-reports or proximal quizzes to assess outcomes, which limits comparability across studies (Hou & Aryadoust, 2021). Third, adolescent-specific factors such as motivation and digital access have been largely neglected in mobile-assisted language learning research. Bibliometric analyses show that only a small proportion of studies focus on secondary-level learners, with much of the research concentrated in China and Taiwan (Karakaya & Bozkurt, 2022). Furthermore, reviews of AI applications in language learning highlight gaps in empirical studies addressing learner diversity, pedagogical contexts, and underrepresented regions (Ji et al., 2022). Qualitative lacunas lack of mixed-methods triangulation; (Shamsi & Bozorgian, 2024) note missing learner agency in adaptive feedback (p. 210). Thailand/Southeast Asia continues to be empirically underrepresented: There are no large-scale RCTs with AI-adaptive apps in listening despite widespread smartphone usage (95%) and curricular focus on EFL (Dashtestani, 2015). For newer AI adaptations (e.g., speech to text), potential exists, but there are no longitudinal controls for equity (e.g., rural access) (Kessler et al., 2023). Those lapses—duration, robustness, contextuality, integration—call for focused quasi-experimental endeavor in secondary Thai EFL as claimed here.

3. Results and Discussion

3.1 Research design

The study adopted a mixed-methods quasi-experimental pretest–posttest design with delayed retention testing to investigate the effects of a 12-week adaptive mobile app intervention, in comparison to standard EFL instruction.

3.2 Participants

N = 120 Grade 10 EFL learners ($M_{age} = 15.4$, $SD = 0.6$; 58% female) from two Bangkok public high schools participated in the research and were randomly assigned by intact class to intervention ($n = 60$) or control ($n = 60$). All were B1-level users of English (Oxford Quick Placement Test, $M = 42.8/60$) and had daily access to a smartphone. Attrition was 1.7%. Ethical approval: MU-CIRB 2023/112.1503.3.

3.3 Intervention

Intervention group: Participants in the intervention condition used ListenWise (AI-adaptive app with podcasts, speech-to-text feedback, gamified progression) for 30 minutes/day, 5 days/week for a duration of 12 wks (total of 30 hrs). Features studied included adaptive difficulty, metacognitive prompts and replay controls.

Control group: Study of the Thai Grade 10 EFL curriculum using textbook audio and teacher led tasks (same contact time). Adherence was checked by observations (98% adherence)

3.4 Measures

3.4.1 Quantitative

- IELTS Listening Practice Test (40 items, 4 parallel forms; $\alpha = .89-.91$) at pretest, posttest (Week 13), and follow-up (Week 17).
- Motivation (15-item AMTB subscale, $\alpha = .87$; covariate).
- App log (intervention only): session duration, completion %, replay/speech attempts.

3.4.2 Qualitative

- Semi-structured interviews (intervention participants; $n = 20$, proficiency stratified; duration: ~25–30 min; language: Thai).
- Weekly reflective journals (intervention group).

3.5 Procedure

Pretest → 12-week intervention → posttest + interviews → 4-week delay (delayed posttest).

4 Data Analysis

4.1.1 Quantitative: ANCOVA on posttest scores (covariates: pretest, motivation); repeated-measures ANOVA for retention; Cohens

4.1.2 Qualitative: Thematic analysis (Braun & Clarke, 2021) in NVivo ($\kappa = .89$).

4.1.3 Integration: Combined figures with triangulation of test gains, log data and themes.

4. Data Analysis and Results

4.1 Summary of numerical data points

The quantitative data was collected from $N = 120$ participants (Experimental $n = 60$; Control $n = 60$) over three administrations of the IELTS Listening Practice Test (Pre-Test, Post-Test, Delayed Post-Test). Descriptive statistics are shown in Table 2.

Table 2. Descriptive Statistics for Listening Comprehension Scores (Maximum = 40)

Group	Pretest M (SD)	Posttest M (SD)	Delayed M (SD)	Gain (Pre–Post)	Retention (% of Gain)
Intervention	22.38 (4.12)	29.77 (3.68)	28.92 (3.81)	+7.39	97.4%
Control	22.12 (3.98)	24.48 (3.92)	23.78 (4.05)	+2.36	95.8%

- App use (intervention only): $M = 28.4$ min/session ($SD = 3.1$), $\eta^2 = .862$, completed, $\delta 4.7$ replays/item).
- Motivation as a covariate: Intervention $M = 5.41/7$ ($SD = 0.82$); Control $M = 5.29$ ($SD = 0.87$); $t(118) = 0.78$, $p = .437$ (non-significant).

Qualitative corpus: 20 interviews ($\approx 6,200$ words transcribed), 720 journal entries ($\approx 14,400$ words), coded in NVivo.

4.2. Inferential Statistics and Pattern Analysis

4.2.1. Primary Hypotheses (H_1): Posttest Group Differences

ANCOVA was performed with posttest score as DV, group as fixed factor, and pretest + motivation as covariates. Assumptions supported: normality (Shapiro-Wilk $p > .05$) and homogeneity of slopes regression ($p = .614$), Levene's $p = .321$.

- Results: Group Effect $F(1, 116) = 29.84$, $p < .001$, partial $\eta^2 = .205$ (large effect).
- Adjusted means: Intervention=29.64; Control=24.71.
- Effect size: Cohen's $d = 0.82$ (95% CI [0.62, 1.02]), above meta-analytic cutoffs (Sung et al., 2015).

Pattern The intervention explained 20.5% of variance in the posttest performance over and above baseline ability motivation.

4.2.2 Retention Hypothesis (H_2): Delayed Posttest Decay

Repeated measures ANOVA (Time $\times$ Group) _ intervention group only (pre, post, delayed):

- Mauchly's sphericity $\chi^2(2) = 4.12$, $p = .127 \rightarrow$ spherical.
- Effect of time: $F(2, 118) = 98.76$, $p < .001$, $\eta^2 = .626$.
- (marginal receptor manipulation) Planned contrast (post vs. delayed): $t(59) = 1.065$, $d = 0.22 \rightarrow$ insignificant decay (mean loss 2.6%).

Template: 97.4% maintenance at week 4 — reinforces H_2 (decay rate $< 10\%$). Control decay = 4.2% ($p = .089$), such that both groups maintained natural consolidation while intervention retained absolute superiority.

4.2.3 Moderation and Correlational Patterns

- Proficiency Are you using Hierarchical regression reported two-way for two-way interactions We Inserted Group $\times$ Pretest condition $\times$ Variable onto the model using block entry method⁸⁶) was significant Cross-lagged panel correlation Pairwise cross ($\beta = -.29$, $p = .012$). Those of lower proficiency (bottom tercile) gained +9.1 points vs. +5.8 in high ($d = 1.04$ vs. 0.61).
- Usage–outcomes correlation: Session time ($r = .41$, $p < .01$), replay frequency ($r = .38$, $p < .01$), and speech attempts ($r = .44$, $p < .001$) positively predicted posttest gain ($\Delta R^2 = .22$ in regression).

An exception to this is if a participant could not be included in the analysis because they only took part at one of the two time(s) when measures were taken (e.g., a post-test or follow-up), in which case d can still be calculated by taking means for other participants only (Sharpe & Woodford, 2016). An outlier was detected on post-test scores of intervention condition ($d = .001$).

4.3 Qualitative Thematic Synthesis (H₃)

To examine Hypothesis 3 (H₃), a thematic analysis was conducted following the procedures outlined by Braun and Clarke (2021). The analysis demonstrated high inter-coder reliability ($\kappa = .89$) and identified four superordinate themes that captured participants' experiences with the mobile-assisted language learning (MALL) intervention. Table 3 presents the identified themes, their prevalence among participants, representative quotations, and their relationships with the quantitative findings.

Table 3. Qualitative Thematic Synthesis of Participants' Experiences (H₃)

Theme	Prevalence	Exemplar Quote	Link to Quantitative
Adaptive Calibration	94%	"The app got harder when I improved — not boring like class tapes."	$r = .44$ with speech attempts
Metacognitive Scaffolding	88%	"It asked 'What did you predict?' — now I do it automatically."	Top-down strategy gain
Gamified Autonomy	81%	"I wanted the streak — listened even on weekends."	$M = 28.4$ min/session
Technical Frustration (Initial)	62%	"Week 1: mic didn't work. Week 3: fine."	Early dropout risk mitigated

Integration: High-usage participants (top quartile) cited adaptive + metacognitive themes $2.1\times$ more than low-usage ($\chi^2(1) = 8.76$, $p = .003$).

4.4 Evaluation of Methodology: Strengths and Weaknesses

To provide a balanced assessment of the study, the methodological strengths and limitations were evaluated. This evaluation considers research design, sample characteristics, measurement instruments, and analytical procedures. Table 4 summarizes the major strengths and weaknesses of the methodology, highlighting both the rigor of the study and areas that may influence the interpretation and generalizability of the findings.

Table 4. Evaluation of the Study Methodology: Strengths and Weaknesses

Dimension	Strengths	Weaknesses
Design	Quasi-experimental with intact class randomization, parallel test forms, delayed posttest (addresses 70% of MALL studies' duration flaw; Godwin-Jones, 2019, p. 5)	Not fully randomized (class-level) → potential teacher effect (controlled via fidelity checks)
Sample	N = 120, homogeneous B1 Thai EFL, high smartphone access (95%) → ecological validity	Single urban region → limited generalizability to rural/digital-divide contexts
Measures	Standardized IELTS forms ($\alpha > .89$), multi-source triangulation (tests + logs + perceptions)	Listening test ceiling effect possible (top score = 38/40); no oral production measure
Analysis	Covariate control, effect size reporting, inter-rater reliability ($\kappa = .89$)	Qualitative n = 20 → saturation likely but not exhaustive

Bias mitigation: Double-coding, member-checking, sensitivity analysis. No evidence of reactivity (Hawthorne) app use voluntary, logs passive.

4.5 Implications of the Findings

The findings of this study provide strong support for the hypothesis that adaptive mobile applications can significantly improve and sustain listening comprehension among secondary EFL learners. The combination of personalised adaptive learning and metacognitive support appears to play an important role in enhancing learners' listening performance over time. Several findings reinforce this conclusion:

Magnitude of the effect: The observed effect size ($d = 0.82$) exceeds the average effect reported in previous meta-analyses of mobile-assisted language learning ($g = 0.62$), indicating a comparatively stronger impact of the adaptive intervention (Sung et al., 2015).

Sustainability of learning gains: Approximately 97.4% of the learning gains were maintained during the delayed post-test, suggesting that the benefits of adaptive MALL extend beyond immediate instructional effects and addressing concerns regarding the temporary nature of technology-assisted learning.

Underlying learning mechanisms: The integration of adaptive feedback and gamification appears to support sustained learner engagement and metacognitive strategy development. These findings extend the metacognitive framework proposed by Vandergrift and Goh (2012) by demonstrating its applicability within adaptive digital learning environments.

Contribution to previous research: The results suggest that shorter interventions, such as those reported by Rahimi and Soleymani (2015), may underestimate the long-term effectiveness of adaptive MALL. The present findings indicate that an intervention period of approximately 12 weeks may be necessary to achieve substantial and sustainable improvements in listening comprehension.

5. Conclusion

In summary, this investigation offers strong evidence from multi-method triangulation that adaptive MALL supports substantial and sustainable improvements in listening performance among secondary EFL learners.

Field implications:

1. **Pedagogy:** Use adaptive applications as curricular supplements. The multi-platform nature of these applications enables their use across multiple devices, supporting flexible and personalised learning opportunities.
2. **Equity:** Address early technical challenges through appropriate onboarding procedures and user support.
3. **Policy:** Promote wider implementation through national EFL digital education frameworks, such as Thailand 4.0.

Research recommendations:

1. Conduct randomised controlled trials (RCTs) in rural and low-SES settings to examine the influence of the digital divide.
2. Conduct longitudinal follow-up studies (>6 months) incorporating neural and eye-tracking measures to examine long-term learning effects.
3. Investigate comparative effectiveness between AI-adaptive feedback and teacher-mediated feedback.
4. Apply learning analytics and machine-learning approaches to log files to predict dropout risks and learning trajectories.

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