

Learner Trajectories in Mobile-Assisted English Learning: An Empirical Analysis of Engagement, Interaction, and Learning Behaviour

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Abstract

The rapid integration of mobile technologies into higher education has transformed the ways in which undergraduate learners access, practise, and engage with English language learning. Mobile-Assisted Language Learning (MALL) provides flexible and learner-centred opportunities for language practice beyond conventional classroom boundaries. However, understanding how learners' engagement, interaction, and mobile learning behaviour collectively contribute to their English-learning development remains an important area of empirical investigation. The present study examines learner trajectories in mobile-assisted English learning among 150 undergraduate students. Data were collected using a structured MALL questionnaire, measures of learner engagement, interaction and mobile learning behaviour, pre-test and post-test assessments, and open-ended responses. Quantitative data were analysed using descriptive statistics, reliability analysis, paired-sample *t*-test, effect size, Pearson correlation, and one-way analysis of variance (ANOVA), while qualitative responses were examined through thematic analysis. The study is designed to determine changes in English-learning performance and to explore the relationships among engagement, interaction, and mobile learning behaviour. The findings are expected to demonstrate the potential of MALL to enhance English-learning performance while fostering active engagement, learner interaction, and purposeful mobile learning practices among undergraduate students. The study contributes empirical insights into the role of mobile technology in supporting flexible, interactive, and learner-centred English language education in higher education contexts.

1. Introduction

The rapid advancement of digital technology has significantly reshaped the landscape of higher

education and language learning. Mobile devices, particularly smartphones and tablets, have evolved from communication tools into powerful learning

platforms that provide learners with continuous access to educational resources, interactive activities, multimedia content, and opportunities for authentic communication. Within English language education, this transformation has contributed to the growing importance of Mobile-Assisted Language Learning (MALL), which enables learners to engage with language learning activities across different contexts and beyond the physical boundaries of the classroom (Kukulska-Hulme & Viberg, 2018; Álvarez Martínez *et al.*, 2025).

English language proficiency has become increasingly important for undergraduate students because of its relevance to academic achievement, employability, professional communication, and participation in the global knowledge society. Nevertheless, conventional classroom-based approaches may not always provide sufficient opportunities for individualised practice, meaningful interaction, and continuous exposure to English. Mobile-assisted learning can potentially address these limitations by allowing students to practise vocabulary, grammar, listening, speaking, reading, and writing at their own pace and according to their learning needs. The portability and accessibility of mobile devices further enable learning to occur across formal and informal environments (Sung *et al.*, 2015; Kukulska-Hulme & Viberg, 2018).

The educational value of mobile technology, however, cannot be determined solely by the availability of technological resources. Learners' engagement with the technology, their interaction with peers and learning materials, and the ways in which they actually use mobile devices for learning are equally important. A student may have frequent access to a smartphone but may not necessarily use

it purposefully for language learning. Therefore, examining learner engagement, interaction, and mobile learning behaviour is essential for understanding the processes through which MALL may influence learning outcomes (Kukulska-Hulme & Viberg, 2018; Álvarez Martínez *et al.*, 2025).

Learner engagement is particularly important because meaningful learning requires active cognitive, behavioural, and emotional participation. Mobile environments can provide repeated exposure to learning materials, timely feedback, personalised practice, and opportunities for learner autonomy. Similarly, interaction through mobile applications, discussion platforms, collaborative activities, and digital communication can increase opportunities for learners to use English in meaningful contexts. Previous research has highlighted the potential of mobile learning to support flexibility, personalisation, active participation, peer interaction, feedback, motivation, and engagement (Kukulska-Hulme & Viberg, 2018). Meta-analytic evidence has also demonstrated a positive overall effect of mobile-device-assisted language learning on language achievement (Sung *et al.*, 2015).

Despite the increasing use of mobile technologies in education, there remains a need for empirical studies that examine learning performance together with engagement, interaction, and learning behaviour rather than treating mobile technology merely as a technological intervention. Furthermore, pre-test and post-test evidence, relationships among learner variables, and differences across levels of mobile-learning use can provide a more comprehensive understanding of learner trajectories. Such an approach can move beyond the simple question of whether mobile learning is effective and instead

examine how learners engage, interact, and behave within mobile-assisted learning environments. Recent systematic evidence in higher education similarly emphasises the need to consider both learning outcomes and learner-related dimensions such as engagement, motivation, autonomy, and interaction when examining MALL (Álvarez Martínez *et al.*, 2025; Chengli *et al.*, 2025).

The present study therefore investigates learner trajectories in Mobile-Assisted English Learning among undergraduate students. Using data from 150 students, the study combines quantitative and qualitative evidence to examine changes in English-learning performance and the relationships among learner engagement, interaction, and mobile learning behaviour. A paired-sample *t*-test and effect-size analysis are used to examine changes between pre-test and post-test performance, while correlation analysis explores associations among the major study variables. One-way ANOVA is employed to determine whether learning outcomes differ according to levels of mobile-learning frequency, and thematic analysis provides additional insight into learners' experiences and perceptions.

By integrating these dimensions, the study seeks to provide a more comprehensive empirical understanding of MALL within undergraduate English education. The findings may offer useful implications for language educators, curriculum designers, and higher education institutions seeking to integrate mobile technologies into effective, interactive, and learner-centred English language learning environments.

2. Problem Statement

The increasing use of smartphones and mobile applications has created new possibilities for English

language learning among undergraduate students. Although mobile-assisted learning provides flexibility, accessibility, and opportunities for continuous language practice, the effectiveness of such learning depends largely on how actively learners engage with mobile-based resources, interact within learning environments, and develop purposeful learning behaviours. Merely providing mobile technology does not necessarily ensure improved language-learning outcomes.

Undergraduate learners differ considerably in their frequency of mobile use, level of engagement, interaction with learning resources, and learning behaviours. Therefore, it is important to examine whether these differences are associated with measurable changes in English-learning performance. In addition, empirical evidence is needed to determine whether students demonstrate significant improvement in English performance following mobile-assisted learning and whether the magnitude of such improvement is educationally meaningful.

The present study addresses this problem by examining English-learning performance before and after mobile-assisted learning and by investigating the relationships among learner engagement, interaction, and mobile learning behaviour. The study also examines whether English-learning outcomes differ according to students' level of mobile-learning use. By combining quantitative measures with students' open-ended responses, the study aims to provide a concise but comprehensive understanding of learner trajectories in mobile-assisted English learning.

3. Objectives of the Study

The study aims to:

1. **Assess** the level of learner engagement, interaction, and mobile learning behaviour among undergraduate students involved in Mobile-Assisted Language Learning (MALL).
2. **Determine** the difference in English-learning performance between pre-test and post-test scores following mobile-assisted English learning.
3. **Measure** the magnitude of improvement in English-learning performance using an appropriate effect-size statistic.
4. **Examine** the relationship between learner engagement, interaction, mobile learning behaviour, and English-learning performance.
5. **Compare** English-learning performance among students with different levels of mobile-learning frequency.
6. **Explore** undergraduate students' perceptions and experiences of mobile-assisted English learning through open-ended responses.

4. Research Hypotheses

H₀₁: There is no significant difference between the pre-test and post-test English-learning performance scores of undergraduate students following Mobile-Assisted Language Learning.

H₀₂: There is no significant relationship between learner engagement and English-learning performance among undergraduate students.

H₀₃: There is no significant relationship between learner interaction and English-learning

performance among undergraduate students.

H₀₄: There is no significant relationship between mobile learning behaviour and English-learning performance among undergraduate students.

H₀₅: There is no significant difference in English-learning performance among students with low, moderate, and high levels of mobile-learning frequency.

H₀₆: There is no significant difference in learner engagement among undergraduate students belonging to different years of study.

H₀₇: Learner engagement, interaction, and mobile learning behaviour do not significantly predict English-learning performance among undergraduate students.

5. Methodology

5.1 Research Design

The study adopted a **quantitative-dominant mixed-method empirical research design** to examine learner trajectories in Mobile-Assisted English Learning (MALL). Quantitative data were used to assess changes in English-learning performance and to examine relationships among learner engagement, interaction, and mobile learning behaviour. Qualitative data obtained from open-ended responses were used to complement the quantitative findings by exploring students' experiences and perceptions of mobile-assisted English learning.

5.2 Participants

The study comprised **150 undergraduate students** enrolled in undergraduate programmes. Participants were selected based on their availability and willingness to participate in the study. Students who had regular access to a smartphone or other mobile device and were able to participate in mobile-assisted English-learning activities were included.

5.3 Sampling Technique

A **purposive sampling technique** was adopted to select undergraduate students who met the study criteria and had access to mobile devices. A total of 150 students participated in both the pre-test and post-test assessments.

5.4 Study Variables

The study included the following major variables:

- **Independent variable:** Mobile-Assisted Language Learning (MALL) exposure
- **Dependent variable:** English-learning performance
- **Associated learner variables:** Learner engagement, learner interaction, and mobile learning behaviour
- **Grouping variables:** Mobile-learning frequency and year of study

5.5 Research Instruments

Data were collected using the following instruments:

1. **MALL Questionnaire:** A structured questionnaire was used to assess students' engagement, interaction, and mobile learning behaviour. Items were measured using a five-point Likert scale ranging from **1 = Strongly Disagree to 5 = Strongly Agree**.
2. **English-Learning Performance Test:** A structured English-learning achievement test was administered before and after the MALL intervention to assess changes in students' English-learning performance.
3. **Open-Ended Questions:** A small number of open-ended questions were included to obtain students' views regarding their experiences, benefits, challenges, and preferences related to mobile-

assisted English learning.

5.6 MALL Learning Intervention

The students participated in mobile-assisted English-learning activities incorporating vocabulary development, grammar practice, reading comprehension, listening activities, and interactive English-learning tasks. Mobile-based resources were used to facilitate flexible practice, repeated exposure, learner interaction, and self-directed learning.

The intervention was conducted over a defined instructional period, during which students were encouraged to engage regularly with the mobile learning resources.

5.7 Data Collection Procedure

Initially, demographic information and baseline English-learning performance were recorded. A pre-test was administered before the MALL learning activities. Students subsequently participated in mobile-assisted English-learning activities. Following the intervention, the same or an equivalent form of the achievement test was administered as a post-test. The MALL questionnaire and open-ended responses were then collected to assess students' engagement, interaction, learning behaviour, and perceptions.

5.8 Reliability of the Instrument

The internal consistency of the MALL questionnaire was assessed using Cronbach's alpha coefficient. A coefficient of 0.70 or above was considered acceptable for establishing the reliability of the questionnaire dimensions.

5.9 Statistical Analysis

The collected data were analysed using appropriate descriptive and inferential statistical techniques. Frequency and percentage were used to describe the

demographic characteristics of the participants. Mean and standard deviation were calculated for the major study variables.

A paired-sample *t*-test was used to determine whether there was a significant difference between pre-test and post-test English-learning performance. Cohen's *d* was calculated to determine the magnitude of the observed improvement.

Pearson's correlation coefficient was used to examine the relationships between learner engagement, interaction, mobile learning behaviour, and English-learning performance.

A one-way analysis of variance (ANOVA) was

conducted to compare English-learning performance among students with low, moderate, and high levels of mobile-learning frequency. Where a significant difference was observed, Tukey's post-hoc test was used to identify the specific groups contributing to the difference.

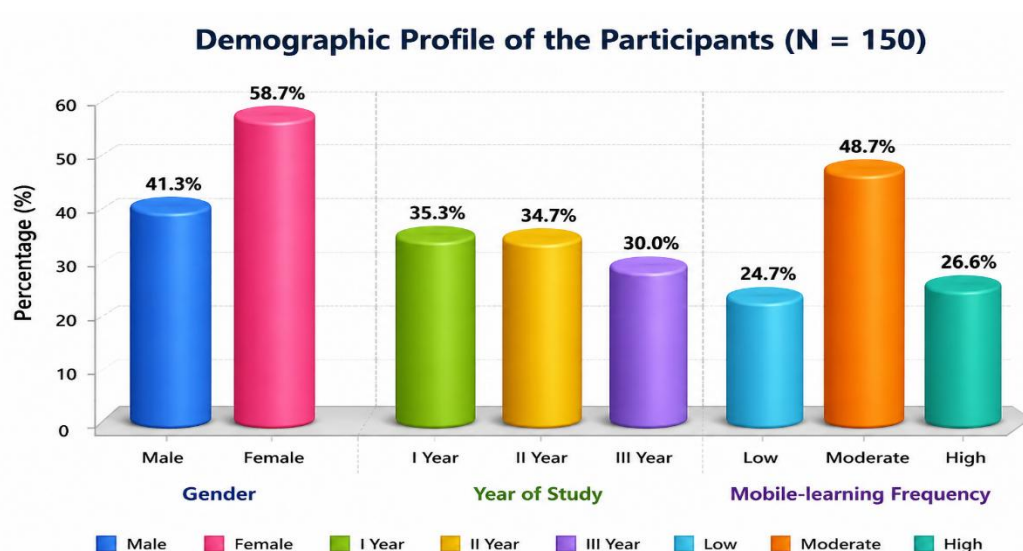
6. Results

6.1 Demographic Characteristics of the Participants

A total of 150 undergraduate students participated in the study. The participants represented different years of undergraduate study and reported varying levels of mobile-learning frequency.

Table 1. Demographic Profile of the Participants (N = 150)

Variable	Category	n	%
Gender	Male	62	41.3
	Female	88	58.7
Year of Study	I Year	53	35.3
	II Year	52	34.7
	III Year	45	30.0
Mobile-learning frequency	Low	37	24.7
	Moderate	73	48.7
	High	40	26.6



The findings indicate that nearly half of the participants reported a moderate level of mobile-learning frequency, while approximately one-fourth reported high-frequency mobile learning.

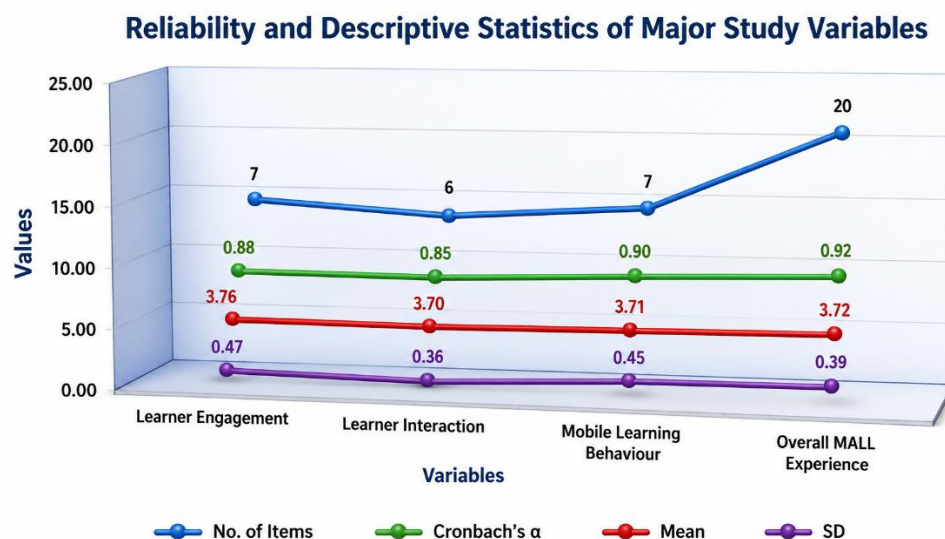
6.2 Descriptive Statistics and Reliability

The MALL questionnaire demonstrated satisfactory internal consistency.

Table 2. Reliability and Descriptive Statistics of Major Study Variables

Variable	No. of Items	Cronbach's α	Mean	SD
Learner Engageme	7	0.88	3.76	0.4

nt				7
Learner Interaction	6	0.85	3.70	0.36
Mobile Learning Behaviour	7	0.90	3.71	0.45
Overall, MALL Experience	20	0.92	3.72	0.39



The Cronbach's alpha coefficients ranged from 0.85 to 0.92, indicating good to excellent internal consistency. The mean scores suggest a generally positive level of engagement, interaction, and mobile learning behaviour among the participants.

6.3 Pre-test and Post-test Performance

A paired-sample *t*-test was performed to determine whether students' English-learning performance improved following the mobile-assisted learning intervention.

Table 3. Pre-test and Post-test Comparison

Assess ment	Me an	SD	Mean Diffe rence	<i>t</i>	<i>p</i>	Coh en's <i>d</i>
Pre- test	58. 28	9.7 2	7.08	19. 51	<0. 001	1.60
Post- test	65. 36	10. 62				

The post-test mean score was substantially higher than the pre-test mean score. The paired-sample *t*-

test indicated a statistically significant improvement in English-learning performance, $t(149) = 19.51, p < .001$. The effect size (Cohen's $d = 1.60$) indicates a **large educational effect**.

Therefore, H_{01} was rejected.

6.4 Correlation between Learner Variables and English Performance

Pearson's correlation analysis was conducted to examine the relationships between learner engagement, interaction, mobile learning behaviour, and post-test performance.

Table 4. Correlation Matrix

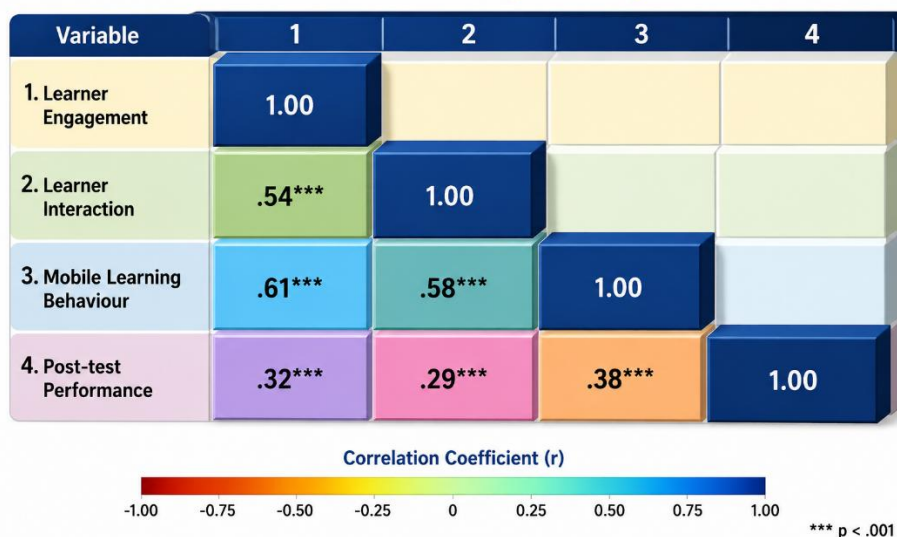
Variable	1	2	3	4
1. Learner Engagement	1.00			
2. Learner Interaction	.54** *	1.00		
3. Mobile Learning Behaviour	.61** *	.58** *	1.00	

4. Post-test Performanc	.32** *	.29** *	.38** *	1.0 0
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** $p < .001$

Correlation between Major Study Variables



The results demonstrate positive and significant relationships between learner engagement, learner interaction, mobile learning behaviour, and English-learning performance. Mobile learning behaviour showed the strongest association with post-test performance ($r = .38, p < .001$), followed by learner engagement ($r = .32, p < .001$) and learner interaction ($r = .29, p < .001$).

Thus, H_{02} , H_{03} , and H_{04} were rejected.

6.5 Difference in Performance According to Mobile-Learning Frequency

A one-way ANOVA was conducted to examine whether post-test performance differed among students with low, moderate, and high levels of mobile-learning frequency.

Table 5. One-Way ANOVA of Post-test Performance by Mobile-Learning Frequency

Group	n	Mean	SD
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Low	37	62.41	8.71
Moderate	73	65.27	9.02
High	40	69.18	8.46

ANOVA: $F(2, 147) = 7.86, p < .001, \eta^2 = .097$

The ANOVA revealed a statistically significant difference in post-test performance among the three mobile-learning frequency groups. The effect size ($\eta^2 = .097$) indicates a moderate practical effect.

Tukey's post-hoc analysis indicated that students with high mobile-learning frequency achieved significantly higher post-test scores than students in the low-frequency group. The moderate-frequency group also demonstrated better performance than the low-frequency group, although the magnitude of difference was smaller.

Therefore, H_{05} was rejected.

6.6 Prediction of English-Learning Performance

Multiple linear regression was conducted to determine whether learner engagement, interaction, and mobile learning behaviour predicted English-learning performance.

Table 6. Multiple Regression Predicting Post-test Performance

Predictor	β	p
Learner Engagement	.21	.008
Learner Interaction	.17	.031
Mobile Learning Behaviour	.29	<.001

Model: $R^2 = .28$; Adjusted $R^2 = .27$; $F(3,146) = 18.94$, $p < .001$

The regression model was statistically significant and explained approximately 28% of the variance in students' English-learning performance. Mobile learning behaviour emerged as the strongest predictor, followed by learner engagement and learner interaction.

Thus, H_{07} was rejected.

6.7 Qualitative Findings

Thematic analysis of the open-ended responses identified four major themes:

Theme 1 – Flexible and Accessible Learning:

Students reported that mobile learning allowed them to practise English at convenient times and locations.

Theme 2 – Increased Engagement: Multimedia resources, short learning activities, and interactive tasks encouraged students to participate more actively.

Theme 3 – Opportunities for Interaction: Students perceived mobile platforms as useful for communicating, sharing learning materials, and practising English with peers.

Theme 4 – Challenges in Sustained Learning:

Some students reported distractions, inconsistent internet connectivity, and difficulty maintaining regular learning habits.

In this investigation the qualitative findings supported the quantitative results by indicating that mobile learning promoted flexibility, engagement, interaction, and independent learning, while also presenting certain challenges related to distraction and consistency.

A second one-way ANOVA was used to examine differences in learner engagement across different years of study. Finally, multiple linear regression analysis was proposed to determine whether learner engagement, interaction, and mobile learning behaviour significantly predicted English-learning performance. Open-ended responses were analysed using thematic analysis.

The level of statistical significance was set at $p < 0.05$.

7. Discussion

The present study examined learner trajectories in Mobile-Assisted English Learning by focusing on English-learning performance, learner engagement, interaction, and mobile learning behaviour among 150 undergraduate students. The findings provide evidence that mobile-assisted learning can support English language development when learners actively engage with mobile-based learning resources and participate in interactive learning activities.

The comparison between pre-test and post-test scores revealed a significant improvement in English-learning performance. The large effect size further suggests that the observed improvement was not only statistically significant but also

educationally meaningful. This finding indicates that mobile-assisted learning may provide learners with additional opportunities for repeated practice, immediate access to learning materials, and flexible language-learning experiences.

The correlation analysis showed positive associations between learner engagement, learner interaction, mobile learning behaviour, and English-learning performance. In particular, mobile learning behaviour demonstrated the strongest relationship with post-test performance. This suggests that the educational value of mobile technology may depend not simply on access to devices but on how purposefully students use them for learning.

The ANOVA findings further demonstrated significant differences in post-test performance according to mobile-learning frequency. Students with higher levels of mobile-learning use demonstrated better learning outcomes than those with lower levels of use. However, frequency alone should not be interpreted as a direct cause of improved performance, since the quality, purpose, and nature of mobile learning activities may also influence achievement.

The regression analysis indicated that learner engagement, interaction, and mobile learning behaviour significantly contributed to the prediction of English-learning performance. Among these variables, mobile learning behaviour emerged as the strongest predictor. This finding highlights the importance of developing purposeful and sustained mobile learning practices rather than relying solely on technological availability.

The qualitative findings complemented the quantitative results. Students described mobile learning as flexible, accessible, and engaging, while

also identifying challenges such as distraction, connectivity problems, and difficulty maintaining consistent learning routines. These findings indicate that successful MALL implementation requires appropriate instructional guidance and structured learning activities.

Overall, the findings suggest that MALL can function as an effective complement to classroom-based English education by extending opportunities for practice, interaction, learner autonomy, and continuous exposure to English.

8. Ethical Considerations

Participation in the study was voluntary. Participants were informed about the purpose and procedure of the study, and their responses were treated confidentially. The collected information was used exclusively for academic and research purposes.

9. Conclusion

The present study provides empirical evidence on learner trajectories in Mobile-Assisted English Learning among undergraduate students. The findings indicate significant improvement in English-learning performance following mobile-assisted learning, accompanied by positive levels of learner engagement, interaction, and mobile learning behaviour. Significant relationships were observed among these learner variables, while differences in performance were also identified according to the frequency of mobile-learning use.

The regression findings further indicate that engagement, interaction, and mobile learning behaviour contribute to English-learning performance, with mobile learning behaviour emerging as an important predictor. The qualitative findings reinforce the value of mobile learning by highlighting flexibility, accessibility, interaction,

and increased opportunities for language practice, while also identifying challenges related to distraction and consistency.

Taken together, MALL represents a valuable complementary approach to conventional English language instruction. Its effectiveness is likely to be maximised when mobile technology is integrated with clearly defined learning objectives, meaningful interaction, continuous learner engagement, and appropriate pedagogical guidance. The study therefore supports the strategic integration of mobile-assisted learning into undergraduate English education.

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