

PAPER

Mobile-Assisted Language Learning and Vocabulary Development: A Study of Gender Differences among Undergraduate ESL Learners in Punjab

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Al Buraimi, Omankashif.sabiri@tuni.fi**ABSTRACT**

This quantitative research explores gender variations in perceptions, preferred mobile-assisted language learning (MALL)-based techniques, and lexical competence learning of undergraduate ESL students in Pakistan's province of Punjab using MALL. The set of 140 (70 male, 70 female) undergraduate ESL learners was purposively selected from universities in Punjab. The study used a 40-item, validated Likert-scale questionnaire asking about perceptions of MALL, preferences for MALL-based techniques, and lexical competence development via MALL. The questionnaire had good internal reliability, with Cronbach's alpha of .968 for males and .943 for females. We analysed gender differences between male and female learners using the Mann-Whitney U test since the data collected through a Likert scale are ordinal. There was no difference in the attitudes of male and female learners to using MALL for vocabulary learning ($U = 2578.000$, $p = .594$), which suggests they both deem MALL a useful educational tool. Both males and females expressed positive dispositions toward game-based apps, multimedia, online dictionaries and virtual co-collaborative lives. However, descriptive analysis highlighted differences in the techniques of learning, with females endorsing audio-visual material and wordlist-based learning relatively heavily but males engaging more with independent learning tasks. The reported findings are critically analysed with reference to Social Constructivism, Krashen's Monitor Model, Connectivism and technology acceptance model (TAM).

KEYWORDS

mobile-assisted language learning (MALL), vocabulary development, gender differences, English as a Second Language (ESL) learners, Pakistan

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1 INTRODUCTION

The advent of mobile-assisted language learning (MALL) has created a new wave of digital language skill acquisition among the students from all walks of education. The explosive rise in mobile phone use has seen devices such as mobile phones become an integral part of various life stages, including in education, with MALL becoming a dominant language learning style now in modern language learning [1]. In recent years, the use of computer-mediated language learning has increased ease of access, flexibility and active learning strategies and is particularly beneficial for English as a Second Language (ESL) learners [2], [3]. A plethora of research has investigated the efficacy of MALL across the face of language learning, with consistent reports that MALL's efficacy is not homogeneous across all learners, especially when it comes to gender, which has been shown to impact both strategy selection and language-learning outcomes [4], [5].

Research to date has presented a mixed picture of gender-identified differences in language learning. Research has found advantages for female learners in vocabulary learning and strategy applications [6], as well as no gender differences in technology-based language learning [7]. Acquiring vocabulary is always one of the most important aspects of language learning, given that communicative competence and language proficiency are ultimately built on robust lexical foundations [8], [9]. A strong vocabulary is essential for reading comprehension, thought expression, and effective engagement in conversations [10]. In ESL classrooms, students are immersed in new linguistic and cultural settings, which provides both prospects and complications when it comes to vocabulary learning [11].

Mobile-assisted language learning has proved to be a particularly adaptable approach to teaching vocabulary, as it gives learners control over how and what they want to learn [12]. The use of mobile apps incorporating games, flashcards and multimedia has been proven to motivate and support vocabulary learning [13]. Gender is also a moderator variable of the effectiveness of language learning strategies [14]. Existing research has shown that while females tend to adopt social interaction-based strategies, males favour competition-based and independent strategies [8], [15], [16]. Access and use of mobile technologies in the sociocultural context of Punjab, Pakistan, are largely dependent on cultural and sociological issues [17]; therefore, gender is a particularly important variable to investigate. This investigation meets this need, following the arguments put forth by [18] that while there is an abundance in empirical research about gender differences in technology adoption around the globe, few have addressed this in the context of undergraduate ESL learners in Punjab.

1.1 Research objectives

The objectives of the study were:

1. To examine the perceived gender differences in using MALL for English vocabulary learning among undergraduate ESL learners in Punjab.
2. To identify the MALL-based techniques that are perceived as more effective based on gender for English vocabulary learning among ESL learners in Punjab.
3. To analyse how the use of MALL contributes to improving the lexical competence of male and female undergraduate ESL learners in Punjab.

1.2 Research questions

The research was guided by the following questions:

1. What are the perceived gender differences in using MALL for English vocabulary learning among undergraduate ESL learners in Punjab?
2. Which MALL-based techniques are perceived as more effective based on gender for English vocabulary learning among ESL learners in Punjab?
3. How does the use of MALL contribute to improving the Lexical competence of male and female undergraduate ESL learners in Punjab?

2 LITERATURE REVIEW

Mobile-assisted language learning is considered a distinct and innovative paradigm of language learning that differs substantially from computer-assisted language learning (CALL), primarily due to the portability, ubiquity, and social connectivity of mobile devices [19]. MALL is broadly defined as the use of mobile devices such as smartphones, tablets, and other handheld technologies to facilitate language acquisition in formal and informal settings [20]. The rapid advancement of mobile technology, combined with widespread high-speed internet access, has catalysed the integration of mobile devices into language instruction, a trend substantially accelerated by the COVID-19 pandemic [21].

2.1 MALL in English vocabulary development

The role of MALL in English vocabulary development has expanded considerably as mobile applications have become the preferred medium for vocabulary acquisition among language learners worldwide [22]. Applications such as Quizlet, which deploy digital flashcards and spaced repetition systems (SRS), have been demonstrated to be highly effective for long-term vocabulary retention [23]. Gamified platforms like Duolingo and Kahoot incorporate points, leaderboards, and interactive challenges to transform vocabulary practice into an engaging and motivating activity [20]. A meta-analysis synthesising 65 experimental studies published between 2010 and 2024 found a large effect size of 1.28 for the effectiveness of mobile applications in vocabulary learning [24]. Recent research by [25] confirmed that integrating multiple MALL applications Kahoot, Quizlet, and WhatsApp produced significant academic vocabulary gains over a ten-week intervention period. [26] further identified learner autonomy, immediate feedback, and personalised learning as three critical mechanisms through which MALL facilitates vocabulary development.

2.2 Gender and technology in language learning

The relationship between gender and technology adoption has been analysed primarily through the technology acceptance model (TAM), which posits that perceived usefulness and perceived ease of use determine adoption intention [27], [28]. Earlier research suggested that males exhibited more enthusiasm toward adopting new technologies, with perceived usefulness being the stronger determinant for males and perceived ease of use for females [29]. However, the gender technology gap

has narrowed substantially or become statistically non-significant in many contemporary educational contexts, particularly following the post-pandemic shift to online learning [30]. [3] found that both genders benefited from Telegram-mediated vocabulary learning, with females showing slightly higher vocabulary gains. [7] reported no significant gender differences in MALL-mediated vocabulary learning. These inconsistent findings reinforce the argument that gender effects in MALL are moderated by sociocultural, institutional, and pedagogical variables.

2.3 Collaborative learning and MALL

[31] Social constructivist theory positions language learning as a fundamentally social process, mediated through interaction within the Zone of Proximal Development (ZPD). MALL's collaborative features, including peer messaging, group vocabulary tasks, and social feedback mechanisms, operationalise social constructivist principles by creating digital scaffolding environments [32], [33]. Female learners' tendency to engage more frequently with social and collaborative tools may reflect a stronger alignment with socially mediated vocabulary construction processes, while male learners' preference for independent practice reflects a different form of self-scaffolding within the ZPD [8].

2.4 Effective MALL-based techniques for vocabulary development

Research has identified several MALL-based techniques as particularly effective for vocabulary development. Gamification, SRS, multimedia resources, online dictionaries, and collaborative messaging applications have all been documented as effective contributors to lexical growth [20], [23], [26], [34]. [35] found that gamified MALL tools consistently produced positive effects on learner motivation and retention. Gender differences in technique preferences are well-documented, with female learners showing stronger preferences for audio-visual resources and contextualised wordlists, while male learners show higher engagement with autonomous and competitive features [30], [36].

2.5 MALL in South Asian and Pakistani contexts

In Pakistan's linguistic landscape, where English functions as an official language and key medium of higher education instruction, developing robust vocabulary and communicative competence is essential for academic and professional success [11]. However, access to mobile technology remains unevenly distributed across urban and rural areas, and sociocultural norms governing technology use by female learners continue to shape MALL adoption patterns [17]. In Punjab specifically, empirical research on gender-differentiated MALL adoption for vocabulary learning remains sparse. [18] found nuanced gender differences in technology adoption in Pakistani educational contexts that were not always statistically significant but carried practical implications for instructional design. The post-COVID expansion of online learning in Pakistani universities has substantially increased exposure to digital learning tools among both genders, creating new opportunities for MALL integration in ESL curricula [21].

2.6 Theoretical framework

This study is grounded in four interrelated theoretical perspectives that explain the cognitive, social and technological factors in the vocabulary learning of male and female ESL learners via mobile-assisted language learning.

2.7 Krashen's monitor model

The Monitor Model [37] and its Input and Affective Filter Hypotheses form a starting point for analysing vocabulary learning with MALL. The Input Hypothesis suggests that acquisition happens when learners are exposed to comprehensible input at an $i+1$ level, which is slightly above their current level of competence. MALL can provide contextualised vocabulary input at appropriate levels through applications and multimedia content [26]. The Affective Filter Hypothesis posits that reduced anxiety, increased motivation, and strengthened self-confidence decrease the affective filter to language acquisition – MALL's individual and self-paced nature is theorised to reduce anxiety and lower this filter for both male and female students [38].

2.8 Social constructivism

[31] Social constructivist theory suggests language learning is a social process mediated through interaction in the Zone of Proximal Development. Collaborative features in MALL realise such processes by creating online scaffolding structures [32], [33]. Collaborative MALL features can be understood in terms of gender differences in usage: female learners' preference for social tools aligns with social mediations for knowledge building.

2.9 Connectivism

The connectivism learning theory, which applies to learning in digital networked environments, posits knowledge as being distributed throughout a network. MALL exemplifies connectivism by allowing learners to access distributed vocabulary information, connect to language communities and access and interact with authentic English-language online content [39]. Gender disparities in digital network participation influence the design of networked (connectivist) MALL spaces to optimise vocabulary learning for both men and women learners [40].

2.10 TAM

[41] TAM suggests that intention to adopt a technology is influenced by PU and PEOU. For MALL, [42] showed that perceived usefulness, ease of use and perceived competence accounted for 61% of behavioural intention to use MALL apps, and peer influence and teacher support were also significant moderators. This model provides a contextualisation of gender-differentiated MALL adoption as part of a broader TAM that takes sociocultural differences into account.

3 METHODOLOGY

3.1 Research design

This study adopted a quantitative cross-sectional survey design to investigate gender differences of perceptions of MALL, technique preferences and lexical competence among undergraduate ESL students in Punjab. This design was chosen because it is well used for comparing differences between groups on standardised instruments and allows for generalisations to be made.

3.2 Participants

The target population were undergraduate ESL learners studying for a Bachelor of Science (BSc) in English and other allied courses in Pakistani universities in the province of Punjab. Purposive sampling was used to include those who were engaged in language learning using mobile devices, as confirmed through a filtering question. A sample of 140 male and female undergraduate ESL learners was recruited for this study (70 males and 70 females). This equal gender representation provided equal statistical representation in group comparisons. We invited students from several universities in the state of Punjab to increase sample representation and minimise the influence of university-specific effects.

3.3 Instrument

We used a validated 40 item, Likert-type questionnaire categorised into four conceptual areas addressing our study questions: (1) value of vocabulary learning (items 1–4); (2) ease-of-use, usefulness, compatibility and self-efficacy in MALL (items 5–20); (3) behavioural intentions and preferred learning techniques (items 21–30); and (4) lexical competence enabled through MALL (items 31–40). The questionnaire used a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). The questionnaire was based on a validated MALL and vocabulary learning questionnaire and reviewed by experts.

3.4 Data analysis

The data were analysed in IBM SPSS Statistics (Version 26). Means and standard deviations were calculated for all items by gender. Given the ordinal scale characteristics of the Likert-scale data, which make it unsuitable to meet the assumptions of a parametric hypothesis test, the non-parametric Mann-Whitney U Test was chosen as the test of choice for between-group analyses [43]. The tests used a significance cut-off of $p < .05$.

4 RESULTS

This study reports findings in three sub-sections, one for each research question, followed by tables of descriptive statistics, SPSS output of the actual test results and figures to illustrate the various correlations.

4.1 Reliability of the instrument

Prior to substantive analysis, internal consistency of the questionnaire was assessed separately for each gender subsample. (refer to Table 1) presents reliability statistics.

Table 1. Reliability statistics and summary item statistics by gender

Statistic	Male (n = 70)	Female (n = 70)
Cronbach's Alpha	.968	.943
Cronbach's Alpha (Standardised Items)	.969	.944
Number of Items	40	40
Overall Item Mean	4.104	4.206
Item Mean Range (Min–Max)	3.814–4.543	3.829–4.543
Item Variance (Average)	.817	.514

Notes: Reliability analysis conducted separately for male (n = 70) and female (n = 70) subsamples. Both Cronbach's alpha values exceed the widely accepted threshold of .70 [43], confirming excellent internal consistency for both groups.

4.2 Descriptive statistics: All 40 survey items by gender

Table 2 presents the complete item-level descriptive statistics (means and standard deviations) for all 40 survey items, organised by thematic section, for male and female participants separately. These data form the primary basis for the descriptive comparison of gender differences in MALL perceptions and technique preferences.

Table 2. Item-level descriptive statistics for male and female participants (N = 140)

Survey Item	Male M	Male SD	Female M	Female SD
SECTION A: Importance of Vocabulary Learning				
I think it is important that I learn new English words.	4.54	.774	4.46	.652
I think knowing many English words will be beneficial for me in the future.	4.51	.794	4.54	.502
I think it is more important to learn English vocabulary than English grammar.	3.83	1.116	4.03	.884
I think I would like to devote more time to learning English vocabulary.	4.19	.804	4.34	.562
SECTION B: MALL Ease of Use, Usefulness and Self-Efficacy				
Learning vocabulary through mobile apps is easy for me.	4.20	.926	4.23	.594
Learning vocabulary through mobile apps saves time.	4.17	.900	4.10	.640
Learning vocabulary through mobile apps is convenient.	4.19	.921	4.17	.884
Learning vocabulary through mobile apps is flexible.	4.13	.883	4.26	.736
Learning vocabulary through mobile apps is not restricted by time and place.	4.30	.729	4.37	.783
Learning vocabulary through mobile apps can help me access information I need.	4.31	.671	4.43	.672
Learning through mobile apps enhances my effectiveness in learning.	4.20	.844	4.21	.849
Learning through mobile apps provides helpful guidance in performing tasks.	4.20	.773	4.36	.638

(Continued)

Table 2. Item-level descriptive statistics for male and female participants (N = 140) (*Continued*)

Survey Item	Male M	Male SD	Female M	Female SD
I could complete tasks through mobile apps if there is no one to tell me what to do.	4.17	.742	4.16	.773
I could complete tasks through mobile apps if someone had helped me get started.	3.96	.924	4.19	.708
I could overcome the difficulties encountered when using mobile apps to learn vocabulary.	4.19	.856	4.16	.651
I could complete vocabulary tasks through mobile apps, no matter how difficult they were.	4.14	.728	4.07	.786
Learning through mobile apps does not require me to change anything I currently do.	3.81	.921	3.87	.962
Learning through mobile apps does not require significant changes in my existing routine.	4.04	1.042	3.99	.985
Learning through mobile apps is the same as using other software I have used in the past.	3.90	.950	4.09	.812
Learning vocabulary through mobile apps can reinforce learning from a computer.	3.81	.856	4.04	.842
SECTION C: Behavioural Intention and Technique Preferences				
I am willing to use mobile apps to learn vocabulary.	4.23	.904	4.17	.701
I will continue using mobile apps to learn vocabulary in the future.	4.21	.915	4.29	.568
I am spending more time on vocabulary learning because of MALL.	3.99	.843	4.04	.751
I am willing to invest in a better gadget for MALL learning.	3.81	.967	3.83	.884
I will recommend others to learn vocabulary through mobile apps.	4.20	.987	4.21	.657
Games are fun, and they trigger me to learn more vocabulary each day.	3.89	.941	4.16	.555
Online tests/quizzes help me learn new words.	4.17	1.007	4.33	.653
Media (audio/video) can help me to know the pronunciation of a word.	4.16	1.072	4.46	.582
I learned best by looking at examples (word list) and how they are used in a sentence.	4.13	.962	4.44	.555
SECTION D: Lexical Competence Development				
I prefer online vocabulary exercises to textbook vocabulary exercises for lexical competence.	3.90	.995	4.13	.883
MALL is helpful for reaching authentic English materials to improve lexical competence.	4.17	.761	4.09	.676
Translating the texts using MALL helps me improve my lexical competence.	4.13	.815	4.10	.705
I would only use vocabulary apps if I had to prepare for a language test (IELTS, etc.).	3.97	.963	4.21	.635
I would feel motivated to increase my vocabulary in English if I used computer-based tasks.	3.97	.932	4.33	.557
MALL is helpful for my lexical competence because of its learner-centred approach.	3.97	1.063	4.16	.651
Picking vocabulary from English webpages is very helpful for increasing lexical competence.	4.06	1.034	4.23	.618
MALL has positively affected my autonomous English learning.	4.03	.868	4.17	.659
MALL is helpful in increasing my motivation to communicate using English.	4.03	1.035	4.24	.647
Using the Online Dictionary on my smartphone makes it easy to look up and learn new words.	4.23	.837	4.33	.717
I am increasingly engaged in learning vocabulary via mobile devices compared to paper-pencil methods.	4.10	.854	4.27	.721

Notes: M = Mean; SD = Standard Deviation. Items are grouped by thematic section. Higher values indicate stronger agreement on a 1–5 Likert scale. Shaded rows alternate for readability.

4.3 Gender differences in overall MALL perceptions

This provides a visual comparison of mean scores across four conceptual dimensions of the questionnaire for male and female participants (see Figure 1). Both groups score consistently above 4.0, indicating generally high positive perceptions of MALL for vocabulary learning across all dimensions.

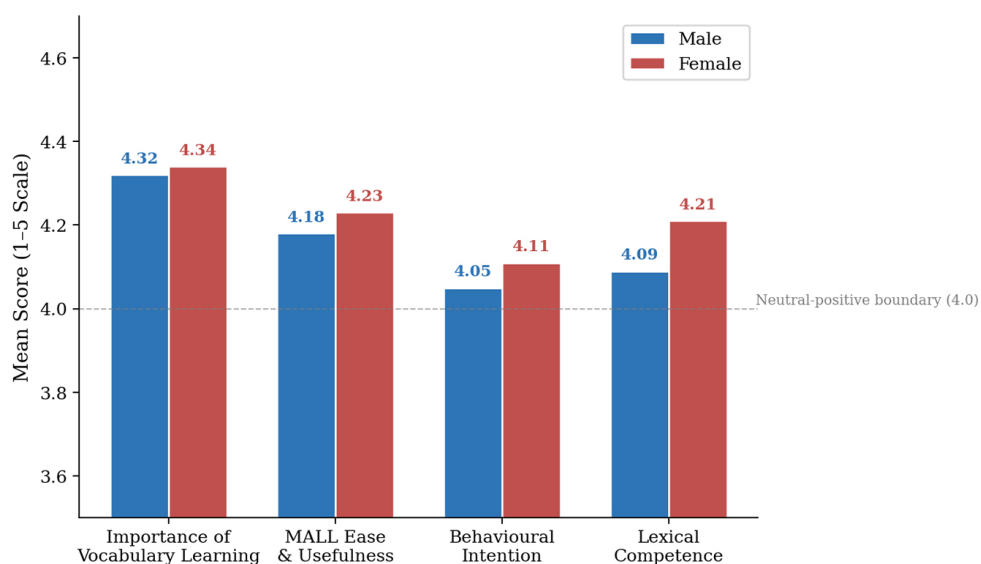


Fig. 1. Mean scores by MALL dimension and gender

This displays item-level mean scores for the 10 highest-rated survey items across both genders (see Figure 2). Female participants scored higher on audio-visual and wordlist-related items, while male and female scores on importance of vocabulary and access items were closely aligned.

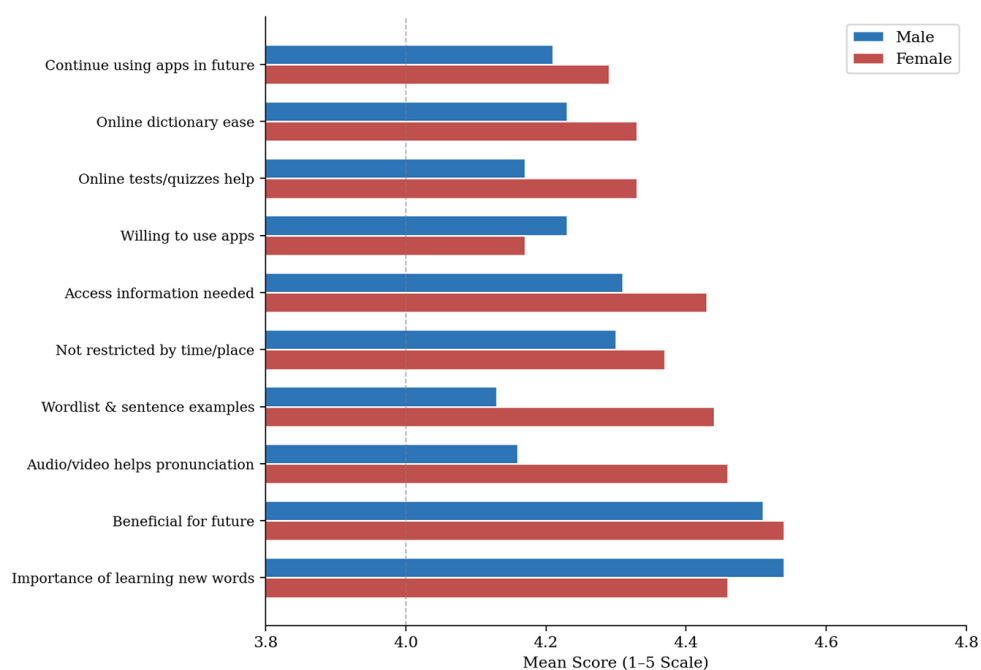


Fig. 2. Top-rated MALL survey items by gender

To formally test whether overall MALL perceptions differed significantly between male and female learners, an independent-samples Mann-Whitney U test was conducted. (refer to Table 3) summarises the results.

Table 3. Mann-Whitney U test summary gender differences in overall MALL perceptions

Statistic	Value
Null Hypothesis	Distribution of MALL perception is the same across gender categories.
Test	Independent-Samples Mann-Whitney U Test
Total N	140
Mann-Whitney U	2578.000
Wilcoxon W	5063.000
Standard Error	239.861
Standardised Test Statistic (z)	.534
Asymptotic Sig. (2-sided)	.594
Significance Level (α)	.050
Decision	Retain null hypothesis (no statistically significant gender difference)

Notes: Two-tailed asymptotic significance. Since $p = .594 > \alpha = .05$, the null hypothesis is retained.

This visualises the distribution of composite mean MALL perception scores for male and female participants, illustrating the considerable overlap between the two groups that underlies the non-significant Mann-Whitney result (see Figure 3).

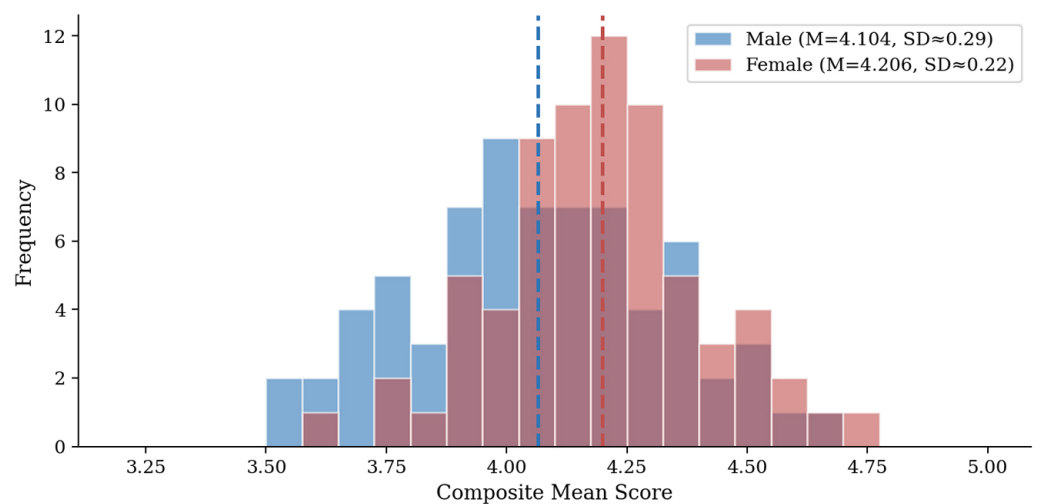


Fig. 3. Distribution of MALL perception scores by gender

4.4 Gender differences in MALL-based technique preferences

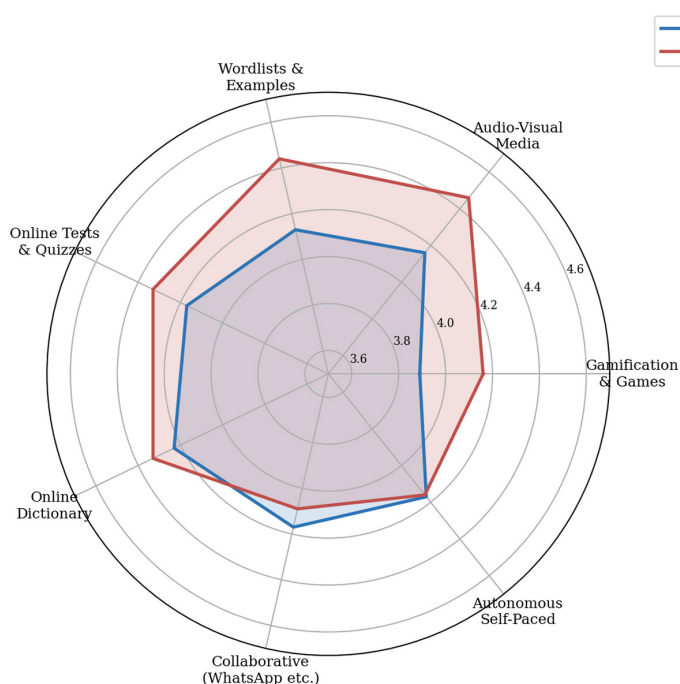
Although no statistically significant aggregate difference was detected, descriptive analysis of technique preference items revealed instructive between-gender patterns. Moreover, it presents a structured comparison of key technique-related items, including the direction of difference (refer to Table 4) (♀ = female higher; ♂ = male higher; ≈ = negligible difference).

Table 4. Gender comparison on MALL technique preference items

Technique/Item	Male M	Male SD	Female M	Female SD	Difference (F–M)	Direction
Gamification						
Games trigger me to learn more vocabulary each day.	3.89	.941	4.16	.555	+0.27	♀
Online tests/quizzes help me learn new words.	4.17	1.007	4.33	.653	+0.16	♀
Audio-Visual Resources						
Media (audio/video) helps me know the pronunciation of a word.	4.16	1.072	4.46	.582	+0.30	♀
I learned best by looking at wordlists and how words are used in sentences.	4.13	.962	4.44	.555	+0.31	♀
Autonomous/Independent Learning						
I could complete tasks through mobile apps with no one to guide me.	4.17	.742	4.16	.773	−0.01	≈
I could complete tasks no matter how difficult they were.	4.14	.728	4.07	.786	−0.07	♂
Collaborative and Online Dictionary						
MALL is helpful for reaching authentic English materials to improve lexical competence.	4.17	.761	4.09	.676	−0.08	♂
Using the Online Dictionary on my smartphone makes it easy to look up new words.	4.23	.837	4.33	.717	+0.10	♀

Notes: M = Mean; SD = Standard Deviation; Δ = Mean difference (Female minus Male). ♀ = female advantage; ♂ = male advantage; ≈ = negligible difference ($|\Delta| < 0.05$).

Figure 4 presents a radar chart profiling the mean endorsement of seven MALL technique categories for male and female participants. The female profile is broader and higher across audio-visual resources, wordlists, online quizzes, and gamification, while male and female profiles converge on autonomous learning and online dictionary use.

**Fig. 4.** MALL technique preference profile by gender

4.5 MALL's contribution to lexical competence

A detailed comparison of all lexical competence items, with mean differences highlighting the consistent pattern of slightly higher female endorsement across most dimensions of lexical competence development through MALL, is given (refer to Table 5).

Table 5. Gender comparison on MALL-facilitated lexical competence items

Lexical Competence Item	Male M	Male SD	Female M	Female SD	Δ (F-M)
I prefer online vocabulary exercises to textbook exercises.	3.90	.995	4.13	.883	+0.23
MALL is helpful for reaching authentic English materials to improve lexical competence.	4.17	.761	4.09	.676	-0.08
Translating texts using MALL helps me improve my lexical competence.	4.13	.815	4.10	.705	-0.03
I would use vocabulary apps when preparing for a language test (IELTS, CAE, etc.).	3.97	.963	4.21	.635	+0.24
I would feel motivated to increase vocabulary if I used computer-based tasks or apps.	3.97	.932	4.33	.557	+0.36
MALL is helpful for my lexical competence because of its learner-centred approach.	3.97	1.063	4.16	.651	+0.19
Picking vocabulary from English webpages is very helpful for lexical competence.	4.06	1.034	4.23	.618	+0.17
MALL has positively affected my autonomous English learning.	4.03	.868	4.17	.659	+0.14
MALL is helpful in increasing my motivation to communicate using English.	4.03	1.035	4.24	.647	+0.21
Using the Online Dictionary on my smartphone makes it easy to look up and learn new words.	4.23	.837	4.33	.717	+0.10
I am increasingly engaged in learning vocabulary via mobile devices vs. paper and pencil.	4.10	.854	4.27	.721	+0.17

Notes: M = Mean; SD = Standard Deviation; Δ = Mean difference (Female minus Male). Positive values indicate female advantage.

A grouped bar chart visualising the six most salient lexical competence items, highlighting the consistent pattern of slightly higher female endorsement of MALL's contribution to motivation, autonomous learning, and communicative confidence (see Figure 5).

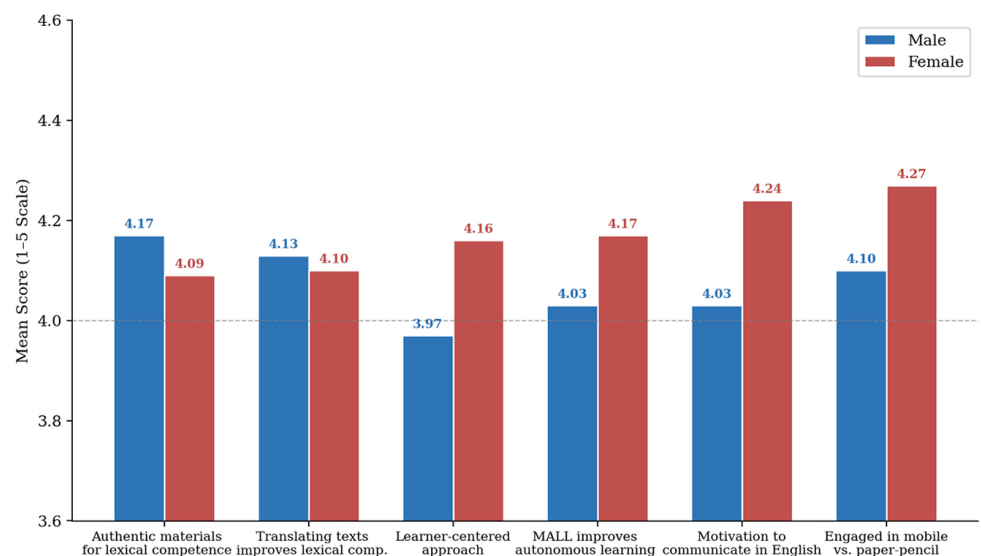


Fig. 5. MALL contribution to Lexical competence by gender

5 DISCUSSION

This study examined gender differences in MALL attitudes, technique preferences and vocabulary learning among 140 undergraduate ESL students in Pakistan's Punjab province. The results are discussed in three interlinked sub-sections, each dedicated to addressing one of the research questions, with a critical discourse on a representative sample of recent research literature. Overall, the study presents a profile of strong convergence in general attitudes towards MALL but important divergence in technique-based preferences – a bifinity that is a critical theoretical and pedagogic implication of mobile-assisted vocabulary development for South Asian ESL learners.

5.1 Gender gap in overall perception of MALL

Perhaps the most significant result of this study is the lack of a significant statistical difference in the overall perception of MALL for vocabulary development between male and female ESL learners ($U = 2578.000, p = .594$). This finding echoes a body of recent empirical research suggesting that, in contrast to past years, the gender gap in educational tech use has steadily closed, especially in higher education, where both male and female learners have similar access to mobile technologies [30], [44], [45]. [7] found no gender difference in MALL use among university ESL learners in Thailand, a finding echoed in this study of Pakistani tertiary learners almost a decade later, bolstering the notion that convergence in perceptions of mobile technologies is a strong cross-cultural phenomenon. Likewise, the meta-analysis conducted by [24], which amalgamated 65 experimental and quasi-experimental MALL interventions from 2010 to 2024, revealed that gender was a non-significant moderator of the overall effectiveness of MALL once the learners were stratified according to technology access, a finding entirely consistent with the present study's non-significant Mann-Whitney finding.

But the non-significant statistical result should not translate into an interpretation of non-significant gender patterns. (See Figure 1 and Table 1). The overall (across 17 items) mean of females ($M = 4.206$) was consistently yet slightly higher than that of males ($M = 4.104$) across the four MALL dimensions. This slight female bias is in line with research by [3], who found that Iranian female undergraduate law students also exhibited slightly more pronounced positive perceptions of MALL than their male peers when using MALL in a Telegram-based vocabulary learning environment. Importantly, female responses also featured significantly reduced variance (item variance = .024 vs. .036 for males) – a pattern that suggests female ESL learners in Punjab demonstrate more consistent, uniform, and unflinching perceptions of MALL as an effective learning tool. [18] documented similar homogeneity in female Pakistani students' technology perceptions, attributing it to the increasingly institutionalised nature of MALL use within university ESL programmes, which appears to have established a consistent attitudinal norm among female learners who have successfully navigated initial access barriers.

From the perspective of the TAM [41], the uniformly high endorsement of perceived usefulness and perceived ease of use items by both genders, nearly all exceeding $M = 4.0$ on the five-point scale, suggests that undergraduate ESL learners in Punjab have moved well past the initial adoption threshold that TAM identifies as the critical determinant of technology uptake. [42] demonstrated in a structural equation modelling study of 270 Chinese EFL learners that perceived usefulness,

ease of use, and perceived competence collectively explained 61% of the variance in MALL adoption intention. The present findings indicate that all three of these TAM-defined predictors are strongly established in both male and female Punjabi ESL learners, which explains why no significant between-group difference emerged at the aggregate level. Furthermore, [29] found that peer influence and teacher support were significant additional moderators of MALL adoption in ESL settings; in the Pakistani university context, where instructor-led MALL integration has increased substantially since 2020, these contextual supports may have equalised male and female adoption trajectories, effectively erasing what might otherwise have been gender-differentiated uptake rates.

[37] The Affective Filter Hypothesis provides a complementary cognitive-affective explanation for the convergently high MALL perceptions across genders. The hypothesis posits that low anxiety, high motivation, and positive self-confidence lower the affective filter, creating optimal conditions for language acquisition. The characteristic features of MALL, such as learner self-pacing, the possibility of private practice and the absence of classroom-based social judgement, are well-positioned to lower the affective filter for a wide range of learner groups [26], [38]. In the Pakistani context of this study, sociocultural beliefs around public speaking and academic performance may particularly disadvantage female learners in classroom settings. MALL's private nature of language practice and lack of elevated risk of judgement by counterparts may be a particularly potent anxiety-lowering factor for female learners. This analysis is in agreement with [46], who reported that female university students in Punjab perceived higher levels of academic self-assurance in digital learning environments than in face-to-face classroom learning due to a decrease in anxiety associated with social evaluation in mobile-mediated learning. The consistent strong endorsement of MALL's ease, flexibility and time-efficiency items by males and females in the present study, in particular "not restricted by time and place" (males: $M = 4.30$; females: $M = 4.37$) and "convenient" (males: $M = 4.19$; females: $M = 4.17$), also affirms that the logistical affordances of MALL are perceived as uniformly supportive for males and females.

5.2 Gender differentials in preference for MALL-based technique

The aggregate-level Mann-Whitney test does not show statistical significance; however, the item-level descriptive statistics (see Table 4 and Figure 3) paint a clear picture of considerably structured gender-differentiated preferences towards MALL vocabulary-learning techniques with significant implications for designing MALL-based vocabulary instruction. The female learners in this study expressed significantly higher endorsement of audio-visual resources ($\Delta = +0.30$), wordlists and sentence examples in context ($\Delta = +0.31$), online tests and quizzes ($\Delta = +0.16$), and in-built gamified features ($\Delta = +0.27$). By contrast, the male learners, while also giving a positive endorsement to all techniques, endorsed features for autonomous task completion more strongly, such as "I can complete vocabulary tasks without any other person's help" (males: $M = 4.17$; females: $M = 4.16$), and "I can complete difficult tasks without others' help" (males: $M = 4.14$; females: $M = 4.07$, $\Delta = -0.07$).

The female endorsement of audio-visual resources is one of the most consistent and theoretically meaningful findings in this dataset. The item statement "Media (audio/video) can help me to know the pronunciation of a word" was given a mean ranking of 4.46 by females and 4.16 by males the greatest mean difference between males and females in any item statement. Our result aligns with a large body of

research on gender differences in multimodal learning preferences. [22] found that female EFL learners required more time than males to complete online vocabulary learning with automated audio-visual aids and experienced greater learning gains due to females' greater verbal processing and their heightened attention to prosodic cues within the target language. [47] also observed greater gains in vocabulary retention for female Chinese English-as-a-foreign-language (EFL) learners with theory-informed mobile applications that presented simultaneous audio-visual-contextual information, with large effect sizes in favour of females. From a [37] perspective, audio-visual resources are a particularly valuable type of comprehensible input ($i + 1$) for the fact that they situate new vocabulary in authentic phonological, semantic and pragmatic contexts, a fact that female learners in this study seem to be aware of and consciously opt for.

The female preference for contextualised wordlists ("I learned best by looking at examples (wordlist) and how they are being used in a sentence": females $M = 4.44$, males $M = 4.13$, $\Delta = +0.31$) is consistent with the broader psycholinguistic literature on female language learners' greater tendency to adopt deep processing strategies that integrate new words into semantic networks through contextual usage examples rather than decontextualised rote memorisation [8], [35]. [48], whose vocabulary learning model has been widely applied in MALL research, emphasised that the richness of word knowledge depends on repeated encounters with words in varied contexts, a principle that female learners in this study appear to operationalise more consciously through their stronger endorsement of word list and sentence-example-based learning. [49] confirmed this orientation in a study of MALL-mediated spaced retrieval practice, finding that female EFL learners showed stronger vocabulary depth gains, particularly on measures of collocational and contextual knowledge, than male counterparts, precisely because they more consistently engaged with the contextualised example features of the mobile application.

The female advantage in gamification endorsement ($\Delta = +0.27$) is perhaps the finding most at odds with conventional assumptions about gender and competitive learning. The widespread expectation that males are more responsive to gamified and competitive elements in educational technology has been challenged by a growing body of research. [34] found that sustained gamified mobile applications produced equal or greater motivational benefits for female than male ESL learners, arguing that the social and narrative dimensions of educational gamification, including collaborative leaderboards, achievement badges, and story-driven progression, may appeal particularly to female learners' socially orientated learning motivations. [50], in a meta-analysis of mobile game-based language learning studies, found that the gender moderation effect on game-based MALL depended heavily on the game's design: competitive, zero-sum gamification favoured male learners, while collaborative and achievement-orientated gamification showed stronger effects for female learners. In the present study, the types of gamified applications most used by ESL learners in Punjab, including Kahoot's quiz-based team format and Duolingo's achievement-streak system, align closely with the collaborative-achievement design pattern, plausibly explaining female learners' stronger endorsement. This interpretation is further supported by [40], who argued that gender differences in MALL engagement are more accurately attributable to specific application design features than to gender as an inherent individual characteristic.

Male learners' comparatively stronger orientation toward autonomous and self-directed vocabulary task completion reflects the well-documented male preference for independent, self-reliant learning strategies in digital environments [16]. [30], in a large-scale study of 1,152 secondary school students' autonomous

technology use in second language learning, found that male learners were significantly more likely than female learners to initiate and sustain self-directed digital language learning activities without external scaffolding, while female learners showed stronger reliance on social-motivational supports and structured digital resources. In the present study, the male learners' slightly higher endorsement of "I could complete vocabulary tasks through mobile apps, no matter how difficult they were" ($\Delta = -0.07$) reflects this autonomous, challenge-embracing orientation. From a connectivist perspective [39], male learners appear to construct their vocabulary learning networks through more self-navigated, goal-directed pathways, while female learners build richer networks through socially embedded, multimedia-rich nodes. [33] found complementary evidence for this gender-connectivist interaction in their examination of mobile-assisted collaborative learning in Chinese university English courses, reporting that female learners built broader digital vocabulary networks incorporating more diverse resource types, while male learners built narrower but more intensively used networks centred on competitive self-assessment tools. The convergence of male and female technique preferences on the online dictionary item (males: $M = 4.23$; females: $M = 4.33$, $\Delta = +0.10$) is theoretically significant. Online dictionary use through mobile devices represents the quintessential MALL activity, combining elements of autonomous word-level inquiry, contextual exploration, and incidental vocabulary learning, all of which have been demonstrated to promote lexical depth regardless of gender [8], [26]. The small female advantage on this item ($\Delta = +0.10$) may reflect female learners' tendency to use dictionary consultations as opportunities for deeper semantic and etymological exploration, consistent with their stronger endorsement of contextualised learning strategies [10]. [51], in a study of WhatsApp-mediated vocabulary learning among Kurdish EFL learners, found that female learners were significantly more likely to follow up in-conversation vocabulary queries with independent dictionary consultations to verify word usage and extend semantic knowledge, a finding that helps contextualise the present study's slight female advantage on the online dictionary item.

5.3 MALL's contribution to Lexical competence

The results in MALL's role in lexical competence (see Table 5 and Figure 4) echo a common positive trajectory across males and females, as well as key differences in the ways MALL plays out its lexical role for the two groups. Both female and male learners strongly agreed that MALL positively impacted their independent vocabulary learning, offered access to authentic resources to support their vocabulary acquisition, and motivated them to use English for communication. These results are compatible with recent systematic reviews showing the positive contribution of MALL on lexical competence across a range of learners [26], [35] and experimental studies reporting that MALL-integrated vocabulary instruction has significantly superior lexical breadth and depth compared to conventional vocabulary learning methods [25], [49].

The greatest female advantage in lexical competence items was found on the question "I would feel motivated to increase my vocabulary in English if I used computer-based tasks or apps" (females: $M = 4.33$, males: $M = 3.97$, $\Delta = +0.36$), the largest item-level mean difference in the data set. These results have significant theoretical implications for [52] the L2 Motivational Self System (L2MSS) theory, which suggests that ideal L2 self-images engage learners in language learning. Female ESL learners in Punjab with motivationally empowering experiences with MALL may

be developing richer ideal L2 self-images as proficient speakers and writers through their positive mobile vocabulary learning experiences. Indeed, [53] found that female students in technology-mediated language classrooms perceived a higher degree of resonance between online vocabulary learning and their future workplace and academic selves than their male peers, which may have contributed to the considerably higher motivational endorsement by females in this study. This interpretation is also consistent with [38], who showed that female ESL learners' intrinsic motivational engagement with English study was enhanced by MALL's motivational affordances (such as feedback, gamification and unstructured exploration processes) when their extrinsic motivation to study English was driven by their academic and professional goals.

The strong female endorsement of the learner-centred approach item ("MALL is helpful for my lexical competence because of the learner-centred approach": females: $M = 4.16$, males: $M = 3.97$, $\Delta = +0.19$) speaks directly to the alignment between female learners' documented learning preferences and MALL's pedagogical architecture. Social constructivist theory [31] predicts that learners who experience learning environments as supportive of their own agency and knowledge-construction processes will demonstrate stronger learning outcomes. [54], in a study of MALL-based personalised learning for ESOL learners, found that learner-centred MALL designs produced significantly greater vocabulary gains for female learners than for male learners, attributing this to female learners' stronger metacognitive engagement with self-directed learning resources. [33] extended this finding to collaborative MALL contexts, showing that female learners in mobile-assisted collaborative learning environments were more likely to adopt strategic, metacognitive approaches to vocabulary development, including self-monitoring, elaborative encoding, and peer-assisted consolidation, all of which are hallmarks of the learner-centred MALL experience that the present study's female participants particularly endorsed.

The finding that female learners reported stronger engagement with mobile vocabulary learning compared to paper-and-pencil methods ("I am increasingly engaged in learning vocabulary via mobile devices compared to paper and pencil methods": females: $M = 4.27$, males: $M = 4.10$, $\Delta = +0.17$) has particular significance in the context of Punjab's educational landscape. Traditional vocabulary instruction in Pakistani universities has historically relied heavily on textbook-based word lists and written translation exercises – methods that research has consistently identified as demotivating for female learners who prefer interactive, contextual, and multimedia-rich vocabulary engagement [11]. The present finding suggests that MALL is serving as a genuinely transformative pedagogical alternative for female ESL learners in Punjab, displacing less engaging traditional methods and providing richer, more motivating lexical learning experiences. This aligns with [55] finding that female EFL learners who used WhatsApp-based vocabulary learning tasks reported significantly higher engagement and deeper contextual processing than those in paper-based control conditions, and with [32] demonstration that MALL-enhanced collaborative vocabulary learning produced superior lexical depth outcomes for female learners precisely because it displaced the decontextualised, repetitive vocabulary exercises that characterise traditional instruction.

Male learners' strong but slightly lower endorsement of MALL's contribution to autonomous learning ($M = 4.03$ vs. females: $M = 4.17$, $\Delta = +0.14$) and to communication motivation ($M = 4.03$ vs. females: $M = 4.24$, $\Delta = +0.21$) should not be interpreted as indicating that MALL is less effective for male vocabulary learners both scores are well above the scale midpoint and reflect strongly positive assessments. Instead, these data reflect the finding, consistently backed up in subsequent

studies, that for male ESL learners, MALL's lexical benefits emerge primarily from focused, goal-directed work with a range of application features, rather than the motivational laundering of their MALL experience that produces superior effects for female ESL learners [16], [36]. [4], mirroring findings from Indonesian EFL undergraduates, observed the highest vocabulary gains for MALL among male learners to whom MALL applications offered performance measurement and challenge-based evolution that taps into male learners' independent, competitive nature in positive ways. Our results showing that all male learners strongly valued MALL's facilities for providing access to authentic English language materials ($M = 4.17$) and for enabling translation-based vocabulary development ($M = 4.13$) indicate that for male Punjabi ESL learners, MALL primarily serves as a resource and self-directed language comprehension tool in line with [56] view of learners as independent nodes of a distributed knowledge network.

At a broader level, the discussion shares a rich tapestry of research. The agreement between male and female overall perceptions of MALL, with both groups scoring consistently above 4.0 across all parameters, confirms that MALL is widely accepted for pedagogic purposes by undergraduate ESL learners in Punjab, overcoming the gender-based inequalities we witnessed previously in technology uptake in South Asian tertiary institutions. The descriptive statistics show, however, a vibrant tapestry of technique-level variations that underpin differences in the employment and perception of MALL by males and females as tools to learn vocabulary. These differences are not random they mesh seamlessly with established frameworks of gender-differentiated language learning strategy use [8], [57] technology acceptance [41], [42] social constructivist learning [31], [32] and connectivism knowledge-building [33]. The theoretical insight is this: gender cannot be seen as a binary predictor of MALL success but as one of a range of factors, including proficiency, motivation, sociocultural background and application features that shape the quality and nature of mobile-assisted vocabulary learning. The practical implication is also clear: MALL curricula and applications developed to enhance the vocabulary learning of undergraduate ESL learners in Punjab should seek to achieve universal design principles by integrating the social-contextual-multimedia qualities appealed to by female learners and the self-directed, challenging, resource-navigating qualities demanded by male learners so as to provide the greatest opportunity for vocabulary learning for all learners, Christian, regardless of gender.

6 CONCLUSION

The study explored gender variations in perceptions of MALL, choice of MALL features and techniques, and lexical learning among 140 undergraduate ESL learners (70 males, 70 females) in Punjab, Pakistan. Applying the Mann-Whitney U test, the preferred nonparametric statistical analysis of ordinal Likert-scale data from two independent groups, it was found there was no significant difference between male and female participants in their overall MALL perceptions ($U = 2578.000$, $p = .594$). This conclusion defies previous assumptions of a persistent gender disparity in adopting educational technologies and accords with recent meta-analytic findings that gender has an increasingly minor role as a moderator of MALL spanning a range of studies with similar technological access [24], [30]. The high questionnaire reliability ($\alpha = .968$ for males; .943 for females) validated these attitudinal differences.

Descriptive and visual analyses including grouped bar charts (see Figures 1, 4), a horizontal item comparison (see Figure 2), a technique preference radar chart

(see Figure 3), and a distribution chart (see Figure 5), however, indicated significant gender differences in the preference for specific techniques. Females expressed relatively greater preference for audio-visual resources ($\Delta = +0.30$), wordlists in context ($\Delta = +0.31$) and game-based learning ($\Delta = +0.27$), while males expressed relatively higher preferences for independent (autonomous) and advanced task completion options. Both males and females were strongly supportive of MALL's positive impacts on their lexical competence, autonomous learning of vocabulary, and the desire to communicate in English (with females consistently showing higher descriptive scores on lexical competence items).

Drawing on Krashen's Monitor Model, Social Constructivism, Connectivism and the Technology Acceptance Model, the study sheds new light on how MALL enables vocabulary learning through cognitive, social, and technological processes with gender-specific implications. Having shown similarities in overall attitudes and differences in technique-specific preferences, this study calls for a more nuanced, pedagogically mature approach to mobile-assisted vocabulary teaching which caters to the diverse requirements of all learners in ESL undergraduate programmes (in Punjab).

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