RJSSER

Research Journal of Social Sciences & Economics Review

Vocabulary and Mobile Assisted Language Learning (MALL): A Survey on ESL Undergraduate Learners of Punjab

* Muhammad Shaharyar Sabiri

** Muhammad Imran Shah (Corresponding Author)

_____

Abstract

The incorporation of technology in education has become a dire necessity of the current era, and mobile phones are the most portable and affordable technology of this current period, due to which their usage in education has gained much importance over the years. To gain an understanding of the practice and integration of MALL in English vocabulary learning, the researcher designed a quantitative survey study. The research was based on the "Input Hypothesis" of the Monitor model and the five-step vocabulary learning model. The study aimed to understand the perceptions of undergraduate ESL learners concerning the usage of MALL for vocabulary learning, MALL-based techniques that they considered effective for learning vocabulary and the role of MALL in improving the lexical competence of the learners. A questionnaire with Likert scale responses from "strongly disagree" to "strongly agree" was designed by the researcher to collect responses from the participants. The researcher recruited a sample of 200 undergraduates through purposive sampling from a public university in Punjab, among which 140 responded to the online questionnaire being administered for data collection. Microsoft Excel and SPSS were utilised to analyse data by calculating the mean and standard deviation of the response. Cronbach's alpha was also calculated to ensure the reliability of the questionnaire along with the chi-square test, which was utilised to find the association between the variables. The study concluded that the usage of MALL was positively perceived among undergraduate ESL learners of Punjab, and they considered it highly effective for enhancing their lexical competence.

Keywords: Mobile-assisted language learning (MALL), English as Second Language (ESL), Vocabulary learning, Undergraduate learners, Survey Study

Introduction

M-learning is the mobile usage irrespective of time and place for the attainment of knowledge and skill, which ultimately roots a modification in the behaviour of an individual (Geddes, 2004). Furthermore, Kukulska-Hulme (2009) particularised M-learning as they referred to it as mobile-assisted language learning (MALL) and elaborated it by explaining that MALL in a broader sense refers to the activities undertaken for the learning of language at any time and place through mobiles deprived of being restricted to any locality or time. With the advent of technology, MALL has also been instigated to attain more reputation than computer-assisted language learning (CALL) and appeared as an inventive learning approach with the professed dominance of CALL. MALL apps gained importance during the process of advancement in mobile technology, but communal social network platforms such as Facebook, Twitter, and Instagram have also made their entrance into the domain of MALL in recent years (Mitchell, 2012).

Despite all the studies being conducted related to MALL, most of them were focused on specific software or a program created by the researcher and then used by the participants, whereas some studies use mobile devices to send language learning materials in a short form that can also be learned by not using mobile devices (Lu, 2008; Thornton & Houser, 2005). Moreover, studies have also discussed the role of MALL concerning the cognitive and effective benefits being provided by the usage of mobile devices along with the instant access and transmission of information because of mobile devices. Furthermore, (Cavus & Ibrahim, 2009; Song, 2008) explained the advantages of MALL because of the immediacy in the delivering and receiving of content along with the flexibility

_____

*   MPhil Scholar, Applied Linguistics, Government College University Faisalabad
    Email: shaharyarsabiri7@gmail.com ORCID: 0000-0001-6694-562X
** Lecturer, Applied Linguistics, Government College University Faisalabad
    Email: m.imran.shah@gcuf.edu.pk

provided by it regarding the time and place, which also enhanced the motivation among the learners of language because of the advantageous properties of MALL. Moreover, the scope of MALL in acquainted and authentic environments was also studied (Shadiev et al., 2020), and most of the works related to the application of MALL employed a TBLT approach and communication language teaching approach for testing the pedagogical implication of mobile phone usage for English language learning.

Problem Statement

In current years, education has experienced revolutionary changes because of the advent of technology, and due to these changes in the educational process, learners and instructors have experienced different phases because of their acceptance, attitudes, and problems associated with the incorporation of technology and new methodologies of teaching and learning. The integration of technology in education has become a dire need of the current era, and mobile phones are the most portable and affordable technology of this current period. However, to extend apprehension of the practice and integration of mobile phones in education, in-depth research is required so that learners and teachers can fully benefit from this modern technology. This study aimed to understand the views and preferences of undergraduate ESL learners about MALL along with the role of MALL in improving lexical competence using mobiles for learning vocabulary, and quantitative instruments were used to obtain their views concerning the usage of MALL for the learning of vocabulary.

Purpose Statement

This survey study aimed to study the use of mobile-assisted language learning for the learning of vocabulary by undergraduate ESL students in Punjab. This research studied MALL (independent variable) and vocabulary (dependent variable) by controlling extraneous variables for the research participants at the university level. The research was based on the input hypothesis of Krashen's Monitor Model (Krashen, 1985) and supported by the (Hatch & Brown, 1995) 5R model for vocabulary learning. The independent variable MALL was defined as the activities undertaken for the learning of language at any time and place employing mobile devices deprived of being restricted to any physical locality or time. The dependent variable vocabulary was defined as the set of words in a language that are learned to gain knowledge of the language.

Research Objectives

The current study will be constructed on the following objectives:
1. To determine the perceived importance of using mobile-assisted language learning (MALL) for English vocabulary acquisition among undergraduate ESL students in Punjab.
2. To observe effective MALL-based techniques in learning English vocabulary among undergraduate ESL students in Punjab.
3. To investigate how the usage of MALL can contribute to improving the lexical competence of undergraduate ESL students in Punjab.

Research Questions

The present research will be grounded in the following questions:
1. What is the perceived importance of using mobile-assisted language learning (MALL) for English vocabulary learning among undergraduate ESL learners in Punjab?
2. Which MALL-based techniques are effective in English vocabulary learning among undergraduate ESL learners in Punjab?
3. In what ways does the use of MALL contribute to improving the lexical competence of undergraduate ESL students in Punjab?

Literature Review

Language Learning and Technology

Mobile learning gained the attention of language learners and instructors after the advent of mobile devices, but before this time, the literature did not value the importance of mobile learning concerning portable laptops and did not differentiate it from conventional CALL, irrespective of their portability (Stockwell, 2016). The literature was also very limited on MALL because of the limited functionalities of early hand-held devices. Moreover, due to this, the learning matter seemed to be shed down from the desktop precursors, and it not only had an influence on the available tools but also impacted the way they were professed (Squire, 2009). Learners presented a confident attitude toward the usage of ICT and considered it beneficial in learning a language, completing tasks, and searching for materials related to the study (K.C., 2019). ICT was adopted positively by students in

their learning because of the availability of real-life tasks in it. Students deemed that ICTs were an imperative resource for English language learning and that they provided additional support and opportunities for practice and interaction (Tri & Nguyen, 2014). The outcomes of the study showed that a large number of the students had constructive attitudes toward the usage of ICTs in English language learning and believed that they improved their learning knowledge. The learners reported using a diversity of ICTs, including online dictionaries, translation tools, and language-learning software.

MALL and Vocabulary

A study was conducted to advance a framework for mobile language learning that showed the flexibility in mobile learning was a very attractive feature for students, and this had to be taken into account so that the individual needs of students of different levels could be countered (Zhai, 2021). The research attempted to design a framework for vocabulary teaching based on the usage of mobile technology and incorporated college students in this basic framework for learning English vocabulary by the use of mobile technology. The study concluded that mobile learning classrooms had a clear advantage over traditional classrooms, and the other thing that was observed in the research was the concentration level of the students, which was slightly higher in the experimental group because of using mobile devices for learning vocabulary, but the difference between the experimental and control groups was not noteworthy. Moreover, the usage of mobile applications was very effective and motivating for enhancing their discipline-specific knowledge of vocabulary and considered the use of mobile applications very useful and intriguing (Kohnke & Ting, 2021). The study aimed to identify the types of applications that were preferred by students in language learning and the aspects that might impact the perceptions and use of the "Books vs Brains" vocabulary application. It was concluded that students were very motivated and felt that the usage of mobile applications was very effective in the construction and escalation of their knowledge of vocabulary during their academic careers.

Mobiles have been extensively used for second language vocabulary learning in formal and informal situations to improve and reinforce second language word memorisation (Lin & Lin, 2019). The study aimed to explore the pros and conceivable restrictions of mobile-assisted second language holding of vocabulary, as during recent research related to second language vocabulary learning, SMS and MMS along with the use of mobile applications were the prominent approaches supported by different theories. The study concluded that mobile technologies facilitated the learning of second language vocabulary and were considered likely pedagogical tools for learning language, as these technologies created authentic, socially interactive, and adapted learning settings that were also context-sensitive for learning language (Jeng et al., 2010; Klopfer et al., 2002).

MALL and Language Skills

Students who used websites that had automated speech recognition technology showed noteworthy improvement in their speaking skills along with vocabulary (Bashori et al., 2022). The researcher found that the vocabulary skills of students along with their pronunciation improved significantly by using the websites that had inbuilt ASR. The researcher used the data from (Bashori et al., 2021) and implemented both quantitative and qualitative methods in the current study to gather information about vocabulary knowledge and pronunciation skills. A quasi-experimental study was designed by the researcher to collect data so that a detailed investigation could be performed related to these skills. The research concluded that these websites helped the students significantly, and the difference among students based on these websites was not noteworthy, but the variation among the experimental and control groups was significant. Proficiency in English writing and narrative capability of the first language pointedly foreseen the eminence of language usage and completion of the task (Kang & Kim, 2021). The student used the KineMaster application to create videos so that digital video tasks could be completed by the students. Students with higher proficiency in English writing and good first-language narrative capability could produce digital videos of higher linguistic eminence and fully formed content by using mobile devices (Kamimura, 1996). The study concluded that mobile phone usage is pervasive and students felt relaxed while using mobile phones regularly, which could prove very beneficial for using mobile-assisted language teaching methods in classrooms.

Mobile VR facilitated EFL learners' listening comprehension and retention because it was inspiring and beneficial and provided improved preparation for communication in real life (Tai &

Chen, 2021). The study inspected the influence of MVR on listening understanding and retention in young EFL learners and investigated the effect of MVR on virtual presence. The study also highlighted that some learners described that they were unfocused because of concurrently abundant functionality, and these difficulties were also highlighted by (Bailey et al., 2016). The study reported that overall learners showed optimistic attitudes towards the usage of MVR for listening comprehension, and in tandem with, the findings (Manegre & Sabiri, 2022) showed that teachers also exhibited optimistic attitudes towards online language learning by using virtual classrooms. The reading comprehension of learners was better on paper-based mediums instead of mobile phones, and reassuringly, they preferred hardcopies for an improved experience of reading; on the other hand, they positively perceived mobile-assisted EFL reading and exhibited an inclination to resume reading from mobile devices to improve their foreign language learning (Yu et al., 2022). The study highlighted the authentic reading experience of EFL learning students by using mobile phones and paper. It further investigated reading comprehension accuracy, speed, and strategies (Chang & Lin, 2019) used by learners when they used phones and printed paper for reading.

The students highlighted that sMALL screen sizes constrained them to access the text and made it problematic for them to guide useful information (Zou & Ou, 2020). The participants also preferred a paper-based medium because of its expediency for taking notes, as taking notes was also considered an effective way to improve consideration and eased learners in reading comprehension (Chang & Ku, 2015). The results of the study claimed that learners had to be integrated into a student-centred instruction model, and second-language learners also stressed that their key aim for learning a second language was to communicate in any real-life situation by being a part of the community.

Language Acquisition
Familiarisation strategies proved meaningfully vital in refining the learning performance of EFL learners in unfamiliar settings by using mobile phones (Shadiev et al., 2022). The study intended to test the strategies of familiarisation on the learning outcomes of learners. For this, the researcher developed familiarisation approaches to help learners turn out to be more conversant about their education atmosphere. The study concluded that strategies of familiarisation made students perform better compared to the learners of the control group who did not practise these strategies (Qiu & Lo, 2017), and the writing of the experimental group improved meaningfully compared to the participants of the control group. Language learning through digital games showed promising effects on the language development of learners along with the enrichment of engagement, thinking, and collaboration skills, which also instigated a reduction in the fear of failure (Raffone, 2022). The study presented the design, progress, and testing of original class collaborative storytelling for secondary school learners who were pursuing English as a foreign language. A mixed-method quasi-experimental study was designed by the researcher for which 95 students were recruited as participants and were separated into 5 experimental groups and one control group for the study. Students showed positive attitudes and encouraged the mixing of game-based activities for learning and teaching L2 topics, as it could be an enjoyable and pleasing way for students (Azar & Tan, 2020; Peirce & Wade, 2010). This could prove very advantageous, and the content associated with it could also be valuable for learning and teaching a second language (Berns et al., 2013).

Technology, Learner, and Teacher in English Language Learning
Calculated implementation and inclusive assessment were mandatory for the employment of WhatsApp so that more communication-associated practices could be provided to language learning students (Alamer & Al Khateeb, 2021; Karapanos et al., 2016). The study intended to observe the application of WhatsApp in informal practice by teachers to enhance the motivation of language learning learners. The study implemented a quasi-experimental design in which the participants were separated into control and experimental groups, and 447 undergraduate learners of Saudi Arabia were selected as participants for the study from the department of English of two public universities. The study utilised two instruments for the gathering of data from the participants and concluded that by fulfilling the requirements, teachers could utilise WhatsApp (Ryan & Deci, 2020) in enhancing learners' motivation during the language learning process, as it aided learners in informal settings by providing them with choices to sightsee more material related to language learning without being restricted to explicit textbooks or resources (Alshammari et al., 2017).

Furthermore, content knowledge of technology and its perceived usefulness was very vital for the attitudes of educators toward the use of MALL (Hsu, 2016). The study aimed to investigate the

content knowledge connected to the technology of EFL teachers and how this knowledge influenced the acceptance of MALL by teachers. All the hypotheses of the research proved right except the one that stated that perceived ease of use would positively influence the attitude toward use (Cakır & Solak, 2015; Mohammadi, 2015). The study concluded that the use of MALL was significantly amplified over time and that teachers showed an optimistic attitude towards the incorporation of MALL in modern education. Moreover, non-English major EFL learners exhibited satisfactory behaviour towards online bilingual instruction and had optimistic perceptions towards learning by using the STEMUP application irrespective of their English proficiency, college, and gender (Tsai, 2022). It was further elaborated that the increase in learning interest and enthusiasm of learners were considered a main benefit while using these modern technologies in education, which led to improved results (Bacca Acosta et al., 2019; Cabero-Almenara & Roig-Vila, 2019).

Methodology

The current study was based on a postpositivist philosophical stance as the input hypothesis of Krashen's Monitor Model, which is a vital theory of second language acquisition that helps to coin constructs. This research was fixated on the input hypothesis of this theory, which elaborated that the learning of language was dependent on access to comprehensible input or challenging material that should be understandable (Krashen, 1985). The input hypothesis was also emphasised because of the importance of input in vocabulary learning, as elaborated by (Hatch & Brown, 1995) in their vocabulary learning model, which was renamed the 5R model for learning vocabulary by (Shen, 2003). In addition, a study of the literature suggested that CALL and MALL practitioners were mostly consumers of the theories (Levy & Stockwell, 2013), and most of them were based on SLA or learning theories (Chapelle, 2005, 2007; Hubbard, 2008). By keeping this in mind, the theory instantiation or adaptation phenomenon was implied by the researchers by applying general theoretical principles to design, develop and implement the use of mobiles for language learning (Farr & Murray, 2016).

Figure 1. Stages of vocabulary learning (Framework)
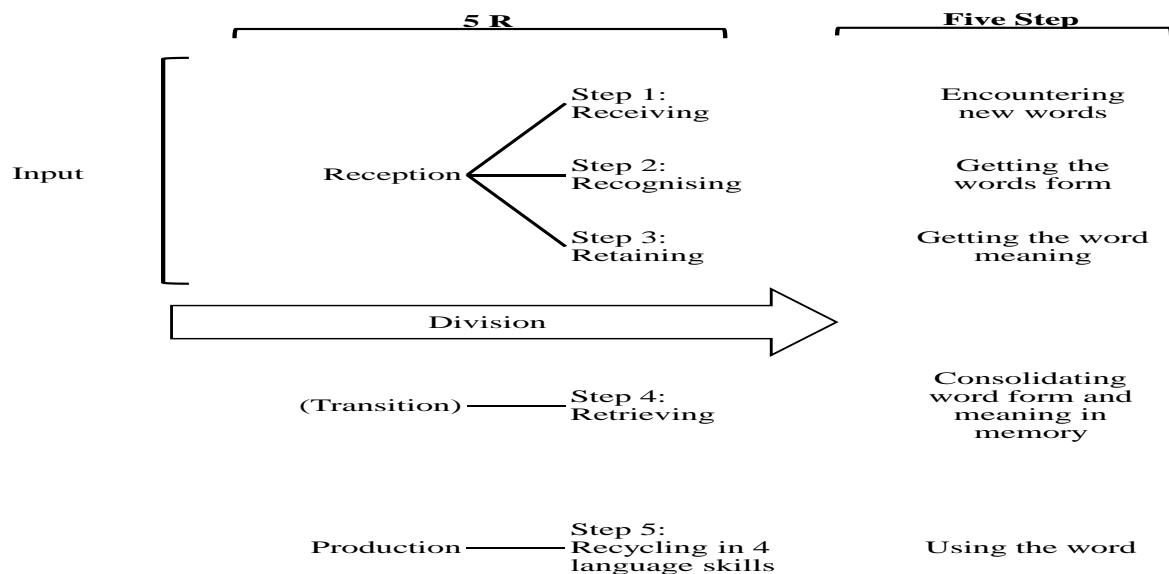
Research Design

The cross-sectional survey method was used for this quantitative study, as the researcher administered the questionnaire at a single point (Mertens, 2010) in time that would provide a snapshot of current views and preferences of undergraduate ESL students. The researcher administered a questionnaire to gather the quantitative data for the study and analysed the questionnaire by using Excel and SPSS, through which Cronbach's alpha which was used so that reliability could be ensured (Mora, 2011; Singh, 2017). Moreover, for validity, the researcher took help from experts regarding the construct, content and face validity of questionnaire (Petrunoff et al., 2013; Zhang & Aryadoust, 2022), standard deviation, mean and chi-square were calculated to obtain the outcomes of the replies of the questionnaire. The researcher also controlled extraneous variables so that internal and external threats could be minimised (Kalton, 1968), which could provide valid and reliable results.

Population and Sampling

The population of the research was undergraduate ESL learners of Punjab studying in the public universities of Punjab and enrolled in English literature and linguistics degree programs. The researcher employed a purposive sampling technique to select the sample so that a true representation of the population could be obtained in the sample (Battaglia, 2018; Guarte & Barrios, 2006). The researcher distributed an online questionnaire among 200 students, among which 140 responses were collected for the research, which represented 70% of the response ratio and was considered sufficient for the extrapolation of facts to the targeted population (Holtom et al., 2022; Mills & Gay, 2019). The questionnaire comprised major themes that would be able to obtain views of students on using MALL for vocabulary learning, preferred techniques for learning vocabulary by using MALL among undergraduate ESL students, and how MALL is improving the lexical competence of students. The questionnaire was adapted from (Aziz & Fageeh, 2013; Deris & Shukor, 2019; Gonulal, 2019; Liu, 2015) and comprised 45 items.

Results and Discussion

The researcher recruited a sample by using a purposive sampling technique and distributed a questionnaire among 200 university undergraduate ESL students, among which 140 responses were collected by the researcher during the current quantitative survey study. The participants of the research were undergraduate ESL learners of Punjab who were enrolled from a public university.

Perceived Importance of MALL for Vocabulary Learning

The researcher calculated Cronbach's alpha for every main theme/section of the questionnaire and obtained a value of 0.933 (see Table 1) for this part of the questionnaire, which indicated that the value was very close to 1 and the questionnaire.

Table 1. Reliability of the first main theme (perceived importance) of the questionnaire

Cronbach's Alpha	Cronbach's Alpha Based on Standardised Items	N of Items
.933	.935	25

The mean value of responses varied from 3.82 to 4.53, which showed that most of the participants showed agreement towards the questions being asked in the questionnaire by the researcher regarding the use of MALL for learning English vocabulary. The percentages showed that the agree option selected by the participants in each statement varied from 39% to 72%, and strongly agreed varied from 31% to 56%, which depicted that almost all students showed more than 80% agreement with the statements. The researcher also observed that the standard deviation (SD) ranged from 0.7 to 0.9 (see Table 2) in the responses of the participants. The data depicted that most of the participants agreed and appreciated the use of MALL in learning English vocabulary.

Table 2. Perceived importance of learning English vocabulary by MALL

Items	Mean	Std. Deviation	N
I reflect it is significant that I acquire novel English words.	4.5	0.715	140
I reflect that knowing numerous English words will be beneficial for me in the imminent.	4.53	0.662	140
I think it is more significant to acquire English vocabulary than English grammar.	3.93	1.008	140
I think I would enjoy to dedicate additional time to acquiring English vocabulary.	4.26	0.695	140
Learning vocabulary over mobile apps is relaxed for me.	4.21	0.775	140
Learning vocabulary through portable apps protects time.	4.14	0.779	140
Learning vocabulary over mobile apps is expedient.	4.18	0.9	140
Learning vocabulary over mobile apps is flexible.	4.19	0.813	140
Learning vocabulary through mobile apps is not constrained by time and place.	4.34	0.755	140
Learning vocabulary through mobile apps can help me access the information I need.	4.37	0.672	140
Learning vocabulary through mobile apps enhances my effectiveness in learning.	4.21	0.844	140
Learning vocabulary through mobile apps delivers cooperative direction in performing tasks.	4.28	0.71	140
If no one is there to direct me, I could do vocabulary learning assignments with smartphone apps.	4.16	0.755	140

Item	Mean	Std. Dev	N
I could complete learning vocabulary tasks through mobile apps if someone had helped me get started.	4.07	0.828	140
I was able to get over the challenges I ran into when using vocabulary learning apps on my phone.	4.17	0.758	140
No matter how challenging the vocabulary exercises were, I could do them using mobile apps.	4.11	0.756	140
I don't need to alter my routine in order to learn vocabulary with mobile apps.	3.84	0.939	140
Learning vocabulary through mobile apps does not necessitate noteworthy variations in my prevailing work routine.	4.01	1.011	140
Learning vocabulary through mobile apps is the equivalent as using other software I have castoff in the past.	3.99	0.886	140
Learning vocabulary through mobile apps can strengthen by the computer.	3.93	0.854	140
I am eager to use mobile apps to acquire vocabulary.	4.2	0.806	140
I will endure using mobile apps to acquire vocabulary in the future.	4.25	0.76	140
I am spending more time on vocabulary learning because of MALL.	4.01	0.796	140
I am willing to invest in a better gadget for MALL learning.	3.82	0.923	140
I will endorse others to acquire vocabulary through mobile apps.	4.21	0.835	140

Effective MALL-Based Techniques for Learning English Vocabulary

The value of Cronbach's alpha for this part of the questionnaire was 0.840 (see Table 3), which was near 1 and was considered very good for the reliability of the questionnaire.

Table 3. Reliability of the second main theme (effective techniques) of the questionnaire

Cronbach's Alpha	Cronbach's Alpha Based on Standardised Items	N of Items
.840	.838	4

The means of the items ranged from 4.02 to 4.31 (see Table 4), and the percentages of the data showed that for these four statements, 46%-62% of the participants showed agreement and 24%-46% of the participants strongly agreed with the statements. This depicted that 86%-92% of the participants agreed with the techniques identified in the questionnaire for learning English vocabulary by using MALL.

Table 4. Effective techniques for vocabulary learning

Items	Mean	Std. Deviation	N
Games are fun, and they trigger me to acquire additional vocabulary each day.	4.02	0.782	140
Online tests/quizzes help me learn new words.	4.25	0.849	140
Media (audio/video) can help me to recognise the pronunciation of a word.	4.31	0.872	140
I learned finest by observing examples (wordlist) and how it is being castoff in a sentence.	4.29	0.798	140

Improving Lexical Competence through MALL

Furthermore, the value of Cronbach's alpha for this theme was 0.938 (see Table 5) and was very close to the ideal value of 1, indicating that this section of the questionnaire also had very high reliability.

Table 5. Reliability of the third main theme (lexical competence) of the questionnaire

Cronbach's Alpha	Cronbach's Alpha Based on Standardised Items	N of Items
.938	.939	11

The means varied from 4.01-4.28 (see Table 6), and the percentages of the data showed that for these statements, 51%-59% of the participants showed agreement and 29%-36% of the participants strongly agreed with the statements. This indicated that 81%-96% agreed with the role of MALL in improving lexical competence and appreciated its role in learning English vocabulary.

Table 6. MALL in improving lexical competence

Items	Mean	Std. Deviation	N
I favour online vocabulary drills to textbook vocabulary exercises for lexical competence.	4.01	0.944	140
MALL is helpful for reaching authentic English materials to improve lexical competence.	4.13	0.718	140
Translating the texts using MALL helps me improve my lexical competence.	4.11	0.759	140

I will only practise vocabulary acquisition through vocabulary learning programs because of their vast availability if I had to practise for a language exam (FCE, CAE, CPE, IELTS, etc.).	4.09	0.821	140
I would sense inspired to upsurge my vocabulary in English if I castoff mobile-based errands or apps for this.	4.15	0.786	140
MALL is helpful for my lexical competence because of its learner-centred approach.	4.06	0.883	140
Learning vocabulary from English webpages is very obliging for growing lexical competence.	4.14	0.853	140
MALL has positively affected my autonomous English learning.	4.1	0.771	140
MALL helps increase my motivation to communicate using English.	4.14	0.867	140
By means of the Electronically Dictionary application on my smartphone brands it relaxed for me to search and acquire fresh words, their origins, their etymologies, and their practises in explanatory instances.	4.28	0.778	140
I am progressively involved in learning vocabulary through mobile devices compared to paper and pencil methods.	4.19	0.792	140

Overall Reliability of the Instrument

The researcher calculated Cronbach's alpha, and its value was 0.960 (see Table 7), which was very close to 1. A value of one was considered perfect, and the value of the questionnaire used by the researcher was very close to this value. A value of 0.960 was considered excellent, which indicated that the questionnaire used by the researcher in the current research was very reliable.

Table 7. Reliability of the complete questionnaire

Cronbach's Alpha	Cronbach's Alpha Based on Standardised Items	N of Items
.960	.961	40

Relationship Between MALL and English Vocabulary Learning

The researcher performed a chi-square test to test the hypothesis that was constructed for the research. All items of the questionnaire had Asymp. The Sig value was 0.000, which was < 0.005 and showed that there was a significant relation between MALL and English vocabulary learning. The highest chi-square value was 191.500c (see Table 8), which suggested that mobile applications were considered a useful platform by learners to obtain obligatory guidance while implementing tasks for learning the vocabulary of English. The values of 175.786c and 167.500c (see Table 8) suggested that mobile applications were considered effective tools for learning English vocabulary and that students felt motivated while using MALL to learn English vocabulary.

Table 8. Chi-square test

Items	Chi-Square	df	Asymp. Sig.
Learning vocabulary through mobile apps delivers obliging direction in accomplishment of tasks	191.500c	4	0.000
I am eager to use mobile apps to acquire vocabulary	175.786c	4	0.000
I would sense inspired to upsurge my vocabulary in English if I castoff mobile-based errands or apps for this	167.500c	4	0.000

Discussion

Discussion on Research Question One

The data revealed that participants thought that knowing more words would be beneficial for them in the future, as the mean of this statement was 4.53 with a standard deviation of 0.662, which showed that the majority of the participants agreed that more vocabulary would be beneficial, which was also depicted by (Kessler, 2016). The participants considered learning English vocabulary as an important aspect of language but also had mixed opinions about considering it more essential than learning English grammar, as illustrated by the average of 3.93 that the majority of the participants considered both vocabulary and grammar as essential parts of learning the English language. Participants showed a positive attitude towards learning new English words, as they considered learning vocabulary to be beneficial and to provide them with benefits in the future, and the students were also ready to devote more time to learning vocabulary by using mobile applications (K.C., 2019).

The data collected from the participants revealed that the majority of the participants agreed that mobile applications/MALL had ease of use in learning English vocabulary and considered the use of mobile applications convenient and flexible while learning English vocabulary, as these findings

correlated with the findings of (Tri & Nguyen, 2014; Zhai, 2021), which depicted the advantages of mall and ICT in learning the English language. The average responses of participants varied from 4.18 to 4.21, which depicted that the majority of the participants agreed with the easiness provided by MALL-based applications for learning English vocabulary. Furthermore, MALL made the learning of vocabulary free from the restrictions of time and place, which enabled learners to learn vocabulary at any time and place by using mobile-based applications, as the average response varied from 4.21 - 4.37. The results of the study elaborated mobile applications for learning vocabulary played an important role in making learners autonomous in their learning process, as these findings aligned with those who also focused on autonomous learning of learners by using MALL in their education (Shadiev et al., 2022), but the focus of the studies was on designing the framework for autonomous learning and learning English in unfamiliar environments.

Moreover, the perceived ease of use would positively influence the attitude towards the use, which was determined in this case, as participants showed a positive influence towards using mobile applications for learning vocabulary because of their ease of use and efficacy during English vocabulary learning tasks (Mohammadi, 2015), who also determined that ease of use would positively affect the attitude towards use. In addition to this, the participants also showed great agreement with the learning experience of using MALL, considered it the same as before using MALL and pointed out that they could reinforce learning vocabulary by using MALL in the future (Tri & Nguyen, 2014).

The results of the study also found that students were willing to recommend others to learn vocabulary by using mobile applications, as they considered it effective for learning the vocabulary of the English language (Zhai, 2021). The students further pointed out that they felt motivated while learning English vocabulary by using MALL and were also optimistic about its usage and would recommend others to use MALL for learning vocabulary, as it could be helpful to overcome difficulties they encountered while performing tasks related to vocabulary learning because of the flexibility and convenience being provided by mobile applications while learning English vocabulary (Deris & Shukor, 2019). Overall, the undergraduate ESL learners of Punjab were very optimistic regarding the use of MALL in learning English vocabulary, as they considered that the usage of modern technological tools would be beneficial for them in the future and would make things easier for them, as pointed out by (K.C., 2019; Kessler, 2016).

Discussion on Research Question Two

The researcher asked about the opinions of the participants regarding different MALL-based techniques, which included games, online quizzes, online available audios/videos and wordlists (Deris & Shukor, 2019), which presented data with examples so that it could be found that participants preferred which techniques for learning English vocabulary by using MALL. It was also observed that students preferred pronunciation skills during vocabulary learning so that they could pronounce words correctly and fluently (Bashori et al., 2022) and the students preferred audio/video for learning (Kang & Kim, 2021). The claim was also supported by (Tai & Chen, 2021; Tsai, 2022), who discussed the impact of VR on the listening comprehension of students and observed improvement among the students.

The second most preferred MALL-based technique among the participants was the use of a wordlist for learning English vocabulary. The study conducted (Chang & Lin, 2019) identified that students preferred to learn by using paper-based mediums, especially for reading comprehension but also depicted an optimistic attitude towards using technology for reading comprehension. Furthermore, the results of the study also depicted that the students preferred online quizzes and then games for learning English vocabulary, as the means of the responses were 4.25 and 4.02, respectively (Raffone, 2022).

Discussion on Research Question Three

The results of the current study further depicted that the average of the responses was 4.28, which showed very high agreement among the participants regarding the use of MALL to enhance their lexical competence. Furthermore, the results of the current study aligned with (K.C., 2019), which illustrated that students had a very optimistic attitude towards using online dictionaries for learning the English language. Additionally, the participants of the study showed an optimistic attitude towards MALL in improving lexical competence because of the motivation being provided by MALL-based applications to the students while learning English vocabulary, as pointed out by (Aziz & Fageeh, 2013). Moreover, it was evident that the purpose of learning a second language was to use it for

_____

communication in daily life, and MALL provided motivation to do so due to the improved preparation provided by MALL that enabled learners to communicate in daily life (Tai & Chen, 2021).

The use of technology was very helpful in accessing authentic material for learning (Tri & Nguyen, 2014), which was further emphasised by (Jeng et al., 2010), who stated that modern technologies are very helpful for students to obtain and use authentic material for their learning. Furthermore, the authenticity of using online platforms was also emphasised by (Klopfer et al., 2002), who discussed the use of PDAs for learning. The results of the current study also depicted that the average of 4.13 regarding the responses of the participants showed that the students also believed that and used MALL to reach authentic English language learning materials and students had positive attitudes towards using vocabulary learning applications because of their vast availability. This illustrated the positive attitude of students towards using MALL for learning English vocabulary, as it motivated them and proved effective in building and expanding their vocabulary knowledge throughout their academic process (Kohnke & Ting, 2021). The participants of the study considered the role of MALL helpful in improving lexical competence, as it provided them with translations of the text, which ultimately helped students develop vocabulary knowledge (Qiu & Lo, 2017).

Conclusion

The study concluded that the learners had an optimistic attitude towards using MALL for learning English vocabulary because of the convenience and flexibility it provided. It was also concluded that the learners preferred MALL because of its ease of use, efficacy and compatibility with modern technological standards. Moreover, students preferred using online audio/videos for learning English vocabulary as it helped in improving pronunciation, but overall, they showed optimistic attitudes towards games, online quizzes and contextual examples (wordlists) for learning English vocabulary. Furthermore, it was concluded that MALL helped enhance lexical competence by fostering learner autonomy, as it provided access to authentic materials and motivated undergraduate ESL learners of Punjab to learn English vocabulary. The current study endorsed the claim that input had a huge role in learning a second language and that MALL also had a significant relationship with learning English vocabulary among undergraduate ESL learners in Punjab. The usage of technology can be proven to be a game-changer in the schoolroom, as it can change the attitude of the learners by just altering the method to do it from physical to digital (Flórez-Aristizábal et al., 2019).

The main contribution of this study was to provide an in-depth view of the usage of MALL for learning English vocabulary among undergraduate ESL learners of Punjab so that MALL could be integrated into education in a better and more effective way. The research provided insights into promoting independent learning by using MALL which could be beneficial for learners in boosting their confidence and teachers could use this to facilitate personalised learning experiences by allowing students to choose activities according to their preferences. The theoretical implication of this study was the use of the "Input Hypothesis" of the Monitor Model (Krashen, 1985) along with the five-step vocabulary learning model (Hatch & Brown, 1995) which was then renamed to the 5R model for vocabulary learning (Shen, 2003) for understanding the usage of MALL for learning English vocabulary among undergraduate ESL learners of Punjab. In this study, the researcher applied these models as a research lens to understand the perceptions and preferences of learners about MALL and the role of MALL in enhancing the lexical competence of undergraduate ESL learners of Punjab. Hence, the application of these models in the current study showed the way these models could be applied to other samples and studies. This study can be helpful for practitioners and educationists in the usage of MALL for vocabulary learning and will ultimately help them to design more effective MALL-based tools for learning English vocabulary.

Limitations:

Every research endeavour has its constraints and boundaries and the current study is no exception. Thus, with discerning eyes, the researcher delved into the extent that outlined the limitations of this study. The research only covered the undergraduate ESL learners of Punjab. The results obtained from the sample were extrapolated to the targeted population assuming that the sample was truly representative of the targeted population. The variation could occur in the results because of a larger sample size from a larger geographical area. The sample was collected from a limited area by using limited resources.

_____

Ethical Standards:

The writers affirm that they have no financial affiliations and have not received any kind of financial support. There are no professed challenging interests of the authors that are relevant to the subject substance of this study. Each author confirms that they are not allied with or vigorously intricate in any organisation or institution that has a monetary or non-financial palisade in the topics or materials covered in this document. Furthermore, each participant who took part in the study gave their free, informed consent.

References

Alamer, A., & Al Khateeb, A. (2021). Effects of using the WhatsApp application on language learners motivation: a controlled investigation using structural equation modelling. *Computer Assisted Language Learning*, 1–27. https://doi.org/10.1080/09588221.2021.1903042

Alshammari, R., Parkes, M., & Adlington, R. (2017). Using WhatsApp in EFL instruction with Saudi Arabian university students. *Arab World English Journal*, *8*(4), 68–84. https://doi.org/10.24093/awej/vol8no4.5

Azar, A. S., & Tan, N. H. I. (2020). The application of ICT techs (mobile-assisted language learning, gamification, and virtual reality) in teaching English for secondary school students in Malaysia during Covid-19 pandemic. *Universal Journal of Educational Research*, *8*(11C), 55–63. https://doi.org/10.13189/ujer.2020.082307

Aziz, A., & Fageeh, I. (2013). Effects of MALL applications on vocabulary acquisition and motivation. *AWEJ*, *4*(4), 420–447.

Bacca Acosta, J. L., Baldiris Navarro, S. M., Fabregat Gesa, R., & Kinshuk, K. (2019). Framework for designing motivational augmented reality applications in vocational education and training. *Australasian Journal of Educational Technology*, *35*(3), 102–117. https://doi.org/10.14742/ajet.4182

Bailey, J. O., Bailenson, J. N., & Casasanto, D. (2016). When does virtual embodiment change our minds? *Presence: Teleoperators and Virtual Environments*, *25*(3), 222–233. https://doi.org/10.1162/PRES_a_00263

Bashori, M., van Hout, R., Strik, H., & Cucchiarini, C. (2021). Effects of ASR-based websites on EFL learners' vocabulary, speaking anxiety, and language enjoyment. *System*, *99*. https://doi.org/10.1016/j.system.2021.102496

Bashori, M., van Hout, R., Strik, H., & Cucchiarini, C. (2022). 'Look, I can speak correctly': learning vocabulary and pronunciation through websites equipped with automatic speech recognition technology. *Computer Assisted Language Learning*, *0*(0), 1–29. https://doi.org/10.1080/09588221.2022.2080230

Battaglia, M. (2018). Nonprobability sampling. In P. J. Lavrakas (Ed.), *Encyclopedia of survey research methods* (pp. 524–526). Sage Publications, Inc.

Berns, A., Palomo-Duarte, M., Dodero, J. M., & Valero-Franco, C. (2013). Using a 3D online game to assess students' foreign language acquisition and communicative competence. In *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics): Vol. 8095 LNCS* (pp. 19–31). https://doi.org/10.1007/978-3-642-40814-4_3

Cabero-Almenara, J., & Roig-Vila, R. (2019). The motivation of technological scenarios in Augmented Reality (AR): Results of different experiments. *Applied Sciences*, *9*(14), 2907. https://doi.org/10.3390/app9142907

Cakır, R., & Solak, E. (2015). Attitude of Turkish EFL learners towards e-Learning through TAM Model. *Procedia - Social and Behavioral Sciences*, *176*, 596–601. https://doi.org/10.1016/j.sbspro.2015.01.515

Cavus, N., & Ibrahim, D. (2009). M-Learning: An experiment in using SMS to support learning new English language words. *British Journal of Educational Technology*, *40*(1), 78–91. https://doi.org/10.1111/j.1467-8535.2007.00801.x

Chang, & Lin, M. C. (2019). Experimental study on strategy-oriented web-based English instruction for EFL students. *Journal of Educational Computing Research*, *56*(8), 1238–1257. https://doi.org/10.1177/0735633117739410

_____

Chang, W.-C., & Ku, Y.-M. (2015). The effects of note-taking skills instruction on elementary students' reading. *The Journal of Educational Research*, *108*(4), 278–291. https://doi.org/ 10.1080/00220671.2014.886175

Chapelle, C. A. (2005). Interactionist SLA theory in CALL research. In *CALL Research Perspectives*. https://doi.org/10.4324/9781410613578

Chapelle, C. A. (2007). Technology and second language acquisition. *Annual Review of Applied Linguistics*, *27*, 98–114. https://doi.org/10.1017/S0267190508070050

Deris, F. D., & Shukor, N. S. A. (2019). Vocabulary learning through mobile apps: A phenomenological inquiry of student acceptance and desired apps features. *International Journal of Interactive Mobile Technologies*, *13*(7), 129–140. https://doi.org/10.3991/ ijim.v13i07.10845

Farr, F., & Murray, L. (2016). The routledge handbook of language learning and technology. In *The Routledge Handbook of Language Learning and Technology*. https://doi.org/10.4324/ 9781315657899

Flórez-Aristizábal, L., Cano, S., Collazos, C. A., Benavides, F., Moreira, F., & Fardoun, H. M. (2019). Digital transformation to support literacy teaching to deaf Children: From storytelling to digital interactive storytelling. *Telematics and Informatics*, *38*, 87–99. https://doi.org/ 10.1016/j.tele.2018.09.002

Geddes, S. (2004). Mobile learning in the 21st century: benefit for learners. *Knowledge Tree: An e-Journal of Flexible Learning in VET*, *6*, 13 p.

Gonulal, T. (2019). The use of Instagram as a mobile-assisted language learning tool. *Contemporary Educational Technology*, *10*(3), 309–323. https://doi.org/10.30935/cet.590108

Guarte, J. M., & Barrios, E. B. (2006). Estimation under purposive sampling. *Communications in Statistics: Simulation and Computation*, *35*(2), 277–284. https://doi.org/10.1080/ 03610910600591610

Hatch, E. M., & Brown, C. (1995). Vocabulary, semantics, and language education. In *Cambridge language teaching library*.

Holtom, B., Baruch, Y., Aguinis, H., & A Ballinger, G. (2022). Survey response rates: Trends and a validity assessment framework. *Human Relations*, *75*(8), 1560–1584. https://doi.org/10.1177/ 00187267211070769

Hsu, L. (2013). English as a foreign language learners' perception of mobile assisted language learning: a cross-national study. *Computer Assisted Language Learning*, *26*(3), 197–213. https://doi.org/10.1080/09588221.2011.649485

Hsu, L. (2016). Examining EFL teachers' technological pedagogical content knowledge and the adoption of mobile-assisted language learning: a partial least square approach. *Computer Assisted Language Learning*, *29*(8), 1287–1297. https://doi.org/10.1080/09588221.2016. 1278024

Hubbard, P. (2008). Twenty-five years of theory in the CALICO journal. *CALICO Journal*, *25*(3), 387–399. https://doi.org/10.1558/cj.v25i3.387-399

Jeng, Y. L., Wu, T. T., Huang, Y. M., Tan, Q., & Yang, S. J. H. (2010). The add-on impact of mobile applications in learning strategies: A review study. *Educational Technology and Society*, *13*(3), 3–11.

Kalton, G. (1968). Standardization: A technique to control for extraneous variables. *Applied Statistics*, *17*(2), 118–136. https://doi.org/10.2307/2985676

Kamimura, T. (1996). Composing in Japanese as a first language and English as a foreign language: A study of narrative writing. *RELC Journal*, *27*(1), 47–69. https://doi.org/10.1177/ 003368829602700103

Kang, S., & Kim, Y. (2021). Examining the quality of mobile-assisted, video-making task outcomes: The role of proficiency, narrative ability, digital literacy, and motivation. *Language Teaching Research*, 136216882110479. https://doi.org/10.1177/13621688211047984

Karapanos, E., Teixeira, P., & Gouveia, R. (2016). Need fulfillment and experiences on social media: A case on Facebook and WhatsApp. *Computers in Human Behavior*, *55*, 888–897. https://doi.org/10.1016/j.chb.2015.10.015

_____

K.C., K. (2019). *Use of ICTs in English language L-learning: A case of semester students at Tribhuvan University* [Tribhuvan University, Kirtipur]. https://elibrary.tucl.edu.np/handle/123456789/1858

Kessler, G. (2016). Technology standards for language teacher preparation. In F. Farr & L. Murray (Eds.), *The Routledge Handbook of Language Learning and Technology* (pp. 57–70). Routledge. https://doi.org/10.4324/9781315657899

Klopfer, E., Squire, K., & Jenkins, H. (2002). Environmental detectives: PDAs as a window into a virtual simulated world. *Proceedings. IEEE International Workshop on Wireless and Mobile Technologies in Education*, 95–98. https://doi.org/10.1109/WMTE.2002.1039227

Kohnke, L., & Ting, A. (2021). ESL students' perceptions of mobile applications for discipline-specific vocabulary acquisition for academic purposes. *Knowledge Management & E-Learning: An International Journal*, *13*(1), 102–117. https://doi.org/10.34105/j.kmel.2021.13.006

Krashen, S. D. (1985). The Input Hypothesis. In *The Input Hypothesis: Issues and Implications* (Issue 1, pp. 1–32). Longman Group UK Ltd. https://doi.org/10.2307/414800

Kukulska-Hulme, A. (2009). Will mobile learning change language learning? *ReCALL*, *21*(2). https://doi.org/10.1017/S0958344009000202

Kukulska-Hulme, A., & Shield, L. (2008). An overview of mobile assisted language learning: From content delivery to supported collaboration and interaction. *ReCALL*, *20*(3), 271–289. https://doi.org/10.1017/S0958344008000335

Kukulska-Hulme, A., & Viberg, O. (2018). Mobile collaborative language learning: State of the art. In *British Journal of Educational Technology* (Vol. 49, Issue 2, pp. 207–218). https://doi.org/10.1111/bjet.12580

Levy, M., & Stockwell, G. (2013). Call dimensions: Options and issues in computer-assisted language learning. In *Call Dimensions: Options and Issues in Computer-Assisted Language Learning*. Taylor and Francis. https://doi.org/10.4324/9780203708200

Lin, J.-J., & Lin, H. (2019). Mobile-assisted ESL/EFL vocabulary learning: A systematic review and meta-analysis. *Computer Assisted Language Learning*, *32*(8), 878–919. https://doi.org/10.1080/09588221.2018.1541359

Liu, X. (2015). *The effectiveness of using CALL environment on reading skills of English learners*. https://doi.org/10.2991/msetasse-15.2015.217

Lomicka, L., & Lord, G. (2012). A tale of tweets: Analyzing microblogging among language learners. *System*, *40*(1), 48–63. https://doi.org/10.1016/j.system.2011.11.001

Lu, M. (2008). Effectiveness of vocabulary learning via mobile phone. *Journal of Computer Assisted Learning*, *24*(6), 515–525. https://doi.org/10.1111/j.1365-2729.2008.00289.x

Manegre, M., & Sabiri, K. A. (2022). Online language learning using virtual classrooms: An analysis of teacher perceptions. *Computer Assisted Language Learning*, *35*(5–6), 973–988. https://doi.org/10.1080/09588221.2020.1770290

Mertens, D. M. (2010). Research and evaluation in education and psychology. In *Research and Evaluation in Education and Psychology* (5th ed.). SAGE Publications, Inc.

Mills, G. E., & Gay, L. R. (2019). Educational research: Competencies for analysis and applications. In *Pearson Education, Inc* (12th ed., Vol. 6, Issue 2).

Mitchell, K. (2012). A social tool: Why and how ESOL students use Facebook. *CALICO Journal*, *29*(3), 471–493. https://doi.org/10.11139/cj.29.3.471-493

Mohammadi, H. (2015). Investigating users' perspectives on e-learning: An integration of TAM and IS success model. *Computers in Human Behavior*, *45*, 359–374. https://doi.org/10.1016/j.chb.2014.07.044

Mora, M. (2011). Validity and Reliability in Surveys. In *Relevant Insights: Vol. February* (Issue 1).

Peirce, N., & Wade, V. (2010). Personalised learning for casual games: The "language trap" online language learning game. *4th European Conference on Games Based Learning 2010, ECGBL 2010*.

Petrunoff, N. A., Xu, H., Rissel, C., Wen, L. M., & Van Der Ploeg, H. P. (2013). Measuring workplace travel behaviour: Validity and reliability of survey questions. *Journal of Environmental and Public Health*, *2013*. https://doi.org/10.1155/2013/423035

_____

Qiu, X., & Lo, Y. Y. (2017). Content familiarity, task repetition and Chinese EFL learners' engagement in second language use. *Language Teaching Research*, *21*(6), 681–698. https://doi.org/10.1177/1362168816684368

Raffone, A. (2022). Gamifying English language learning through interactive storytelling and MALL technologies. *Language Teaching Research*. https://doi.org/10.1177/13621688221110206/ ASSET/IMAGES/LARGE/10.1177_13621688221110206-FIG5.JPEG

Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology*, *61*, 101860. https://doi.org/10.1016/j.cedpsych.2020.101860

Shadiev, R., Liu, T., & Hwang, W. Y. (2020). Review of research on mobile-assisted language learning in familiar, authentic environments. *British Journal of Educational Technology*, *51*(3), 709–720. https://doi.org/10.1111/bjet.12839

Shadiev, R., Yang, M., Reynolds, B. L., & Hwang, W.-Y. (2022). Improving English as a foreign language–learning performance using mobile devices in unfamiliar environments. *Computer Assisted Language Learning*, *35*(9), 2170–2200. https://doi.org/10.1080/09588221.2020. 1868533

Shen, W. (2003). Current trends of vocabulary teaching and learning strategies for EFL settings. In *Fen Chia Journal of Humanities and Social Science* (Issue 7, pp. 187–224).

Singh, A. (2017). Common procedures for development, validity and reliability of a questionnaire. *International Journal of Economics, Commerce and Management*, *5*(5), 790–801.

Solmaz, O. (2017). Autonomous language learning on Twitter: Performing affiliation with target language users through #hashtags. *Journal of Language and Linguistic Studies*, *13*(2), 204–220.

Song, Y. (2008). SMS enhanced vocabulary learning for mobile audiences. *International Journal of Mobile Learning and Organisation*, *2*(1), 81–98. https://doi.org/10.1504/ijmlo.2008.018719

Squire, K. (2009). Mobile media learning: multiplicities of place. *On the Horizon*, *17*(1), 70–80. https://doi.org/10.1108/10748120910936162

Stockwell, G. (2016). Mobile language learning. In *The Routledge Handbook of Language Learning and Technology* (pp. 296–307). Taylor and Francis. https://doi.org/10.4324/9781315657899-34

Tai, T.-Y., & Chen, H. H.-J. (2021). The impact of immersive virtual reality on EFL learners' listening comprehension. *Journal of Educational Computing Research*, *59*(7), 1272–1293. https://doi.org/10.1177/0735633121994291

Thornton, P., & Houser, C. (2005). Using mobile phones in English education in Japan. *Journal of Computer Assisted Learning*, *21*(3). https://doi.org/10.1111/j.1365-2729.2005.00129.x

Tri, D. H., & Nguyen, N. H. T. (2014). An exploratory study of ICT use in English language learning among EFL university students. *Teaching English with Technology*, *14*(4), 32–46.

Tsai, S. C. (2022). Learning with mobile augmented reality- and automatic speech recognition-based materials for English listening and speaking skills: Effectiveness and perceptions of non-English major English as a foreign language students. *Journal of Educational Computing Research*, 444–465. https://doi.org/10.1177/07356331221111203/ASSET/IMAGES/LARGE/ 10.1177_07356331221111203-FIG2.JPEG

Yu, J., Zhou, X., Yang, X., & Hu, J. (2022). Mobile-assisted or paper-based? The influence of the reading medium on the reading comprehension of English as a foreign language. *Computer Assisted Language Learning*, *35*(1–2), 217–245. https://doi.org/10.1080/09588221. 2021.2012200

Zhai, C. (2021). Practical research on college English vocabulary teaching with mobile technology. *International Journal of Electrical Engineering & Education*, *0*(0), 1–14. https://doi.org/ 10.1177/0020720920985057

Zhang, & Aryadoust, V. (2022). A systematic review of the validity of questionnaires in second language research. *Education Sciences*, *12*(10), 723. https://doi.org/10.3390/educsci12100723

Zou, X.-L., & Ou, L. (2020). EFL reading test on mobile versus on paper: a study from metacognitive strategy use to test-media impacts. *Educational Assessment, Evaluation and Accountability*, *32*(3), 373–394. https://doi.org/10.1007/s11092-020-09320-0