The Impact of Mobile Resources on Enhancing Lifelong Learning Among Chinese Undergraduate EFL Students:
A Gender-Based Exploration

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ABSTRACT

The COVID-19 pandemic has accelerated the adoption of online education, including mobile-assisted language learning (MALL). Extensive research has examined various aspects of MALL; there remains a gap in understanding the preferred mobile resources that promote lifelong learning ability, particularly in relation to gender differences. This study focuses on Chinese EFL learners' preferences for mobile resources in promoting lifelong learning. Employing a quantitative questionnaire, the researchers examine the relationship between mobile learning efficacy and lifelong learning ability. The findings indicate no significant differences in mobile resource preferences among male and female students. However, a moderately positive relationship between mobile learning efficacy and lifelong learning ability was discovered. Notably, this study identifies that Chinese EFL students preferred mobile resources that may act as a platform to enhance mobile learning efficacy and support lifelong learning.

KEYWORDS

Gender Difference, Lifelong Learning (LL), Mobile Learning Efficacy (MLE), Mobile Resources Preference (MRP), Mobile-Assisted Language Learning (MALL)

INTRODUCTION

The field of mobile-assisted language learning (MALL) has rapidly expanded over the past decade, integrating mobile resources into language learning (Rajendran et al., 2020). While previous research has extensively explored various aspects of MALL, a critical research gap remains in understanding

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how MALL resources can effectively promote lifelong learning (LL) values among Chinese undergraduate EFL students.

This research gap is of paramount importance due to the transformative impact of LL on individuals' personal and professional growth. LL is crucial not only for enhancing employability but also for fostering active citizenship, social inclusion, and continuous personal development (Rajendran et al., 2020). However, despite the recognized potential of MALL to promote LL values (Ermerawati, 2019), there exists a need to investigate the specific MALL resources preferred by Chinese undergraduate EFL students in advancing their LL abilities.

This study bridges this research gap by shedding light on the MALL resources that resonate with Chinese undergraduate EFL learners' LL goals. By examining the preferred MALL resources that contribute to LL values, this research contributes significantly to the existing literature on MALL. The investigation not only offers insights into effective language learning strategies, but also provides practical implications for educators and curriculum designers aiming to harness the power of mobile technology to foster sustainable and impactful English language education. Furthermore, in a dynamically evolving educational landscape, this study empowers educators and learners to leverage MALL resources effectively, thereby enhancing the overall mobile learning experience for Chinese EFL undergraduates. Particularly in the context of the post-pandemic era, findings of this research offer a timely perspective on combining pedagogical approaches with mobile technology, ensuring that English language education remains adaptive, relevant, and capable of cultivating LL abilities.

MALL in China

The number of English learners in China tops the list due to its large population, and China's active participation in globalization creates the need for more efficient English education (Shan & Li, 2020). While most Chinese students are skilled at reading and grammar, they are still weak at listening and speaking due to a long-time of grammar-oriented teaching concept (Fan, 2019; Zhu & O'Sullivan, 2022). In Chinese EFL education, information and communications technology (ICT) has been increasingly explored. With greater accessibility and awareness of how to use ICT, Chinese policymakers have recognized ICT's role in supplementing college English education (Ghavifekr & Rosdy, 2015; Wu, 2019). According to Hao et al. (2017), China is now playing a leading role in smartphone ownership and mobile internet access, which enables language learners in higher education to increasingly use out-of-class self-directed learning facilitated by mobile technology (Lai et al., 2022). Li et al. (2022) provides a systematic review of the findings of 23 studies published between 2015 and 2020 on MALL in Mainland China, which suggests the need to develop sound MALL pedagogies associated with sociocultural aspects of language learning in relevant contexts.

Although mobile technologies are widely accessible, they have not been extensively studied as language learning tools through an academic lens in China (Wang & Cui, 2016). In the context of higher education in China, MALL research received the most publications in 2019 (Li et al., 2022). It was found that vocabulary has received the most emphasis (Kuimova et al., 2018) and English is the most investigated MALL language (Shadiev & Yang, 2020). In addition, an informal context was the most popular educational setting for MALL practice, mobile phones/smartphones were the most used devices, and WeChat was the most used and popular tool and application (Li et al., 2022).

To date, research in this area has generally involved learning strategies combined with mobile devices or applications (Gao & Shen, 2021) and the integration of mobile resources with a certain language (García Botero et al., 2019; Zhou, 2021). For instance, Kan & Tang (2018) claimed that MALL is a worthwhile research gap due to the increasing ownership of mobile devices among the world's largest English-learning population. Moreover, China's Ministry of Education encourages using technology to promote instructional efficiency in collegiate English language education (China Ministry of Education, 2016). Therefore, it is worthwhile to examine how learners in China use mobile devices to support their English language learning and how mobile learning resources can be effectively incorporated into teaching to promote students' learning efficacy (Kan & Tang, 2018).

Mobile-Assisted Language Learning (MALL), Mobile Learning Efficacy (MLE), Gender Differences, and Lifelong Learning (LL)

The era of digitalization has raised requirements and increased challenges for individual technology literacy, which facilitates an individual's access to mobile resources to help career advancement and increase quality of life. Current mobile users tend to embrace opportunities offered by the current special informative era, but they may feel overwhelmed by overabundant mobile resources and tools. Additionally, the wide range of language learning mobile applications encourages learners to be more learner-centered (Burston, 2014). Rajendran and Yunus (2021) suggested that study be extended to better explore how mobile learning and self-directed learning impact lifelong learning. Lifelong learning means continuously and willingly seeking knowledge for personal or professional reasons. It helps with skills, jobs, and personal growth and also connects one with others and one's community (Source: en.wikipedia.org). In this vein, scholars have explained that mobile learning could play an important role in LL processes (Hao et al., 2017).

Over the past few decades, MALL has received extensive scholarly attention. Due to its portability, interactivity, connectivity, customizability to learners' needs, and effectiveness in addressing the real-time fluid context-sensitive nature of language learning, MALL has gained popularity on the global market (Ali & Miraz, 2018). In this vein, Hao et al. (2017) suggested that mobile devices will soon be widely used to support learning in both formal and informal contexts. Despite numerous advantages and conveniences brought about by mobile technology and resources, there are some disadvantages and problems regarding MALL. Lai et al. (2022) mentioned that several articles demonstrated that learners had limited knowledge about strategy use and technology use in the mobile technology learning process. Therefore, these researchers suggested that teachers recommend a wide range of technological resources to students, share metacognitive and cognitive strategies for using these resources, and encourage students to use technology to support their language learning. Therefore, utilizing resources via mobile devices for learning is critical in distance learning, particularly in the post-pandemic context since learning has largely shifted to online platforms. Moreover, mobile-assisted learning competence is an indispensable component of an individual's LL ability. The latter is crucial in acquiring the skills necessary and adequate online resources to promote academic performance and career development.

In psychology, self-efficacy is an individual's belief in their capacity to act in ways necessary to reach specific goals. This concept was originally proposed by the psychologist Albert Bandura (Bandura, 1994). Accordingly, mobile learning efficacy (MLE) could be interpreted as mobile users' or learners' beliefs in their capacity to use mobile resources to reach specific goals in language learning settings; thus, the relationship between mobile resources and MLE is worth investigating.

Furthermore, gender differences in language are both linguistically and socially complex, making them a popular topic for research in linguistics and sociolinguistics (Jinyu, 2014). Previous studies on gender differences in language have mainly focused on gender differences in language learning styles and language learning strategies (Gu, 2002; Martinez et al., 2016; Montero-SaizAja, 2021; Viriya & Sapsirin, 2014). Additionally, some research has investigated learning style preferences among different genders and age groups (Shuib & Azizan, 2015), but such work has rarely investigated gender differences among language learners' preferences for mobile resources (Kan & Tang, 2018). Concerning research methods, Shortt et al. (2021) found that questionnaires, pre-tests or post-tests, and interviews were the most frequent data collection methods. However, knowledge of learners' preferences for the mobile platform and their usage patterns remains limited (Stockwell, 2008).

According to Kuimova et al. (2018), mobile learning makes the learning process comprehensive and motivates learners to pursue LL, indicating that a mobile-assisted learning mode could help develop learners' LL ability. For instance, Sharples (2000) discovered that mobile technologies are best suited to the implementation of LL because certain features of mobile technology and issues regarding LL methodology could be combined perfectly. Moreover, mobile technologies have been

effective at reaching learners who are not helped by traditional forms of technology-enhanced learning, helping learners meet LL targets (Arrigo et al., 2013).

A learning society can provide diversified avenues for its members to seek knowledge (Nordin et al., 2010). Using technology, people can acquire knowledge through methods beyond classroom activities. To some extent, technology can promote LL ability, which helps individuals adapt to the rapidly changing world. All forms of education that one receives after one's formal education are part of the LL process (Nordin et al., 2010). Additionally, LL aims to improve knowledge, skills, and competence, with a personal, civic, social, or employment-related perspective (Yamat et al., 2007). According to Nordin et al. (2010), individual-centered or self-directed is a unique characteristic of LL, which involves self-determination or self-regulation.

Therefore, this study identifies the most preferable mobile resources to help students achieve better MLE. This process inspires future scholars, educators, and students to make smarter choices in this digital area of abundant resources, helping students save time and energy when choosing between overwhelming options. Additionally, this work investigates the relationship between MLE and LL abilities to explore further possibilities to enhance MLE and promote the LL ability of Chinese undergraduate EFL learners.

LITERATURE REVIEW

Because technology is constantly changing and mobile-assisted learning is evolving at a rapid pace, mobile resources are updated at an unprecedented rate as well. In this vein, MALL must develop at a rapid pace, particularly in the post-pandemic era.

MALL and Gender

Among studies related to MALL, few have investigated factors influencing MALL based on gender difference, especially in the context of Chinese EFL. For instance, Rajendran et al. (2020) found that female students were more highly motivated, preferred to interact with language learning apps more often, and spent more time on the app than male students. Another study (Wan Daud et al., 2021) investigated gender differences in learning Arabic language proficiency via M-learning among Malaysian university students. The findings revealed that male learners received substantially greater adjusted average scores on the performance test than female students taking the same courses, indicating noticeable correlations between M-learning modes and gender regarding achievement. These data could help lecturers improve their teaching practices in this era of technology advancement.

Men and women may differ in their mobile-assisted learning preferences. For instance, Astleitner and Steinberg (2005) indicated that male participants preferred visual input in a learning environment and a more complex background than female participants. Jeljeli et al. (2018) examined several criteria such as gender, major type, and age to shed light on students' preferred educational instrument. It was found that no significant differences in students' tool preferences were dependent on age and gender, but there was a significant difference between genders and majors, with male students being more satisfied than female students in terms of perception on the effect of these tools on performance. Dousay and Trujillo (2019) also reported that women have higher maintained situational interest when animation, narration, and text are effectively combined.

According to Astleitner and Steinberg (2005), women used the learning modules more frequently than men did, but they paid less attention and scanned less frequently, which indicates that there are gender differences in learning behaviors. To this end, the results of the previous studies might indicate that there are gender differences in the cognitive processing of information. However, these gender differences can be decreased by varying certain features of web-based learning. Therefore, the literature revealed that gender differences in mobile language learning have not been investigated thoroughly. However, these differences are crucial in mobile learning even though MALL is a relatively new technology. Thus, research should further examine gender differences in mobile learning because

understanding gender differences in students' language learning could help teachers know how to encourage and improve learning processes for students according to gender (Bao et al., 2013).

Factors Hindering Development of MALL

Various factors may impede the effectiveness of mobile technology in language learning. These factors can be technological, pedagogical, or psychological, as explained by (Shudong & Higgins, 2005). Technological factors include small fonts on the small screen, small memory and storage capacity, inconvenient input, and network facility limitation related to technology and hardware (Hao et al., 2017). Similarly, one technological factor posited by Thornton and Houser (2005) was the small screen and keypad on mobile devices, which may be troublesome for users with poor eyesight and big hands. Pedagogical factors are disadvantages hindering learners from employing mobile learning to promote efficiency. For example, Shudong and Higgins (2005) illustrated that it is difficult to track the learning achievements of learners because mobile learning can occur anywhere and at any time. Additionally, it is difficult to administer a test without on-site supervision.

Other pedagogical factors impacting the development of mobile learning include an absence of a "learning atmosphere" and interpersonal and direct interaction (Bouhnik & Marcus, 2006). Psychological factors involve motivations, habits, and healthy lifestyles. Many people lack the motivation needed to use mobile learning consistently, so they are reluctant to deviate from traditional learning methods (Hao et al., 2017). On a similar note, the students in a study by Stockwell (2008) were deterred by the high costs of using mobile phones for educational purposes, opting instead to use desktop computers. Thus, challenges exist beyond technological, pedagogical, and psychological factors that may hinder the development of MALL.

In China, research on this subject has been limited to the development of MALL for language learning. For instance, Yang (2020) conducted a case study to investigate psychological motivations for using mobile resources among four EFL learners. Yang found that there are four elements influencing learners' motivation, including: (1) interesting and useful reading content; (2) language difficulties; (3) affordance of mobile technologies; and (4) motivational design of the application.

Overall, Yang (2020) stated that motivation is a key factor in stimulating and sustaining an individual's learning desire. However, Yang is one of the few researchers who have examined the development of MALL in China. Overall, Mainland China's participation in MALL projects has remained low compared with that of other countries, such as Japan, the United States, and the UK (Burston, 2014). Additionally, Hao et al. (2017) identified three major areas that affect Chinese university students' behavioral intentions to adopt mobile learning, and pedagogical factors had the greatest effect out of these factors (Hao et al., 2017).

THEORETICAL FRAMEWORK

The study is anchored on a theoretical framework consisting of three theories mainly employed to underpin and address the three research objectives. Variables of gender, mobile resource preference, mobile learning efficacy, and LL ability are involved in this study. It aims to identify the preferred mobile resources for EFL learners in China by gender, investigate how the mobile resources preferences based on gender impact the students' mobile learning efficacy, and establish the relationship between mobile learning and LL ability.

The Technology Acceptance Model (TAM) is used to determine what mobile resources are appropriate and preferred among undergraduate EFL learners in China. By employing mobile technology in language learning, learners can learn at their own pace by their preferred methods, enabling them to be self-regulated and learner-centered. Additionally, the present study aims to identify whether MRP affects learners' MLE and to measure learners' learning efficacy by applying the self-directed theory (SDL). In this vein, SDL suggests that people can become self-directed when their needs for competence, connection, and autonomy are fulfilled. This idea implies that adequate,

well-designed mobile resources could positively affect users' motivations to learn, to grow, and to seek fulfillment. Therefore, language-learning apps should be developed to inspire students' learning interests and foster learner autonomy, promoting the user's LL ability.

Furthermore, research question 3 (RQ3) is designed to investigate the relationship between MLE and LL ability, which is supported by the theory of Connectivism. The theoretical framework is shown in Figure 1. Connectivism is a theory that explains how individuals learn in the digital age. It highlights how internet tools like search engines, social networks, and online discussions have changed the way of learning. Instead of learning just on one's own, individuals now learn within networks of people and information (Source: en.wikipedia.org). In this research, Connectivism is employed to connect MLE, which indicates mobile learning power with LL ability. Thus, students should combine thoughts, theories, and general information in a useful manner and accept that technology is a significant part of the learning process. Additionally, connectedness facilitated by technology creates opportunities to make choices about learning to accommodate the needs of self-regulated learners via mobile resources to formulate a sustainable LL atmosphere for active learners (Siemens, 2005).

The following are definitions and explanations of key theories supporting this research:

1. Connectivism: Proposed by (Siemens, 2005), it views learning as networked processes within digital environments. It underscores technology's role in facilitating learning across global networks, utilizing tools like the internet and social networks. This theory aligns with this study's exploration of mobile-assisted language learning's networked nature.
2. Self-Directed Learning (SDL): Is rooted in Knowles' (1975) work and empowers learners to autonomously set goals, select resources, and assess progress. This theory's emphasis on autonomy resonates with this study's investigation of how Chinese EFL students engage with mobile resources for self-directed language learning.
3. Technology Acceptance Model (TAM): Developed by Davis (1989), TAM explores factors shaping users' adoption of technology. This model informs this study's analysis of Chinese EFL students' attitudes and intentions toward using mobile resources for language learning.

These theories help better understand how Chinese EFL students use mobile resources for lifelong language learning.

Therefore, the present study aims to identify the most preferable mobile resources for EFL college learners in China and to investigate if gender differences impact these preferences and the students' MLE. The latter may help educators, teachers, and mobile resource developers employ effective strategies in future work. The study also explores the relationship between MLE and LL abilities and how to connect self-directed language learning via utilizing mobile resources with sustainable LL. The LL ability developed by utilizing mobile resources would be a fundamental ability in a rapidly changing world.

To address the research aims, this study examines the preferences and effects of mobile resources on EFL learners' mobile learning efficacy (MLE) and LL abilities, with a focus on the impact of gender. The following research questions guide the exploration:

1. What mobile resources do undergraduate EFL learners in China prefer based on gender?
2. How does gender-based mobile resource preference impact undergraduate EFL learners' mobile learning efficacy (MLE) in China?
3. What is the relationship between mobile learning efficacy (MLE) and LL abilities among undergraduate EFL learners in China, as influenced by gender?

The researchers developed the following hypotheses, as seen in Table 1, in light of the research questions:
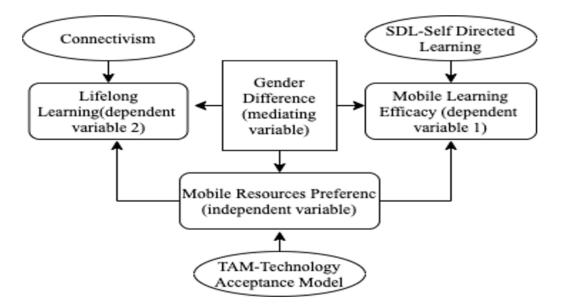
Figure 1. Theoretical Framework (Davis, 1989; Knowles, 1975; Siemens, 2005)

Table 1. Hypotheses for each research question

Research Questions	Null Hypothesis (H0)	Alternative Hypothesis (H1)
RQ1	There is no statistically significant difference in preferred mobile resources by gender among undergraduate EFL learners in China.	There is a statistically significant difference in preferred mobile resources by gender among undergraduate EFL learners in China.
RQ2	Gender-based preferred mobile resources do not have a statistically significant impact on the Mobile Learning Efficacy (MLE) of EFL learners in China.	Gender-based preferred mobile resources have a statistically significant impact on the Mobile Learning Efficacy (MLE) of EFL learners in China.
RQ3	There is no statistically significant relationship between Mobile Learning Efficacy (MLE) and LL abilities among EFL learners in China, when considering gender.	There is a statistically significant relationship between Mobile Learning Efficacy (MLE) and LL abilities among EFL learners in China, when considering gender.

METHODOLOGY

Participants and Instruments

The participants attending to this study were 39 male and 182 female learners, conveniently selected in different majors out of four universities to ensure a diverse range of academic backgrounds. They were mostly in their sophomore and junior years of study. It is worth noting that 214 participants (97%) responded "Yes" when asked the question, "Are you using a mobile device to learn English?" The survey result indicated that most Chinese college students hold a positive and welcoming attitude towards mobile language learning, echoing Cheng and Kim (2019), who investigated university students' attitudes towards English language learning apps. The results showed that students generally held positive attitudes towards English language learning apps because of their convenience, ubiquity, and rich resources.

In this study, a questionnaire was given to undergraduates from different majors. These majors are categorized into three main groups: science and engineering, social sciences, and the arts. In response to the three research questions, the questionnaire was adapted from existing mobile learning and LL ability questionnaires to fit the present study. The questionnaire part about using mobile resources was adapted and modified from the work of Kan & Tang (2018) based on the actual needs of the present research. The third part concerned the MLE of undergraduate students in several Chinese colleges, which is closely related to LL ability. The third part was taken from a master's dissertation in China (Li, 2020) that investigated the development of college students' mobile learning abilities.

The questionnaire was meticulously designed to address the research questions, resulting in three distinct sections:

Section 1: Demographic Information About the Participants

This section aimed to collect important background information about the participants, such as their majors, academic years, and gender. Understanding these demographics allowed researchers to better contextualize and interpret preferences and attitudes towards mobile language learning resources.

Section 2: Preference for Mobile Resources and Usage of Mobile Learning

This section investigated participants' preferences to utilizing mobile resources for language learning. It explored which language skills participants were inclined to practice using mobile devices and the types of resources they found most effective. This insight provided a comprehensive picture of the preferred tools and strategies for language learning in a digital context.

Section 3: MLE to Develop LL Abilities

This section focused on the participants' perceived effectiveness of mobile learning in fostering LL abilities. It delved into how participants believed mobile resources contributed to their broader learning skills beyond language acquisition. This exploration offered valuable insights into the interplay between mobile learning and the development of LL skills, providing a holistic understanding of the potential educational impact.

Before finalizing the questionnaire, experts in the field reviewed its content for relevance and accuracy. To ensure the questionnaire's effectiveness, a preliminary test was conducted with a smaller sample, during which items that did not align with the research requirements were eliminated. Through iterative refinement, a comprehensive questionnaire consisting of 42 items was crafted, exhibiting robust content validity that captured college students' Mobile Learning Efficacy (MLE). The reliability of the questionnaire was assessed using Cronbach's alpha, a statistical measure. The resulting alpha values exceeded zero. 7 (Paterson et al., 1988), affirming the survey's reliability and the consistency of its items in measuring the intended constructs.

Overall, the diverse composition of majors captured a comprehensive view of mobile language learning resource preferences across multiple disciplines. Furthermore, the questionnaire's design, which was adapted from existing instruments, allowed for more in-depth investigation of participants' preferences and mobile learning efficacy.

Data Collection and Analysis

A pilot study was conducted among eight undergraduates in two universities to determine whether the questionnaire was feasible and practical. The students completed questionnaires to determine if items needed wording shifts or other changes to reduce potential nonresponse rates.

These students gave valuable feedback on the format, logic, and wording of each question. After modifying and rearranging the orders, researchers distributed the questionnaire to four universities located in northern and southwestern China. Among these schools, one was a double first-class university (this categorization refers to "world-class universities building universities" and "world-

class discipline building universities," a strategic educational goal proposed in 2017). The other three schools were "non-double first-class universities."

Prior to participating in the survey, all respondents were provided with explicit information assuring them that their responses would be used strictly for statistical analysis and research purposes, ensuring the utmost confidentiality of their data. This procedure was fully aligned with the ethical standards mandated by the respective universities. To facilitate ease of participation, participants' anonymity was diligently maintained throughout the survey process. To evaluate the reliability of the survey's 5-point Likert scale questions, Cronbach's alpha was employed, and the results are presented in Table 2. These reliability tests confirmed the internal consistency and reliability of the measured variables, namely Mobile Learning Efficacy (MLE) and Language Learning (LL) abilities.

Moving forward, the latest version of SPSS statistics software was employed to analyze the collected data. At this point, it was necessary to analyze the significance and KMO value. If the significance was less than 0.05, this meant that the questionnaire data was suitable for factor analysis. Subsequently, the KMO value was observed. If the value was higher than 0.8, this meant that the validity was high; if the value was between 0.7 and 0.8, the validity was good; if the value was between 0.6 and 0.7, the validity was acceptable; and if the value was less than 0.6, the validity was poor. Factor analysis was then performed on two variables, MLE and LL, as outlined in Table 3. The results demonstrated strong validity for these variables, with KMO values well above 0.8, reinforcing the quality of investigation.

This comprehensive data collection process ensured reliability, validity, and adherence to ethical guidelines throughout the study.

FINDINGS AND DISCUSSIONS

The findings, presented in this section, highlight significant insights that contribute to the understanding of how MALL impacts LL and how gender differences play a role in this context.

Table 4 describes the participants' characteristics. Among the participants, 11.31% of the respondents were science and engineering majors, social science majors accounted for 86.43%, and only 2.26% of the respondents were art majors. The proportion of senior respondents was only 4.52%, likely because most of the respondents had already passed the CET (College English Test) required by the Ministry of Education in China; thus, they were no longer interested in questions related to English subjects.

Table 2. Reliability test of variables

Variables	Cronbach's Alpha	Cronbach Based on Normalization Items' Alpha	Number of Items
MLE	0.760	0.807	8
LL	0.936	0.945	16

Table 3. Factor analysis of variables: KMO and Bartlett's test

Variables	KMO Sampling Suitability Quantity	Bartlett's Sphericity Test		
		Approximate Chi-Square	Degree of Freedom	Significance
MLE	0.893	1012.853	28	<0.001
LL	0.933	2720.394	120	0

Table 4. Overview of demographics

Majors	Frequency				Valid Percent				Cumulative Percent			
	Science and Engineering	Social Science	Arts	Total	Science and Engineering	Social Science	Arts	Total	Science and Engineering	Social Science	Arts	Total
Gender												
Female	20	19	0	39	9.0	8.6	0.0	17.6	9.0	8.6	0.0	17.6
Male	5	172	5	182	2.3	77.8	2.3	82.4	11.3	86.4	2.3	100.0
Grade												
Freshman	18	39	0	57	8.1	17.6	0.0	25.8	8.1	17.6	0.0	25.8
Sophomore	7	100	3	110	3.2	45.2	1.4	49.8	11.3	62.9	1.4	75.6
Junior	0	42	2	44	0.0	19.0	0.9	19.9	11.3	81.9	2.3	95.5
Senior	0	10	0	10	0.0	4.5	0.0	4.5	11.3	86.4	2.3	100.0
Type of University												
Double-first class	5	22	1	28	2.3	10.0	0.5	12.7	2.3	10.0	0.5	12.7
Non-double-first class	20	169	4	193	9.0	76.5	1.8	87.3	11.3	86.4	2.3	100.0
Are you using a mobile device to learn English?												
YES	18	181	5	204	8.1	81.9	2.3	92.3	8.1	81.9	2.3	92.3
NO	7	10	0	17	3.2	4.5	0.0	7.7	11.3	86.4	2.3	100.0
	221											

The characteristics of the participants revealed distinct proportions across various factors such as majors, grades, and university type. Notably, the gender distribution was unbalanced, which resulted from convenient sampling in which the gender distribution of the participants was difficult to control.

Regarding the target language skills students preferred to practice via utilizing mobile resources, there were no significant differences between males and females. Among the seven skills examined, vocabulary, listening, and speaking were the main target language skills students preferred to practice via mobile devices, whereas the proportions used for writing, grammar, and translation practice were much lower.

In terms of language skills practiced using different mobile resources, English learning websites and apps topped the list of mobile learning resources. However, there were too few valid responses to analyze concerning four skills (including writing). When selecting multiple resources, cumulative calculation processing was used. Ultimately, no participant chose communication application resources.

These findings were consistent with those from similar research (Jeljeli et al., 2018), which explored the role of gender in determining preferred online tools and students' perceptions of the effect of such tools on performance. However, Jeljeli et al. (2018) found that gender was not an influential factor when determining preference tools.

Table 5 compares preferences for mobile resources among male and female students using chi-square tests to determine significance. Among six categories of mobile resources, English learning websites and APPs ranked first, and male and female students chose the same TOP three mobile resources. However, far more female than male students chose communication apps.

Overall, Table 5 displays the following findings: some resources, such as communication apps, were more frequently used by female students, whereas other resources, such as authentic visual and audio resources, were more commonly used by males. However, there was no significant difference between genders. That is, although there were differences in some cases, it is not clear whether these are statistically meaningful. Part of this issue may be the relatively small sample of male students. Therefore, H1 of RQ1 should be rejected, and H0 should be accepted. In other words, there is no statistically significant difference in preferred mobile resources by gender among EFL learners in China.

Moving forward, a t-test was employed to investigate the relationship between MLE and gender, as seen in Table 6, to investigate RQ2: "How do MLE and gender impact MLE of EFL learners in China?"

Table 6 demonstrates that the means were quite close to each other (3.5 for male students and 3.6 for female students), implying that there is no significant difference in MLE between these two genders.

Table 7 is an independent t-test, which is also a comparison of MLE between male and female students. In this table, the mean values for male and female students in terms of MLE and the "sig" (or p-value) of the t-test were quite similar, indicating no significant difference in MLE between male and female students.

Table 5. Frequently used resources by students

	Websites & APPs	Reference Materials	Forums & SMS	Communication Apps	Authentic Visual & Audio Resources	Authentic Online Reading Material
Male	17	13	6	5	11	6
Female	136	100	64	73	78	38
Male	29%	22%	10%	9%	19%	10%
Female	28%	20%	13%	15%	16%	8%

Table 6. Comparison of MLE between males and females

	Gender	N	Mean	Std. Deviation	Std. Error Mean
MLE	Male	32	3.5352	0.74949	0.13249
	Female	172	3.6417	0.70620	0.05385

Table 7. Independent samples test for comparison of MLE between males and females

		Levene's Test for Equality of Variances		t-Test for Equality of Means							
						Sig. (2-Tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
		F	Sig.	t	df				Lower	Upper	
MLE	Equal variances assumed	0.168	0.683	-0.776	202	0.438	-0.10656	0.13727	-0.37722	0.16410	
	Equal variances not assumed			-0.745	41.880	0.460	-0.10656	0.14302	-0.39520	0.18208	

Additionally, a chi-squared test, as seen in Table 8, was performed to see whether there was a significant gender difference for MLE. The result was significant, meaning that one gender was more likely to use mobile resources for learning than the other ($p = 0.016$).

RQ2 is divided into the following two questions:

1. Is there a difference in the usage of mobile resources to learn English between male and female students?
   a. Based on the above analysis, there is a difference in the usage of mobile resources to learn English between male and female students.
2. Is there a difference in MLE between male and female students?
   a. No, there is no difference in the MLE between the male and female students.

Table 8. Chi-squared test on MLE and gender

	Value	Df	Asymptotic Significance (2-Sided)	Exact Sig. (2-Sided)	Exact Sig. (1-Sided)	Point Probability
Pearson Chi-Square	7.016[a]	1	0.008	0.016	0.016	
Continuity Correction[b]	5.372	1	0.020			
Likelihood Ratio	5.689	1	0.017	0.048	0.016	
Fisher's Exact Test				0.016	0.016	
Linear-by-Linear Association	6.984[c]	1	0.008	0.016	0.016	0.012
N of Valid Cases	221					

Note. a. Cells (25.0%) have an expected count of less than 5. The minimum expected count is 3.00. b. Results computed only for a 2x2 table. c. Standardized statistic is -2.643.

Next, the study examined RQ3: "What is the relationship between MLE and LL abilities among EFL learners by gender in China?" A Spearman correlation was employed to calculate between Question 22 ("Will you continue to use mobile resources to learn English after graduating from university?"), as seen in Table 9, and the MLE final variable. The following matrix is representative of the entire group (i.e., not divided into male and female categories).

Tables 6, 7, and 8 all looked into gender differences in Mobile Learning Efficacy (MLE). While the means for MLE were similar between male and female students, a chi-squared test, as seen in Table 8, revealed a significant gender difference in the inclination to use mobile learning resources. The analysis did, however, point out that the relatively small male sample size could have an impact on the significance of the findings, necessitating further investigation.

Table 9 displays that the R-value (or correlation coefficient) is 0.336 and the p-value (or sig) is less than 0.0005, indicating a statistically significant positive relationship between the variables. Thus, there is a weak-to-moderate positive relationship between MLE and LL ability. Therefore, there is a statistically significant relationship between MLE and LL ability among EFL learners by gender in China, so H1 should be accepted and H0 should be rejected.

The investigation into the relationship between MLE and LL abilities revealed a positive relationship, implying that higher MLE was associated with higher LL abilities among EFL learners. This finding emphasizes the potential of mobile resources to support LL.

Overall, when investigating RQ1, researchers identified that there was no significant difference in MRP between male and female students. Consequently, this finding impacted the investigation of RQ2 ("How do MLE and gender impact MLE of EFL learners in China?"), which did not make sense because there was no significant gender difference regarding MRP. Next, the researcher divided RQ2 into two parts to make it more straightforward and explicit. On the other hand, RQ3 was not supported by sufficient items. The researchers focused on Q22 to investigate gender differences in LL.

Moving on, this research made a comparison between genders in LL, as seen in Table 10.

Table 10 indicates that R-values (or the correlation coefficients) were similar for male and female students. For female students, there was a significant relationship between MLE and LL ability (p < 0.0005), but for male students, there was not (p = 0.082). It is mostly because male students were represented by far fewer individuals (N = 32) than female students (N = 172). The larger the sample size, the greater the statistical power was (or the chance of detecting significance if the R-value were small). In other words, it was unclear if the results showed no relationship for male students or if the sample was too small, but the latter was most likely. Therefore, one would need to increase the male sample for further analysis.

In conclusion, this section emphasizes the study's significance, providing valuable insights into the relationship between mobile learning efficacy, gender, and LL abilities among Chinese EFL students.

Table 9. Relationship between MLE and LL

			Q22. Will you continue to use mobile resources to learn English after graduating from university?	MLE_final
Spearman's rho	Q22. Will you continue to use mobile resources to learn English after graduating from university?	Correlation Coefficient	1.000	0.336
		Sig. (2-tailed)	.	0.000
		N	204	204
	Final	Correlation Coefficient	0.336	1.000
		Sig. (2-tailed)	0.000	.
		N	204	204

Note. Correlation is significant at the 0.01 level (2-tailed).

Table 10. Gender differences in LL

Q22. Will you continue to use mobile resources to learn English after graduating from university?	Correlation Coefficient/R-Value	Sig. (2-Tailed)/P-Value
Male (N = 32)	0.312	0.082
Female (N = 172)	0.314	0.000

The discovery of patterns and trends in preferred resources and MLE levels lays the groundwork for future research and targeted interventions aimed at improving language-learning outcomes.

CONCLUSION

Through a comprehensive quantitative questionnaire administered to undergraduate EFL students across four Chinese universities, this study successfully addressed its research inquiries:

1. What mobile resources do undergraduate EFL learners in China prefer based on gender?
2. How does gender-based mobile resource preference impact undergraduate EFL learners' mobile learning efficacy (MLE) in China?
3. What is the relationship between mobile learning efficacy (MLE) and LL abilities among undergraduate EFL learners in China, as influenced by gender?

Notably, the study found that gender had no statistically significant influence on the preferred mobile resources of male and female EFL learners in China. Furthermore, the study discovered no significant difference in Mobile Learning Efficacy (MLE) between the two genders. However, a significant relationship between MLE and LL abilities among EFL learners based on gender was discovered. This significant correlation highlights the critical importance of cultivating students' MLE in developing their LL abilities, which indicates that this mutually beneficial relationship has the potential to advance sustainable education in China, particularly in the post-pandemic era.

The findings contribute to the understanding of mobile-assisted language learning (MALL) and its significance in the context of promoting lifelong learning (LL) abilities among Chinese undergraduate EFL learners. This work serves to do the following:

1. Narrow down the choices of the overwhelming mobile resources for students and educators to save time and energy when being faced with a large number of options.
2. Make mobile resource developers more aware of the features that attract users, which will help them better accommodate future users with more satisfactory services.
3. Establish a positive relationship between MLE and LL to increase the awareness of combining mobile learning literacy with LL ability.
4. Finally, promote the development of MALL and the awareness of LL ability in the rapidly changing world.

LIMITATIONS AND IMPLICATIONS

While this research contributes valuable insights, there are a few limitations that should be acknowledged. Firstly, the online survey nature of the study may have resulted in a biased sample, primarily comprising respondents interested in the survey topic. Future research should aim for a more balanced and representative sample. Secondly, the timing of questionnaire distribution during summer vacation may have affected participation rates. Conducting the study during the academic

semester could increase engagement. Thirdly, the generalizability of the findings is limited to the specific universities included in the study. Future research should consider a more diverse range of universities and expand the sample size.

Despite these limitations, the findings provide valuable implications for promoting LL through mobile resources among Chinese EFL learners. The absence of significant gender differences in mobile resource preferences suggests that tailored approaches for different genders may not be necessary. The positive relationship between mobile learning efficacy and LL ability emphasizes the importance of leveraging mobile resources to foster LL. These insights can assist educators and students in making informed choices in the digital learning landscape and enhance awareness of LL practices.

In conclusion, this study contributes not only to the advancement of MALL but also to the recognition of LL abilities' pivotal role in the post-pandemic era. By elucidating the interplay between MLE and LL, this research equips educators, resource developers, and policymakers with actionable insights. As the educational landscape evolves, the convergence of technology-enhanced learning and LL emerges as a powerful force, capable of steering educational practices toward greater efficacy and relevance.

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