College English teaching in a digital environment: The experience of China

La enseñanza del inglés universitario en un entorno digital: la experiencia de China

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Abstract:
The study aims to evaluate the efficacy of mobile applications within language education, as well as to understand how this technology affects language learning outcomes and student perceptions. The research methodology rests on the development and testing of mobile technology interventions for learning English in an educational setting. The study used a mixed approach to analyze the data. This included a language proficiency test, such as the College English Test 4 (CET-4). Additionally, attitudes towards the mobile assisted environment for learning English by conducting a qualitative survey using a 5-point Likert scale were assessed. Two popular applications in China (Keke English and Lanren English) were used according to the research objectives. The study involved a sample of 190 students studying English as a foreign language (EFL) at three public colleges in China. The distribution of language proficiency levels in both the control and experimental groups showed differences in the preliminary test, while the experimental group demonstrated a slightly higher level of language proficiency. After the intervention, in the experimental group, there were significant improvements in various aspects of language proficiency. The improvement is evident in the post-test results of the experimental group, as reflected by a *t*-value of approximately 13.249. This result suggests the effectiveness of the intervention. Negative percentages (≈-50.0% and ≈-16.7%) indicate a decrease in the proportion of students with the B1 (intermediate) level after the intervention. Thus, some students managed to reach higher levels of language proficiency (B2, C1). The practical significance of the research findings lies in their potential to improve the practice of language teaching, especially in the context of English language teaching in Chinese colleges.

Keywords: educational applications, English as a foreign language, gamification, learning strategies, mobile technology.

Resumen:
El estudio tiene como objetivo evaluar la eficacia de las aplicaciones móviles en la enseñanza de idiomas, así como comprender cómo esta tecnología afecta a los resultados del aprendizaje de idiomas y a las percepciones de los alumnos. La metodología de investigación

se basa en el desarrollo y la prueba de intervenciones de tecnología móvil para aprender inglés en un entorno educativo. El estudio utilizó un enfoque mixto para analizar los datos. Este incluyó una prueba de competencia lingüística, como el College English Test 4 (CET-4). Además, se evaluaron las actitudes ante el entorno asistido por dispositivos móviles para aprender inglés mediante la realización de una encuesta cualitativa basada en una escala Likert de 5 puntos. Se utilizaron dos aplicaciones populares en China (Keke English y Lanren English) de acuerdo con los objetivos de la investigación. El estudio involucró a una muestra de 190 alumnos que estudian inglés como lengua extranjera (EFL) en tres universidades públicas de China. La distribución de los niveles de competencia lingüística tanto en el grupo de control como en el experimental mostró diferencias en la prueba preliminar, mientras que el grupo experimental demostró un nivel de competencia lingüística ligeramente superior. Después de la intervención, en el grupo experimental, hubo mejoras significativas en varios aspectos de la competencia lingüística. La mejora es evidente en los resultados de la prueba posterior del grupo experimental, como refleja un valor *t* de aproximadamente 13.249. Este resultado sugiere la eficacia de la intervención. Los porcentajes negativos (≈-50.0 % y ≈-16.7 %) indican una disminución en la proporción de alumnos con el nivel B1 (intermedio) después de la intervención. Así, algunos alumnos lograron alcanzar niveles más altos de competencia lingüística (B2, C1). La importancia práctica de los hallazgos de la investigación radica en su potencial para mejorar la práctica de la enseñanza de idiomas, en especial en el contexto de la enseñanza del inglés en las universidades chinas.

Palabras clave: aplicaciones educativas, inglés como lengua extranjera, gamificación, estrategias de aprendizaje, tecnología móvil.

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1. Introduction

Learning English as a foreign language is essential for international, political, and cultural communication, as well as for collaboration and group work in the international classroom. Mobile technologies have become more popular over the last decade and have provided an opportunity to move towards 21st-century education (Zhai & Ma, 2022). The use of mobile technology in teaching and learning English creates a new learning environment for both teachers and students.

1.1. English language education and assessment in China

Like other countries, China has made great efforts to improve the system of English language education and assessment in the past two decades. Foreign language education, generally English language education, is an obligatory course from grade three at primary school to graduate school. Besides, college English language education is obligatory for all college students and graduate students including those who are enrolled in master's courses or doctoral courses. Currently, each year at least 60 million Chinese university students are learning English and taking English examinations (Edwards, 2017). Chinese students have to take numerous tests and examinations at different levels. Besides quizzes and tests at school, they have to pass unified English examinations administered by local education committees or the National Education Examination Authority. On the whole, the goals of English language education at the higher education level are to develop students' ability to use English in their future work and social interactions and to raise their cultural awareness to meet the needs of China's social development and international exchanges.

1.2. Mobile learning environment

China's dedication to modernization and innovation in education has led to the widespread integration of digital technologies in English language teaching (Shahrol

et al., 2020). From the implementation of online learning management systems to the introduction of virtual classrooms and language learning applications, colleges in China have been using digital tools to enrich the teaching and learning experience. The covid-19 pandemic has accelerated the transition to distance teaching and learning, prompting teachers to quickly adapt to the virtual environment (Başal & Kaynak, 2020). Regardless of the results, distance learning has become the de facto method of education delivery. Thus, this crisis has stimulated innovation in the education sector (Zhao & Watterston, 2021). When colleges faced the challenges of maintaining continuity of learning during an unprecedented period of upheaval, the importance of digital literacy, resilience, and adaptability became apparent.

Digital technology refers to the use of digital systems, tools, and devices that process, store, and transmit data in electronic form (Clark-Wilson et al., 2020). The development of digital technologies and their integration into English teaching has raised concerns about their potential impact on the future of education (Romero-Hall & Jaramillo, 2023). In this scenario, teachers act as guides and coordinators. Their main task is to help students effectively navigate the vast array of online resources and educational applications to achieve their language goals. Mobile devices are the most commonly used type of technology among students in the learning process. It consists of portable two-way communications devices, computing devices and the networking technology that connects them (Bernacki et al., 2020). Currently, mobile technology is typified by internet-enabled devices like smartphones, tablets and watches. This has led to a significant increase in mobile learning in English classrooms, both in high-tech and low-tech environments, in developed and developing countries (Theodoulou & Curwood, 2023).

As students become more aware of the availability of these devices, it is likely that they will spend more time using mobile language learning resources. This includes language learning applications (for example, Duolingo), tangible resources (such as Busuu), and online classes conducted via video conferencing platforms. In the classroom, teachers can play a crucial role in encouraging students to use their devices creatively and productively. The use of images, audio, video recordings, and other media effectively facilitates the language learning process (Xu et al., 2023). However, teachers still feel uncomfortable using this technology in the classroom, even when they are familiar with the devices.

Thus, the mobile learning environment has led to a paradigm shift in education, breaking down traditional barriers and altering the dynamics of teaching and learning (Liu & Cai, 2023). No longer confined to physical classrooms, students have the freedom to access course materials, interact with teachers, and collaborate with their peers anytime, anywhere. This unprecedented level of flexibility allows students to customize their educational experience according to their needs, schedules, and preferences. These opportunities contribute to a culture of continuous learning and self-discovery (Zhang, 2024). Through the use of multimedia content, gamified learning activities, and real-time feedback mechanisms, mobile language courses engage students in dynamic and experiential learning processes, enhancing memorization and understanding. Technology not only provides a productive learning environment, but it also motivates students to learn the language and improves their learning outcomes (Girón-García & Bernad-Mechó, 2024).

1.3. Technological landscape in language education

Technology-assisted language learning has become an important issue in language education research. Researchers have examined the impact of online platforms, mobile applications, virtual reality, and other digital resources on language proficiency, engagement, and motivation (Han et al., 2021; Kurhila & Kotilainen, 2020). The ever- evolving technological landscape in language education continues to present new opportunities for research and innovation. At the same time, it poses challenges for students in Chinese colleges who require further study. Limited access to technology in certain regions of China can prevent students from utilizing online resources and language-learning tools (Su & Zou, 2022). In addition,

English-language interfaces and instructions on technology platforms may be inconvenient for students who are not proficient in English (Wong & Looi, 2024).

2. Literature review

More and more studies have addressed the use of technology in education, focusing on factors that either support or hinder the integration of mobile devices into classrooms (Bećirović et al., 2021; Jugembayeva & Murzagaliyeva, 2024). The existing literature emphasizes technocentric factors when evaluating teacher behavior. Consequently, the way teachers use mobile technologies is seen as a criterion for assessing their abilities in digital education. One of the studies found that technology enhances the motivation, efficiency, and communication frequency of language learners. It also helps to develop students' language skills, such as speaking, listening, vocabulary, and grammar. Additionally, it encourages the acquisition of metacognitive and metalinguistic knowledge, as well as provides opportunities for feedback from peers (Hockly & Dudeney, 2018). However, mobility is a challenge for any type of learning. As students access these technologies, their need for formal learning may decrease.

2.1. Mobile-assisted language learning as a widespread model

Mobile devices equipped with GPS and location sensors are ideal machines to provide assistance in specific situations. For instance, they can offer students useful phrases when they are traveling, or a medical dictionary when visiting a doctor (Zhou & Wei, 2018). Virtual and augmented reality applications and simulations are opening up more opportunities for immersive communication experiences. Although these technologies are still in their early stages of development, they are advancing at a rapid pace, suggesting that they may soon become more efficient (Godwin-Jones, 2019).

Mobile pedagogy is widely used in language teaching for distance education. Mobile-assisted language learning (MALL) involves the use of mobile devices, such as personal digital assistants and smartphones. In the past, the main reasons for the poor quality of teaching were technological limitations, such as low sound quality, unstable network connections, and the high cost of new technologies (Cakmak, 2019). However, the development of mobile technologies and user-friendly smartphones mitigates these limitations. Over time, MALL has become a popular language learning model, especially in non-English speaking countries, as it promotes convenient language learning.

Communication via voice messages and text notes allows for language interaction (García et al., 2018). Language learning becomes more dynamic and accessible through social interaction rather than being limited to specific circumstances. Due to the availability of authentic language environments, language learners can delve into the process of communication with native speakers. Modern technologies improve English teaching and learning by providing a more authentic learning experience through their ubiquitous and connected nature (Loewen et al., 2019). These benefits expand the possibilities of knowledge and content sharing, multimedia presentation, and language learning.

Recent empirical research has examined the practice of teaching English through mobile applications (Nuraeni et al., 2020). Some authors have proposed a mobile- based pedagogical system to enhance the skills of English language teachers in using mobile technologies to teach the language. However, the latest studies have shown that hybrid teaching methods have not produced the expected results and technology has weakened the role of teachers (Yang, 2020). Technocentric focus receives more scientific attention than pedagogical innovations.

2.2. Research on different CALL models

The development of educational technologies and artificial intelligence is rapid, especially in the field of intelligent computer-assisted language learning (iCALL).

Consequently, the technology of automatic speech recognition (ASR) is becoming a potential solution to some of the challenges in education (Bashori et al., 2021). ASR- based technologies and applications attract the attention of researchers and practitioners due to their numerous features. These technologies offer more opportunities for practice, consistent and objective feedback, as well as various techniques for visual presentations of educational materials.

The above features are in line with the principles of sociocultural theory and are considered to be the most significant aspects of effective classroom instruction.

Moreover, in addition to more extensive interaction in the target language and real-time feedback, ASR-based technology can also provide L2/FL students with more control over their self-learning. This creates a less threatening environment for self- study (McCrocklin, 2019). Technological advances in iCALL have opened up a range of learning opportunities, including videos with subtitles, mobile games, and virtual reality tools. Research has confirmed the positive impact of these technologies on students' vocabulary, particularly in terms of productive vocabulary learning and their self-confidence in learning. These findings could pave the way for integrating these tools into teaching English as a second language (Jiang et al., 2022).

Pedagogical beliefs have been identified as crucial factors for the success of technology integration. Nevertheless, there is a lack of studies that have incorporated pedagogical beliefs into technology adoption models. One of these studies explored the Technology Acceptance Model (TAM) by analyzing the pedagogical beliefs of English teachers at a university in China (Liu et al., 2017). In particular, the study explored how the constructivist and/or transmissive pedagogical beliefs of teachers influence four key constructs of the TAM: perceived usefulness, perceived ease of use, attitude towards use, and intention to use. The results indicated that teachers' transmissive pedagogical beliefs do not significantly affect their attitudes towards information and communication technology or their perception of its usefulness.

However, transmissive beliefs significantly influence teachers' perception of the ease of using technology. Compared to teachers of other subjects, foreign language teachers were the least inclined to use technology, and its implementation was slow and unproductive. In addition, the cultural backgrounds of language teachers, especially those who are not native speakers of the language they teach, can influence their pedagogical beliefs and practices. This, in turn, can affect their approach to integrating technology into the classroom. However, few studies have explored such effects among language teachers in the Chinese cultural environment; and even fewer researchers have focused on how the pedagogical beliefs of Chinese language teachers influence their intention to utilize the digital environment in their practice (Dağdeler et al., 2020).

Artificial intelligence technologies are an important element of the digital educational environment. Currently, the prevalence of ChatGPT and other large language models (LLM) has caused significant challenges in education, especially for English language learning in China. To address these issues, research has explored the beliefs of EFL (English as a Foreign Language) teachers from Chinese universities regarding the integration of LLM into language education (Gao et al., 2024). The study found concerns among EFL teachers at Chinese universities, including the neglect of traditional learning resources, concerns about academic integrity, and the over-reliance on technology. An analysis of data from previous studies proves that although a technological environment can potentially become a powerful educational tool, this environment requires students to regulate their learning. In other words, students must make decisions about what to study, how to study it, when to change plans and strategies, and when to increase efforts (An et al., 2020).

To create a positive learning experience, it is essential to design a suitable learning environment. This is the place where students acquire knowledge and skills. Online learners must have access to all necessary resources, such as learning outcomes and job requirements. Those attending night classes can access content both in the classroom and through mobile

technology (Tsai & Tsai, 2018). Learning environments should enhance social interaction between students and instructors through wikis, social media platforms, and blogs. This approach blurs geographical barriers, creating a collaborative learning space for individual and group interactions.

2.3. Problem statement

The study aims to evaluate the efficacy of mobile applications within language education, as well as to understand how this technology affects language learning outcomes and student perceptions. To achieve this goal, it is necessary to accomplish the following objectives:

1. Assess the level of language proficiency of students before and after participating in a mobile-assisted English language learning program.

2. Study the perception, attitudes, and experience of students regarding the use of mobile applications for learning English.

3. Explore the potential benefits of integrating mobile technologies into language education at colleges.

3. Methods and materials

3.1. Research design

The research methodology is based on the development and testing of a mobile technology intervention for learning English within the educational process. A mixed approach was used to analyze the data. Mixed approach combines elements of quantitative research and qualitative research in order to answer the research question. This study used a sequential explanatory design of mixed approach as it includes quantitative data collection and analysis, qualitative data collection and analysis, and a greater focus on quantitative data. This includes a language proficiency test for students and a qualitative evaluation of the English language learning environment.

The study lasted one academic semester (4 months). The first stage was the selection of applications and the design of an intervention program. This stage included defining learning outcomes, selecting appropriate learning materials and resources, and organizing content into sequential modules. An analysis of popular language learning apps was carried out and those that met the learning objectives and curriculum were selected. The second stage was the development of the pedagogical approach and teaching methods for the language learning intervention (the choice of educational strategies, methods and classroom activities that promote active participation, interaction and meaningful use of language among students). The second stage is largely based on the decisions and framework established in the first stage. The choice of programmes and the design of the intervention programme provide the basis on which the pedagogical approach and teaching methods can be effectively built. In the final stage, the effectiveness of the intervention was evaluated.

3.2. Mobile-assisted language learning intervention

This learning course (intervention) is designed to help college students in China improve their English proficiency through interactive mobile learning activities. The training program covers a variety of language skills, including listening, speaking, reading, and writing. The course is based on two popular applications in China (Keke English and Lanren English), which are in line with the research objectives.

3.3. Theoretical basis

Keke English is a mobile application that provides comprehensive materials for learning English, from English books to TED talks. There has been little research on this app, but the

studies that do exist have proven its effectiveness in language learning. The theoretical basis is that this app gives learners a positive perception of vocabulary learning. Such mobile language learning has resulted in an enjoyable and innovative experience of learning and studying vocabulary through mobile apps, which can definitely increase the time and space for learners to study. Using Keke English, students can practice speaking, listening, reading, and writing in English. The application also offers online courses and other resources for many popular English language tests, such as TOEFL and IELTS (Figure 1).
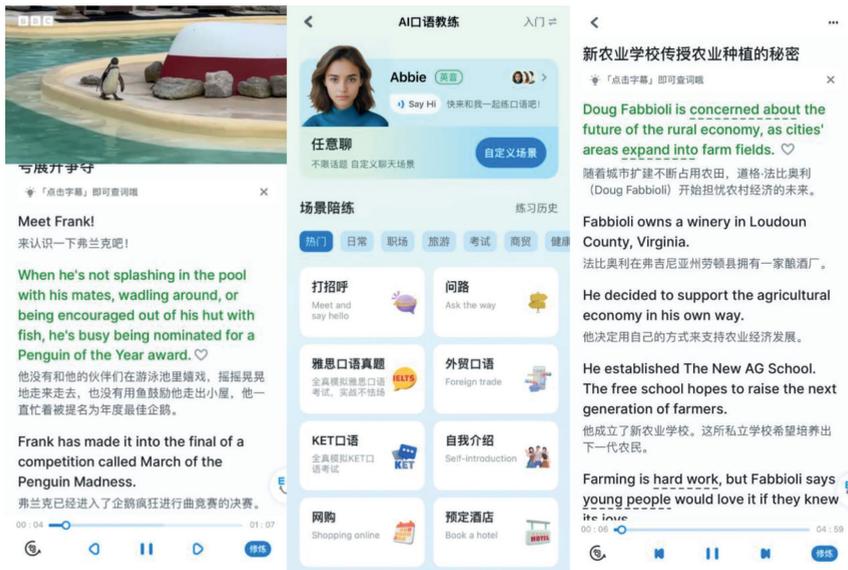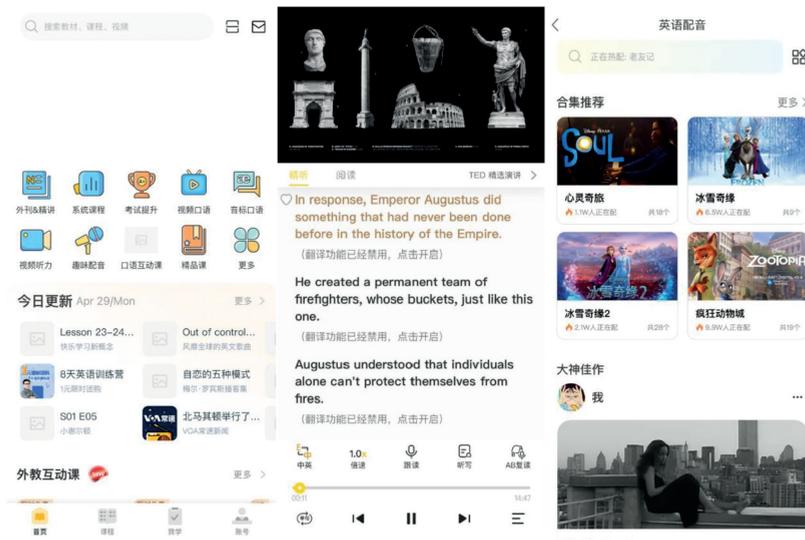
FIGURE 1. Keke English mobile application.

FIGURE 2. Lanren English mobile application.

Lanren English is an application that offers a wide range of materials for learning English, such as news podcasts, English movies and songs, TED talks and books, as well as vocabulary for various English language tests. Users can also practice speaking and get reports from the application (Figure 2).

3.4. Curriculum development

The training was structured in such a way that each lesson (held twice a week) included a specific amount of time allocated to working on applications. These applications were alternated each session, and both had a structured system that allowed for organizing classes within a comprehensive course. The applications offer a variety of practice activities that can be tailored to specific classes and topics. Students can spend 15-20 minutes practicing vocabulary on an application or 20-30 minutes doing listening exercises with the other one. Within the current program, this part of the lessons lasted less than 30 minutes. The practice of self-learning by students outside of classes was encouraged, but not monitored.

3.5. Sample

The study involved a sample of 190 students studying English as a foreign language at three public colleges in China. By the third and fourth years of study, students typically reach a certain level of English proficiency. It was expected that these students would be more deeply involved in academic studies compared to first-year students. The participants were randomly selected from all the students enrolled in the third and fourth years. The lists of students were provided by the college administrations. The students received invitations to participate in the study by e-mail. Among 300 students, 190 provided responses with consent. Students who did not agree to participate were excluded from the study. Thus, the sample consisted of 190 students aged 20 to 26 years. Before the study, it was confirmed that all the included participants had at least one type of mobile device (for example, smartphone or tablet). Then, the participants were randomly divided into two groups – experimental and control. There were 95 students in each group. The educational program of the control group has not changed. The experimental group underwent English language training through a mobile-assisted learning program.

3.6. Survey

The initial level of data collection was the College English Test 4 (CET-4) (Practice Test 4). This is a standardized English proficiency test conducted in China, primarily for college students. The CET-4 evaluates the level of English proficiency of examinees in reading, listening, writing, and translation skills. CET-4 and CET-6 are equivalents to international standardized English tests, such as IELTS and TOEFL. The results of the CET-4 are presented as scores on a scale. The scaled scores range from 0 to 710 for each section (reading, listening, writing, and translation), which are combined into one the overall score. The test does not directly correspond to the specific levels of the Common European Framework of Reference for Language (CEFR). Nevertheless, the results were converted to the CEFR scale according to the following principle:

- A1 (beginner): scores below 200.
- A2 (elementary): scores from 200 to 300.
- B1 (intermediate): scores from 301 to 400.
- B2 (upper intermediate): scores from 401 to 500.
- C1 (advanced): scores from 501 to 600.
- C2 (proficient): scores above 600.

This conversion of CET-4 scores into CEFR levels increased the quality of the assessment process. Thus, language proficiency levels were accurately tested and reported in a standardized way that was specifically designed for this study. After the intervention, the test was conducted again.

Data collection for the current study also included a survey of students in the experimental group in order to assess the mobile-assisted environment for learning English. The survey was based on the scale used by the previous authors (Gao & Shen, 2021) and adapted for this study. The questionnaire consists of fifteen questions, assuming 5-point scores on the Likert scale (Appendix 1). The 5-point Likert scale is one of the most common formats. It provides a balanced range of response options while keeping the survey concise (Chan, 2016). In addition, it was used in the original questionnaire. The points are distributed as follows: (1) Strongly disagree, (2) Disagree, (3) Neutral, (4) Agree and (5) Strongly agree. The scale used in the questionnaire assess students' attitudes and behavior towards using mobile applications for various English language learning activities, including communication, co- education, self-study, vocabulary practice, and access to online courses. The scale also reflects students' preferences for mobile learning compared to traditional methods. The survey was conducted online in Google Forms in the final stage of the study. The participants received a link to the survey in their emails.

3.7. Statistical processing

The data obtained from the survey were calculated and analyzed using the statistical program SPSS 25. The reliability of the measures utilized in this study was tested using Cronbach's alpha. The interpretation of Cronbach's alpha internal consistency indicators is as follows: >0.9 = excellent; >0.8 = good; 0.7 = acceptable; 0.6 = questionable; and >0.5 = poor. Cronbach's alpha values were 0.88 in the pre-test and 0.90 in the post-test. This result suggests acceptable internal consistency.

To evaluate the effectiveness of the proposed model, the study involved conducting a t-test and calculating the standard deviation of the sample. These methods allowed the researchers to examine the difference in pre-test and post-test indicators for the mobile-assisted learning program. Both qualitative and quantitative data collected using these tools were verified through a detailed discussion and analysis of the results.

3.8. Research limitations

Some potential limitations of the study include the possibility of generalizing the results, as the sample may not fully represent English language learners in China.

Additionally, the availability and quality of selected language learning platforms may vary. These differences between the platforms potentially affect the effectiveness and functionality of the platforms.

3.9. Ethical issues

In this study, all the processes involving human participants were conducted in accordance with ethical research standards. Informed consent was obtained from all participants included in the study. No ethical standards were violated.

4. Results

The pre-test and post-test results revealed the level of language proficiency in the control and experimental groups (Table 1). The distribution of language proficiency levels in the control group was as follows: 4.2% of A1 (beginner), 13.1% of A2 (elementary), 60.8% of B1 (intermediate), 17.5% of B2 (Upper Intermediate), and 4.4 % of C1 (advanced). None of the participants in the control group reached the highest level of language proficiency (C2 or proficient). In the experimental group that used the mobile learning program, the distribution of language proficiency levels in the preliminary test was somewhat different. Thus, 4.4% of the participants had A1, 8.6% had A2, and 52.3% had B1. In addition, 26.0% were at the B2 level, 8.8% were at the C1 level, and none of the participants reached the C2 level.

After the intervention, both the control and experimental groups underwent a post- test to assess changes in language proficiency. In the control group, the participants showed a less noticeable improvement in their language proficiency compared to the participants in the experimental group. The post-test distribution of language proficiency levels in the control group was as follows: 4.5% of A1, 13.3% of A2, 61.0% of B1, 17.7% of B2, and 4.6 % of C1. In addition, a small percentage of participants (0.9%) achieved the highest level of proficiency (C2), which indicates some progress in language skills. Participants in the experimental group demonstrated varying degrees of improvement in language proficiency after the intervention. There were 0% of students who had A1 level, and 4.3% moved to the elementary (A2) level.

A significant proportion of students with a B2 level significantly increased (43.5%). A significant number of participants (43.5%) advanced to the B2 level, while some students (21.7%) reached C1. Moreover, 4.3% of the participants achieved the highest level of language proficiency (C2), demonstrating exceptional language proficiency.

These results suggest that the intervention had a positive effect on the participants' language skills at different levels of language proficiency.

TABLE 1. Pre-test and post-test results.

Language proficiency level	Control group		Experimental group	
	Pre-test	Post-test	Pre-test	Post-test
A1 (Beginner)	4.2%	4.5%	4.4%	0.0%
A2 (Elementary)	13.1%	13.3%	8.6%	4.3%
B1 (Intermediate)	60.8%	61.0%	52.3%	26.1%
B2 (Upper intermediate)	17.5%	17.7%	26.0%	43.5%
C1 (Advanced)	4.4%	4.6%	8.8%	21.7%
C2 (Proficient)	0.0%	0.9%	0.0%	4.3%

The test showed a significant improvement in the results of the experimental group. Consequently, a mobile learning intervention has proven to be more effective at improving English language proficiency than traditional learning. The standard deviation *(s)* of the sample is approximately 0.45. A *t*-value of approximately 13.249 indicates a significant difference between the pre-test and post-test scores for the mobile learning program (experimental group). In a paired *t*-test, the *t*-value measures the size of the difference relative to the variability within the sample. A larger *t*-value suggests that the observed difference is less likely to have occurred by chance. In this case, a *t*-value of 13.249 suggests that the difference between the pre-test and post-test scores is very significant and can hardly be explained by a random variation. Values such as ≈-50.0% and ≈-16.7% imply a decrease in the percentage of students with the B1 (intermediate) level after the intervention. Negative percentages indicate a decrease or reduction in the percentage of students relative to the baseline or control point (after the intervention compared to the point before the intervention). This shift in the

distribution of students according to their skill levels is linked to the transition of students to higher levels of language proficiency (B2, C1, etc.) and not to a decrease in their overall level of proficiency. Table 2 shows the distribution of students' responses on a 5-point Likert scale. These responses reflect their personal attitudes towards the mobile-assisted English language learning program.

TABLE 2. Participants' responses on the 5-point Likert scale.

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1. I use mobile applications to communicate with friends in English.	5	10	20	45	15
2. I use mobile devices to discuss English with my classmates.	8	12	15	40	20
3. If I have any questions, I prefer to use mobile applications rather than asking English teachers.	10	20	25	30	10
4. When I find it difficult to pronounce English words, I use mobile applications to learn correct pronunciation.	3	7	15	40	30
5. I use mobile applications to read articles and news in English.	6	10	18	40	21
6. I use English language learning applications installed on my mobile devices to improve my English skills outside of the classroom.	2	5	10	45	33
7. I prefer to learn English using mobile applications rather than using textbooks.	5	10	20	45	15
8. I prefer to use mobile devices to learn English rather than computers.	10	15	20	40	10
9. I use mobile applications to search for synonyms and antonyms to improve my writing skills in English.	5	10	25	40	15
10. I use mobile applications to access English language test samples and evaluate my learning progress.	8	12	20	40	15

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
11. I rely on the help of mobile applications in learning English.	5	10	15	45	20
12. I use mobile applications to find online English language courses.	5	8	18	40	24
13. I share English language learning materials with my classmates through mobile applications.	10	15	20	40	10
14. After classes, I watch videos on learning English in mobile applications.	8	12	20	40	15
15. I prefer mobile-assisted English language classes to traditional classroom activities.	5	10	20	45	15

The results of the Likert ratings for the intervention gives an idea of the perceived benefits and experience of students in the program. The majority of students (45-50%) agree or completely agree with statements indicating their preference for using mobile applications for various English language activities. This shows a clear propensity for mobile learning methods compared to traditional approaches. A significant number of students (40-45%) noted that they use mobile apps for a wide range of English language learning activities, including communication, learning vocabulary, reading articles, accessing educational materials, and watching videos. Therefore, mobile applications can be comprehensive and effective educational tools. Additionally, many students (35-45%) expressed confidence in the effectiveness and reliability of mobile applications for language learning purposes. This fact suggests a positive perception of mobile applications as valuable tools for improving English language proficiency. To quantify this data, the average score for each item on the Likert scale was calculated (Table 3).

TABLE 3. Average scores for each item on the Likert scale.

Elemento	Puntuación media
1. I use mobile applications to communicate with friends in English.	≈ 2.42
2. I use mobile devices to discuss English with my classmates.	≈ 2.45
3. If I have any questions. I prefer to use mobile applications rather than asking English teachers.	≈ 2.89

4. When I find it difficult to pronounce English words. I use mobile applications to learn correct pronunciation.	≈ 3.47
5. I use mobile applications to read articles and news in English.	≈ 3.58
6. I use English language learning applications installed on my mobile devices to improve my English skills outside of the classroom.	≈ 3.76
7. I prefer to learn English using mobile applications rather than using textbooks.	≈ 3.86
8. I prefer to use mobile devices to learn English rather than computers.	≈ 3.42
9. I use mobile applications to search for synonyms and antonyms to improve my writing skills in English.	≈ 3.47
10. I use mobile applications to access English language test samples and evaluate my learning progress.	≈ 3.37
11. I rely on the help of mobile applications in learning English.	≈ 3.74
12. I use mobile applications to find online English language courses.	≈ 3.73
13. I share English language learning materials with my classmates through mobile applications.	≈ 3.45
14. After classes. I watch videos on learning English in mobile applications.	≈ 3.45
15. I prefer mobile-assisted English language classes to traditional classroom activities.	≈ 3.86

In general, the data indicate that students see mobile applications as useful and effective tools for learning English. Participants clearly preferred mobile teaching methods over traditional approaches to learning. These results highlight the importance of integrating technology into language instruction to enhance engagement, accessibility, and effectiveness in the context of language learning. Statements 6, 7, 11, 12 and 15 received the highest average

scores, indicating strong agreement among students regarding their preferences for using mobile applications for various English learning activities. The students expressed confidence in the efficacy of mobile applications for achieving language learning goals.

5. Discussion

The results of the study demonstrated a significant improvement in the level of language proficiency in both the control and experimental groups. The control group showed slightly less significant progress compared to the experimental group, which used a mobile learning program. The students in the experimental group had varying levels of improvement at different skill levels. For instance, 4.3% of the participants moved to the elementary (A2) level. There was a considerable increase in the proportion of students with B2 (43.5%). A large number of the students (43.5%) advanced to the B2 level, showing a high level of language proficiency. A significant part of the participants (21.7%) reached C1, while 4.3% of the participants managed to achieve the exceptional level of language proficiency (C2).

Stakeholders involved in teaching English language should inform content and mobile software developers about the potential of smartphones in solving problems related to language learning and educational applications (Kacetl & Klímová, 2019). By collaborating with developers, stakeholders can help create more learning-friendly mobile applications that make vocabulary learning easier for language learners and are suitable for learning activities (Rosell-Aguilar, 2018). Thus, this scientific work was aimed at filling this gap and identifying the benefits of mobile-assisted learning.

Compared to the traditional approach to learning, digital learning tools can lead to better achievements among students without technical knowledge. It can be assumed that students were more interested in the interactive content of the course and digital educational resources. Students showed a lower inclination to use mobile apps for communication, with average scores of approximately 2.42 for communicating with friends and 2.45 for discussing English with classmates. Their preference for mobile applications over asking teachers when they have questions also registered a moderate score of around 2.89.

Another study examines the problems of language teachers related to open distance learning in higher education institutions (Jie & Sunze, 2023). University professors participated in semi-structured interviews and expressed their opinions on how mobile technologies affect the processes of teaching and learning in higher education institutions. In particular, four topics related to the teaching of English in the context of mobile technologies were discussed: technological mediation, progressive pedagogy, English language teaching, and learning flexibility (Kusmaryani et al., 2019). The findings revealed that mobile technologies and pedagogical innovations are not a problem for teachers. Instead, the challenges include psychological anxiety, expanded teaching roles, and learning flexibility. Based on the above results, the authors proposed a theoretical basis for digital education and a learning model for digital language media. The current study also presented an intervention model based on mobile-assisted language learning. Although the opinions of the teachers were not collected, an analysis of the responses on the Likert scale showed that most students prefer to use mobile applications for various English language activities. For instance, they reported an average score of 3.47 for using apps to improve pronunciation, while reading articles and news in English, scored higher at 3.58. This result indicates a strong propensity for mobile-assisted learning methods.

A similar article reports on the results regarding learning strategies used by a group of Chinese EFL learners in a mobile technology environment (Gao & Shen, 2021). According to the findings, the mobile technology environment changed the way Chinese EFL students adopted a specific set of learning strategies. These strategies differed in type

and frequency from those typical of teacher-led and exam-oriented language classes. The data from our study indicates a strong preference for mobile- assisted English language classes over traditional classroom activities, with an average score of 3.86. This preference highlights a growing acceptance of modern, technology- driven approaches to language education.

Other studies have argued that digital gamification is an entertaining and enjoyable method to support learning English as a second language. This method can effectively reduce the gap between learning and educational practice (Dehghanzadeh et al., 2021). The use of applications and gamification is considered one of the most well-known teaching methods to motivate students and increase their engagement in the learning process. The reason is that various elements (both dynamics and mechanics) provided by a gamified environment boost motivation and interest in learning English (Ishaq et al., 2021). Another study confirms the results of the current experiment using the example of one of the most popular language learning applications on the market: Busuu (Shibata, 2020). The data was collected through an online questionnaire, similar to the one used in the current study. The results show patterns of usage and which features students consider to be most valuable for learning a language. The high expectations of users and the fact that one third of respondents use Busuu as their only source of learning suggest that a significant number of users view applications as a reliable tool for learning languages. These findings are consistent with those obtained from the analysis of other popular applications in China (Keke English and Lanren English).

6. Conclusions

The study highlighted the importance of integrating mobile technology into language education to improve learning experiences, engagement, and overall language proficiency. This approach provides a modern and interactive way of learning, allowing students to practice and enhance their language skills outside the classroom. The results of the study demonstrated a significant improvement in the level of language proficiency in both the control and experimental groups. The control group showed slightly less significant progress compared to the experimental group, which used a mobile learning program. The students in the experimental group had varying levels of improvement at different skill levels. For instance, 4.3% of the participants moved to the elementary (A2) level. There was a considerable increase in the proportion of students with B2 (43.5%), showing a high level of language proficiency. A significant part of the participants (21.7%) reached C1, while 4.3% of the participants managed to achieve the exceptional level of language proficiency (C2). In this study, the participants also shared their opinions on a mobile-assisted environment for learning English using a questionnaire on the Likert scale. The analysis of their responses revealed that the students prefer to use mobile applications for various English language classes, which indicates a strong propensity for mobile learning methods. The students expressed confidence in the effectiveness and reliability of mobile applications for language learning, emphasizing the obvious advantages of introducing technology into language education. The calculated average scores for each item on the Likert scale once again confirmed the positive perception of mobile applications as valuable tools for learning English. The students reported using mobile applications for a wide range of activities, including communication, vocabulary improvement, reading, and access to educational materials. These findings highlight the usefulness of mobile applications in improving English language proficiency.

This study has implications for understanding and designing mobile technology learning for EFL students in order to develop effective strategies for improving their learning experience. The findings could form the basis for initiatives that aim to support the professional development of language teachers. These initiatives could help educators implement innovative pedagogical approaches and effectively integrate technology into their teaching practice. Future research may focus on the problem of developing digital literacy skills and student independence.

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Author contributions

Ke Li: Conceptualization; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Resources; Software; Supervision; Validation; Visualization; Writing (original draft); Writing (review and editing).

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Appendix 1

The survey to assess the attitudes towards the mobile-assisted environment for learning English among students in the experimental group

1. I use mobile applications to communicate with friends in English.
    1. Strongly disagree
    2. Disagree
    3. Neutral
    4. Agree
    5. Strongly agree

2. I use mobile devices to discuss English with my classmates.
    1. Strongly disagree
    2. Disagree
    3. Neutral
    4. Agree
    5. Strongly agree

3. If I have any questions, I prefer to use mobile applications rather than asking English teachers.
    1. Strongly disagree
    2. Disagree
    3. Neutral
    4. Agree
    5. Strongly agree

4. When I find it difficult to pronounce English words, I use mobile applications to learn correct pronunciation.
    1. Strongly disagree
    2. Disagree
    3. Neutral
    4. Agree
    5. Strongly agree

5. I use mobile applications to read articles and news in English.
    1. Strongly disagree
    2. Disagree
    3. Neutral
    4. Agree
    5. Strongly agree

6. I use English language learning applications installed on my mobile devices to improve my English skills outside of the classroom.

   1. Strongly disagree

   2. Disagree

   3. Neutral

   4. Agree

   5. Strongly agree

7. I prefer to learn English using mobile applications rather than using textbooks.

   1. Strongly disagree

   2. Disagree

   3. Neutral

   4. Agree

   5. Strongly agree

8. I prefer to use mobile devices to learn English rather than computers.

   1. Strongly disagree

   2. Disagree

   3. Neutral

   4. Agree

   5. Strongly agree

9. I use mobile applications to search for synonyms and antonyms to improve my writing skills in English.

   1. Strongly disagree

   2. Disagree

   3. Neutral

   4. Agree

   5. Strongly agree

10. I use mobile applications to access English language test samples and evaluate my learning progress.

    1. Strongly disagree

    2. Disagree

    3. Neutral

    4. Agree

    5. Strongly agree

11. I rely on the help of mobile applications in learning English.
    1. Strongly disagree
    2. Disagree
    3. Neutral
    4. Agree
    5. Strongly agree

12. I use mobile applications to find online English language courses.
    1. Strongly disagree
    2. Disagree
    3. Neutral
    4. Agree
    5. Strongly agree

13. I share English language learning materials with my classmates through mobile applications.
    1. Strongly disagree
    2. Disagree
    3. Neutral
    4. Agree
    5. Strongly agree

14. After classes, I watch videos on learning English in mobile applications.
    1. Strongly disagree
    2. Disagree
    3. Neutral
    4. Agree
    5. Strongly agree

15. I prefer mobile-assisted English language classes to traditional classroom activities.
    1. Strongly disagree
    2. Disagree
    3. Neutral
    4. Agree
    5. Strongly agree