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Teaching english using mobile applications to improve academic performance and language proficiency of college students

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Abstract

The purpose of the study is to determine the effectiveness of mobile applications in conjunction with the students' online collaboration in the educational environment of Chinese colleges (the context of learning English). The students were selected from all those who study English in their educational programs. At the first stage, they passed a test on the level of language knowledge and among 423 students 140 were selected who had a level of B2 and below. Then they were divided into control and experimental groups. Each had 70 people. The experimental group was trained using the following mobile applications: Busuu, Lingoda, LinguaLeo, BBC Learning English. The results showed that the participants in the experimental group scored higher on the final test (74.71) than the control group participants (65.9). It suggests that mobile learning technologies can improve student achievement. The preliminary test determined the level of knowledge of the experimental group students in this way: 85% of students know English at the B2 level, 14% - B1, and 1% - A2. These figures improved significantly in the second test: the number of students who reached the C2 level was 7%, C1–79%, and 14% of all students remained with the B2 level. For the control group students, these indicators remained unchanged. Most of the students found this format of education suitable and interesting for online collaboration. These results may be useful for teaching practice, because they provide evidence base with the experimental research for the introduction of mobile technologies in the modern educational process. It solves the problem of using the certain mobile applications (Busuu, Lingoda, LinguaLeo, BBC Learning English) that have not been explored before.

Keywords Educational applications · Group work · M-learning · Online English learning · Student achievement

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1 Introduction

English is the main foreign language in China, and it is in demand in schools and colleges. Students understand its relevance and status as an international guide, educational and entertainment tool, communication medium, so a quality and appropriate approach to teaching should be presented (Wang & Zhang, 2019).

The assessment of Y.X. Zhang, Director of the Department of Higher Education in the Chinese Ministry of Education, was low enough. He said that Chinese university students speak and understand English very poorly. This level does not correspond to that set for universities (Du, 2012). The Chinese ministry launched a process of integrating reforms aimed at correcting students' incapability to use English for communication in 2002 (Zhang et al., 2020). Over time, this began to be influenced by the integration of online collaboration and mobile learning technologies. The peak of these methods fell in 2020 due to the COVID-19 pandemic.

In recent decades, several innovative approaches to teaching have emerged in colleges and universities in China. Among them is collaborative learning (CL). CL is a teaching method in which students work together to achieve common goals (Chen & Chang, 2016). With the use of mobile technologies, this process can be transferred to an online platform. Group work is also considered a great addition to group discussions, allowing all group members to participate in the discussions. Issues of online collaboration are not analyzed in current research on English teaching (Volkova et al., 2021). This does not allow one to assess the possibilities for improving the effectiveness of online collaboration (Du et al., 2018).

As mobile applications are increasingly being used to learn foreign languages, the popularity of mobile learning technologies in general is growing. Online collaboration and mobile learning have had a significant impact on English language teaching (ELT) in recent years. Online collaboration and mobile learning have made it easier for students and teachers to access a wealth of language learning resources (Lu et al., 2022). Students can access online dictionaries, grammar resources, and multimedia content, and teachers can find and share lesson plans, activities, and teaching materials with colleagues around the world. Online collaboration tools have made it easier for students and teachers to communicate with each other, regardless of location. With platforms like Zoom, Skype, and Google Meet, teachers can hold virtual classes and meetings, and students can practice their language skills with native speakers from around the world. Mobile learning has made it possible for students to learn at their own pace and in their own time. Language learning apps like Duolingo, Babbel, and Rosetta Stone allow students to practice their skills on their mobile devices, and many of these apps use algorithms to personalize the learning experience based on the student's level and progress ((Cai, 2017b).

The term "mobile learning" is defined differently in existing research, which indicates the point that mobile learning and its applications are developing. Mobile learning, also known as m-learning, refers to the use of mobile devices such as smartphones, tablets, or laptops to facilitate learning and education. It involves the delivery of educational content and resources through mobile technologies and devices (Heil et al., 2016). Mobile learning is such a form of organization of an autonomous and personalized educational process, where the basis or dominant technologies are

mobile communication devices, with through which students can form and improve their skills, and competencies not only during classes in class, but also at any time convenient for them and being in any place (Meirbekov et al., 2014). The lack of an appropriate definition may hinder future research (Peng et al., 2009). Overall, online collaboration and mobile learning have revolutionized the way English language teaching is conducted and have provided new opportunities for language learners and educators. Therefore, this study aims to improve the English language teaching methodology in Chinese colleges, which contributes to the improvement of students' academic performance by integrating mobile applications into the educational program with an emphasis on online group work.

1.1 Literature Review

1.1.1 Mobile Learning Technologies

The above reforms should be seen as an understanding by the Chinese authorities of the critical requirement to improve the teaching methodology for college students, because of the current low-performing Mobile Learning Technology (MLT) condition ((Cai, 2017a). Innovation in these college English programs began along with a series of successes in the late 20th century as China began a process of modernizing teaching (Yu & Liu, 2018). Moreover, mobile learning has become a popular research issue in education. The authors point to an increased students' motivation and achievement through the integration of mobile applications and technologies in general. Mobile learning is an appropriate addition to educational techniques for improving college learning (Lim & Churchill, 2016).

Because mobile devices have significant potential for mobility, social interaction, and individuality (Li et al., 2022; Sung et al., 2015; Zydney & Warner, 2016), language learning has become incorporated into mobile technology development. The mobile learning format helps students to be in the educational process regardless of time and place, while working in a team and setting up content for self-study (Chwo et al., 2018).

Mobile learning technologies are shaping better and more convenient language learning tools and apps (Hao et al., 2019). While college learning environments have been found in research to be optimal for integrating and enhancing mobile learning, there is a gap in exploring the application of MLT to app-based English (Lai & Zheng, 2018). Some research showed that a mobile learning system with fast web access facilitated learning and met the needs of students (simplification of assignments, rejection of notes, modernization of the educational environment, etc.) (Yu & Liu, 2018). Such results can also be reached from the right choice of learning methods and online collaboration using mobile technology.

Another advantage of mobile learning is the high level of mobility and authenticity, which opens opportunities for learning outside the classroom. Videos, films, and lectures in the form of recorded videos are widely used in listening and speaking classes among the main sources of authentic materials for language learning (Chiu et al., 2018). This is impossible without mobile learning technologies (for example, social networks like YouTube, Instagram, or any other applications with a video for-

mat). Authentic English videos as audio and visual aids have a positive impact on improving students' listening and speaking skills. However, as an independent tool, a video does not have an established methodology and generally accepted patterns. Classroom activities and teaching methods can often be repetitive and impromptu, resulting in ineffective use of video material in English classes (Wang, 2015).

In recent years, there has been a lot of research focused on language learning through mobile devices (MALL). However, very few of them are in the context of college teaching in China. They have focused on literature reviews describing the status and trends of MALL in contemporary Chinese colleges and universities (Zhou, 2020). In addition, the provisions under study largely overlapped with the period 2004–2014 during the implementation of college education reforms (Xu, 2020). Although MALL research in China is increasing, systematic English teaching methods have been overlooked.

At the same time, MALL's existing research base has greatly contributed to developing trends and filling gaps in China's college teaching practices. For example, in line with results on applied theoretical frameworks adopted in language education around the world, sociocultural theory has often been used to support MALL in China (Zain & Bowles, 2021). Most Chinese studies have measured the effect of MALL on overall language proficiency, rather than on students' specific language skills. International and Chinese studies prove that among all MALL tools, mobile phones are the most effective and popular (Wang & Cui, 2016). However, most review studies in China used only general terms to describe their benefits (e.g., mobile devices). Therefore, there is a need to study the operation of these devices from the computer science and technology point. MALL-based educational programs had a positive impact on learning outcomes, especially on the level of lexical knowledge and listening skills through situational activities, collaborative functions, and social contacts (Lin & Lin, 2019).

Educational systems must be designed to update quickly, keep pace with new technologies and pedagogical innovations, and meet the needs of students (Sailin & Mahmor, 2018). In this context, mobile technologies are designed to help students develop skills in critical thinking, problem-solving, information use, communication, collaboration, and to improve academic performance (Raja Hussain, 2015). Therefore, teachers should contribute to the development of students' skills using appropriate mobile applications and innovations in teaching methods (Jimoyiannis et al., 2013).

1.1.2 Online collaboration

Collaboration refers to the act of students working together in the context of solving collective intellectual problems. It is used as a learning method where students work together towards a common goal (Rogers, 2013). Collaboration has proved valuable from various outlooks in the online learning environment. For example, collaborative work encourages students to engage in active learning that helps them build knowledge and achieve shared growth, encourages student innovation, and increases problem-solving competence (Lin et al., 2013). Collaborative learning helps students develop their voice within the group and promotes positive feelings towards learn-

ing as competition is prevented. Collaboration, especially when working on group assignments, is considered as one of the benefits for students in an online learning environment (Cheng et al., 2016). Therefore, there is an urgent need to test various models and ways of online collaboration in the educational process in colleges in China.

Online collaboration is a relatively new pedagogical phenomenon and has an interdisciplinary character. It has begun to develop most actively due to the COVID-19 pandemic. It was found that the effectiveness of online collaboration is influenced by such factors as a small number of students in a group, an objective approach to assessment, overcoming technical difficulties, etc. (Du et al., 2018). The aforementioned studies have focused on variables that relate online collaborative learning to psychological, educational, and technological aspects, including relations in the group, interface features, and student-teacher interactions. However, there is a need to determine the impact of this method on the performance of college students.

1.1.3 Problem Statement

This study aims to improve the English language teaching methodology in Chinese colleges, which contributes to the improvement of students' academic performance by integrating mobile applications into the educational program with an emphasis on online group work.

The research is motivated by the need to test mobile applications as part of college English learning. They were considered as an addition to the existing educational program for students of various specialties.

The purpose of the study is to determine the effectiveness of mobile applications in conjunction with the students' online collaboration in the educational environment of Chinese colleges (in the context of learning English).

Tasks that had to be solved during the study:

1. Using tests to assess the academic achievements among students in the control and experimental groups.
2. Analyze the results and determine the trend of indicators to progress or regress.

2 Methods and materials

2.1 Research Design

The impact of mobile learning technologies and online collaboration was tested by introducing English learning apps into the curriculum of students. To achieve this goal, the method of quasi-experimental research was used. It aims to establish a causal relationship between two variables. The results were based on the academic performance of the participants, as well as their responses about the skills acquired during the experiment. To solve the research problem, a survey of participants was conducted. It was held before the start of the study and at its end (after one academic semester). Participants were asked to use at least one app of their choice. They also

had the opportunity to learn a few other apps and notify their teachers about it. Mobile applications that were presented to the participants: Busuu, Lingoda, LinguaLeo, and BBC Learning English (involves watching videos or podcasts and discussing on Zoom or Google Meet with teachers in a group, in addition to the tasks presented in the app). These applications were chosen for implementation in the course because each of them offers group assignments or a lecture format. This implies online collaboration between students and provides an opportunity for researchers to analyze not only the operation of mobile technologies, but also their relationship with online collaboration. Throughout the school semester, students interacted weekly with these apps, which include interactive exercises using quizzes, written exercises, and audio and video materials that complement the English classes. These services were chosen as the most effective since they can be used both as a tool for independent work and when working with other students.

2.2 Participants

The participants were students of Mianyang Normal University, studying in the second year. The main selection criterion was the presence of the English language in the curriculum. Therefore, the participants were randomly selected from all majors that studied English. At the first stage, they passed a test on the level of language knowledge and among 423 students 140 were selected who had a level of B2 and below. This is important for this study to show how the performance of participants with the same level of English proficiency improved or worsened. They were randomly divided into two groups: control and experimental. Each had 70 people. In the control group, English was studied without changes, while in the experimental group, hours were introduced for collective online classes using mobile apps.

2.3 Data Collection and Analysis

The students completed two surveys and two tests at the beginning and end of the experiment, respectively. Surveys were developed by researchers specifically for this experiment. Each questionnaire consisted of 4 yes/no questions or a scale score. Since all surveys and tests were taken online, the researchers manually processed only the responses and results received to obtain statistical data. First, they were collected in tables using Microsoft Excel, and then translated into charts. Two surveys were conducted in Google Forms. Sample questions are presented in Appendix 1 and 2. English proficiency tests were presented by the international portal English Language Assessment. The assignments were approved by the teachers, and it was possible to take the test on the official website.

The reliability of the questionnaires was tested using Cronbach's alpha. Scale for interpreting Cronbach's alpha values:

>0.9 – excellent;
>0.8 – good;
0.7 – acceptable;
0.6 – doubtful; as well as.
>0.5 – bad.

To investigate the performance of the proposed model, ANCOVA was conducted. It allows one to establish the difference in the results of surveys of two groups. The Shapiro-Wilk test was used to calculate the normality of the data obtained in the study.

2.4 Research limitations

Speaking of the study limitations, the analysis of the results did not consider the age and gender ratio of the participants, since the main important criterion for the results was their level of English language proficiency. Also, demographics characteristics of students that could affect their answers were ignored. Future research may involve a long-term experiment. Consideration should be given to expanding the sample of the experiment to attract more students and improve the accuracy of the experimental results.

2.5 Ethical issues

All processes performed in human research followed the ethical standards of institutional research. Informed consent was obtained from all participants included in the study. Ethical issues were not violated during the study.

3 Results

The first survey was aimed at studying the students' attitude to the integration of mobile technologies into the process of learning English. It gave the following results:

98% of students want and need to use apps in their curriculum. Only 35% use English learning apps on their own. 53% of students noticed the interest of teachers in using mobile technologies in the classroom. This indicates that most students are ready for innovations in their educational programs and consider mobile technologies to be effective. Teachers can often slow down this process. At the same time, there is a too low percentage of those who are engaged in individual training in gadgets.

The results of the first study stage showed that 85% of students speak English at the B2 level, 14% - B1, and 1% - A2. These data are also presented in Fig. 1.

The second and final survey focused on students' evaluation of their online and group work. The analysis of the responses gave the following indicators:

60% of respondents prefer teamwork, and 40% value independent work more. The online collaboration in mobile applications was implemented by 89% of students. This means the applications are highly capable of improving and updating the way students collaborate online. It is worth mentioning that in addition to group lectures, students also had the opportunity to solve tasks together, do common projects, and evaluate each other's knowledge. Thus, for only 5% this format of language learning turned out to be difficult. For 95% of the participants, it did not become difficult to understand the interface and features of the applications.

At the end of the academic semester, students were retested to see if their general English had improved after studying with the mobile apps. The number of students

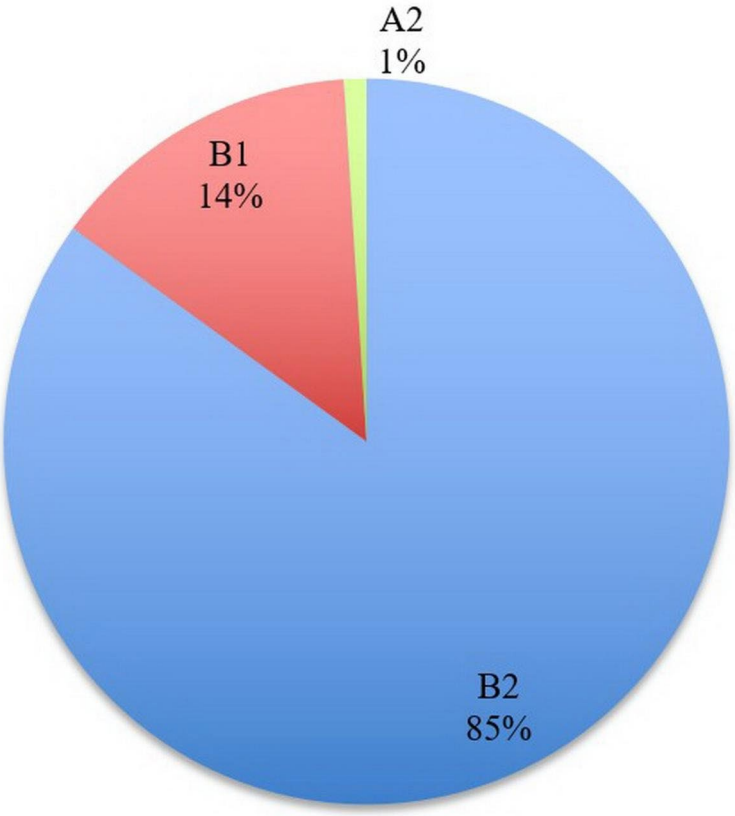

Fig. 1 First test results

who reached the C2 level was 7%, C1–79%, and 14% of all students remained with the B2 level. These data are presented in Fig. 2.

The pre- and post-interview Cronbach's alpha values were 0.88 and 0.90, indicating acceptable internal consistency. The result of the Shapiro-Wilk test was 0.97 ($p=0.23$), implying a normal distribution of the data.

To rule out differences between the prior knowledge of the two groups, ANCOVA was used.

The mean for the experimental group was 74.71 and the standard error was 3.45. Accordingly, for the control group, the indicators were as follows: 65.9 and 3.59. This suggests that there was a significant difference between the test scores of the two groups ($F=10.84$, $p<0.05$) (Table 1).

The final test showed that the experimental group participants scored more points (74.71) than the control group students (65.9). It suggests that mobile learning technologies can improve student achievement.

There was also an improvement in academic achievement scores. The main criterion for determining this was the average score, which was calculated based on

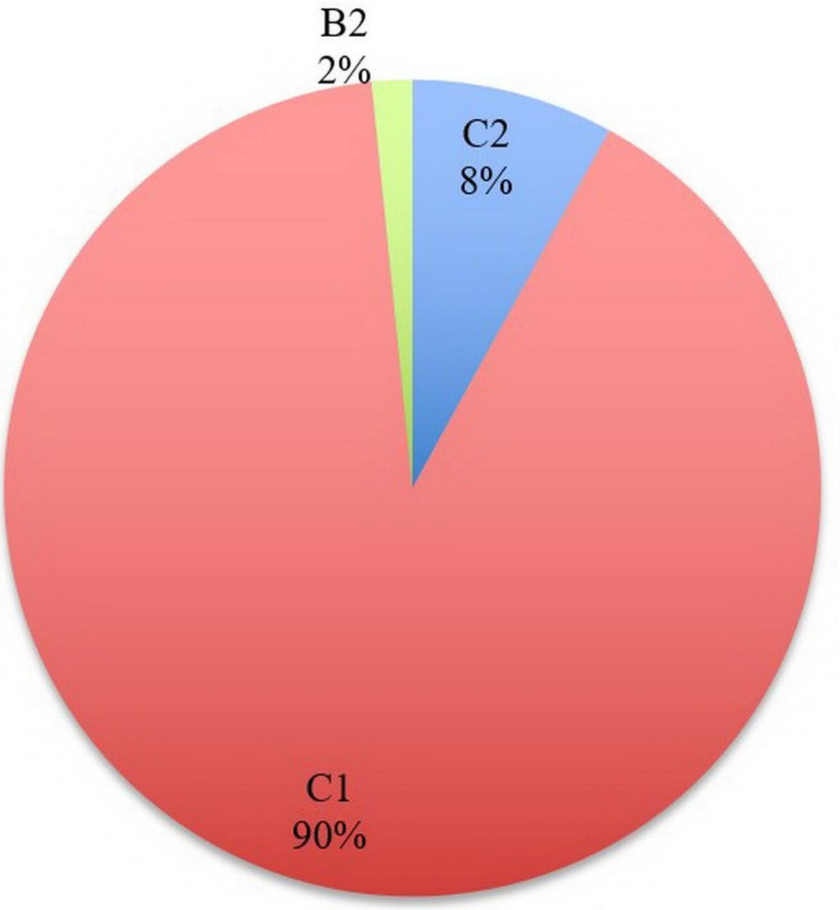

Fig. 2 s test results

Table 1 ANCOVA Results for student academic achievements

Group	n	Value	SD	Adjusted mean	SE	*F*
Control group	70	66.44	19.75	66.89	3.59	
Experimental group	70	75.14	12.43	75.15	3.45	10.84*

* $p < 0.05$.

students' assessments, including control tasks. Thus, at the beginning of the academic year, after the completion of the first module, it was 85.3. At the end of the experiment, the students' progress showed that the average score reached 93.1. The teachers who were involved in the calculation of this indicator claim that the level of academic performance increased by 7.8 points. These indicators relate to the experimental group, since the indicators in the control group did not change.

The respondents' scores improved significantly in the context of the general level of English proficiency. It would also be wrong to say that during this academic semester, the only thing that influenced the improvement in the level of the studied language was the use of the proposed method. The methodology, as a rule, is more effective in conjunction with other methods and tools. Therefore, the use of mobile technologies for online collaboration can improve student achievement. One of the advantages of this format is the organization of interaction between a teacher and students in the real time with meaningful feedback. It should be considered as an element of online collaboration, since effective group work is often accompanied by mentors in the form of a teacher or lecturer. The feedback system, as a background component, launches the constructor of learning and management models, which includes automated selection of tasks and organizational forms of educational activity (didactic basis of technology), choice of teaching aids and pedagogical techniques.

It is important to refer to the fact that all students were provided with quick access to the learning resources of the Internet and personal educational environment (access to educational presentations, training, and diagnostic materials) during the experiment, which they could use to overcome learning difficulties.

Analyzing the results of the presented model's practical implementation confirms the possibility of revealing the didactic potential of modern mobile learning and allows one to put the question of the formation of a new professional training model, which includes the use of mobile applications.

4 Discussion

The results obtained are in good agreement with the results of previous studies, which show that making learning mobile is beneficial for overall academic performance. For example, at the beginning of the academic year, after the completion of the first module, it was 85.3. At the end of the experiment, the student's progress showed that the average score reached 93.1. The teachers who were involved in the calculation of this indicator claim that the level of academic performance increased by 7.8 points. In this case, the students did not evaluate the applications and their work, they pointed more to their effectiveness and the need to use them for learning English. To streamline this process, app developers are partnering with colleges, schools, and universities to provide free trials of mobile learning programs. In this way, they create educational projects with a high level of gaming component, so that students can fully experience the benefits of mobile learning (Huang et al., 2014, 2021). Another study focuses not on academic performance but on benefits, game form, flexibility, and students' ingenuity, which have been successfully tested. The results suggest that the obtained correspondence between these criteria can facilitate learning tasks (Reychav & Wu, 2015), so they are among the key factors that enhance the effectiveness of mobile learning.

There is a study in which the educational effect of mobile applications was also proven by assessing student performance. The only difference is that the experiment lasted longer (one year). At the same time, one mobile application was proposed, which was used both on a full-time and part-time basis. Third-year students per-

ceived this innovation positively (based on grades) (Berger & Klímová, 2018). Students especially appreciated its interactivity. They noted that they learn faster and more efficiently because they can use it anytime and anywhere. These results are based on the self-assessed responses of the participants. Comparing results, this study also improved overall performance.

Another study was aimed at determining the effect of using a mobile application on the expansion of students' vocabulary. The study analyzed the learning outcomes of students in the app, which showed that the overall score of most students in vocabulary tests increased (Hao et al., 2019). They also improved their English spelling skills. Also, in the proposed application, students could use a pronunciation feature that helped them memorize words. Since the experiment was conducted with younger participants, the mobile application formed their English knowledge rather than improved it. In any case, research has proven that this format is effective in the context of listening and the use of sound effects.

A study examining the impact of Web 2.0 collaborative technologies on student achievement and self-regulation compared to a traditional learning approach found that collaborative technologies have a significant impact on academic achievement and self-regulation compared to a traditional approach (Jena et al., 2018). For the experiment, a quasi-experimental design was used. SlideShare, Wiki, WhatsApp, and YouTube have been used as separate mobile learning technologies and for collaboration.

Thus, the effectiveness of mobile learning and online collaboration can be tested against many different criteria. Studies show that students who have been research participants support the use of mobile technologies in teaching, which means that the use of these technologies will provide additional motivation for learning foreign languages.

5 Conclusions

The results of this study contribute to the mobile learning knowledge base and online collaboration. A quasi-experimental study was conducted to test academic performance and English proficiency among sophomore students in various majors. The results showed that the participants in the experimental group scored higher on the final test (74.71) than the participants in the control group (65.9). It suggests that mobile learning technologies can improve student achievement. The preliminary test determined the level of knowledge in this way: 85% of students know English at the B2 level, 14% - B1, and 1% - A2. These figures improved significantly in the second test: the number of students who reached the C2 level was 7%, C1–79%, and 14% of all students remained with the B2 level. For students in the control group, these indicators remained unchanged. Thus, mobile applications should be considered as an element of the educational program, which can significantly affect the level of students' knowledge. It also increases students' interest in the language learning process and involves them in online collaboration.

Speaking about group work, the selected applications allowed participants to interact online, work in groups on common projects and tasks, and solve tasks together.

Students noted a great interest in this format of education, which transfers mobile applications to a multifunctional point. 60% of respondents prefer teamwork, and 40% value independent work more.

These results can be added to the theoretical and empirical database in education, teaching, computer science, and language learning. Due to many factors involved in online collaboration and learning English, more study with many participants is needed. Also, in the following studies, it is worth paying attention to the demographics characteristics of students and trace the influence of these factors on the attitude towards mobile education.

Appendix 1

1. Rate on a scale from 1 to 5 the need for and importance of using mobile applications in learning English.
2. Do you use any apps on your own to improve your English skills individually?
3. Rate the school from 1 to 5 and your desire to start using applications on your phone or laptop in the classroom.
4. Do you see educators interested in introducing any form of mobile learning technology into your course?

Appendix 2

1. Do you prefer individual/independent work or group work?
2. Using the suggested applications, were you able to implement online collaboration in the way you would like?
3. Was it difficult for you to work in groups with new students?
4. On a scale of 1 to 5, how easy or difficult was the application interface for you in the context of group assignments?

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Data Availability Data will be available on request.

Declarations

Competing interests This research has no competing interests.

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