Multimedia Tools and Applications (2023) 82:17947–17962
https://doi.org/10.1007/s11042-022-14217-9

The effects of the superstar learning system on learning interest, attitudes, and academic achievements

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Received: 16 August 2021 / Revised: 27 October 2022 / Accepted: 1 November 2022 /
Published online: 18 November 2022

Abstract
The COVID-19 pandemic has contributed to the production of a mobile learning app–the Superstar Learning System. Designed by Superstar Company, the Superstar Learning System is a mobile application for curriculum learning assisted with PPTs, knowledge dissemination, and management sharing based on micro-service architecture. To identify the effects of the Superstar Learning System, we randomly selected 71 tertiary students to participate in the study. The data were obtained through three research instruments: a scale to measure learning interest, a scale to measure learning attitudes, and a scale to measure academic achievements. Based on the analysis of a Mann-Whitney U test, it was concluded that the Superstar Learning System could: (1) enhance significantly more learning interest than the multimedia projecting system, (2) cultivate significantly more positive attitudes of students than the multimedia projecting system, and (3) lead to significantly better academic achievements than the multimedia projecting system. In the future, interdisciplinary cooperation, involving statistics, computer sciences, education, linguistics, and related disciplines, is necessary to arrive at solid conclusions.

Keywords The superstar learning system · The multimedia projecting system · Learning interest · Attitudes · Academic achievements

1 Introduction

The Superstar Learning System, designed and manufactured by Superstar Company, is a mobile learning platform powered by many learning functions such as knowledge dissemination and management sharing. With the gradual popularization of smartphones and the maturity of 4G technologies, the 5G era is coming. Mobile intelligence, interconnection, and

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convenient payment have become the characteristics of the new era. The influence of mobile Internet on readers' reading behavior, usage patterns, and interaction rules became increasingly profound, which contributed to the production of the Superstar Learning System [48]. As an effective mobile learning application, the Superstar Learning System improved learning outcomes.

Numerous studies were committed to mobile device-assisted learning effects in numerous fields (e.g. [25, 34, 35, 38, 42–44, 46]). Mobile device-assisted learning improved learning effects, encouraged both independent and collaborative learning experiences, provided valuable interactions, enhanced opportunities for language practice, and promoted lifelong learning [13]. A mobile device, Physics Mobile Learning, was used by students or teachers to learn Indonesian culture and to train the ability of diagram representation and critical thinking [24]. Mobile learning was considered an important supplement for either formal or informal learning approaches [12].

Various kinds of mobile devices were designed and developed to assist learning in many fields (e.g. [22, 33]). The use of mobile devices, e.g. Infographics in education, improved academic achievements in four courses and enhanced the retention of acquired knowledge in four courses: Turkish, Social Sciences, and Science and Technology [22]. Participants in a mixed-mode mobile learning environment with real plants and spoken texts paid more attention to the plants and achieved a higher score on the transfer test than those in the single-mode condition with real plants and written texts [17].

Mobile systems were also developed to aid learning and driving [36, 37]. Mobile learning games exerted a positive influence on learning, which was effective in transferring factual knowledge as textbook learning [33]. Interactive Mobile Learning System effectively increased the frequency and intensity of drivers' performance [25]. As a popular mobile app, the Superstar Learning System was studied in terms of its learning and teaching effects in many disciplines (e.g. [2, 50]).

Smartphones were also reported effective in learning in various disciplines. The smartphone app acted as an effective educational tool to improve MR radiographers' knowledge in recognizing and characterizing MR image quality errors [1]. Smartphone-based mobile learning also positively improved nursing students' knowledge, skills, confidence in performance, and learning attitudes [11]. Besides, the use of smartphones in the classroom significantly improved the learning style, concentration, and achievement of students in terms of visual/verbal conceptual knowledge learning [20].

Although there have been numerous studies (e.g. [2, 6, 8, 15, 19, 21]) committed to effectiveness and efficiency of mobile devices applied to education, there is an existing problem that scanty of them have paid systematic attention to the effects on learning interest, attitudes, and academic achievements. This study, aiming to determine their effects on learning interest, attitudes, and academic achievements through comparative analyses between pre-and post-tests, is meaningful and necessary for their future development.

2 Literature review

2.1 Comparisons of major online learning platforms in China

There are three major online learning platforms in China: Superstar Learning System, Blue Ink Platform, and Tower Platform. Superstar Learning System surpassed the other two platforms.

Superstar Learning System consisted of complete functions and was available to any user. While Blue Ink Platform required users to be vocational or undergraduate students. Tower Platform needed more strict control over classroom-based learning and teaching. The interface of the Superstar Learning System was significantly more concise and friendly than the other two platforms. The Superstar Learning System formed collaborative learning more efficiently than the other two platforms. It has thus received more popularity than Blue Ink Platform and Tower Platform [16].

2.2 Attributes of the superstar learning system

The Superstar Learning System was designed to facilitate teaching and learning. It made use of the vast number of books, periodicals, newspapers, videos, and original resources accumulated by Superstar Company in the past 20 years. It integrated knowledge management, course learning, special creation, and office application to provide readers with a full-range learning and working environment. Teachers projected the lecture notes to a large screen connected through a multimedia projector, and students took notes on the Superstar Learning System platform [15]. Students also brought the Superstar Learning System everywhere by installing it on their mobile devices.

2.3 Multiple functions of the superstar learning system

The Superstar Learning System is endowed with multiple functions to improve learning and teaching effects. It provides a platform for roll calls, competitive answers, peer interactions, resource searching, video play, and learning activity arrangement. It enhances students' interest in learning, solves teaching problems, activates the classroom atmosphere, and improves students' logical thinking ability. Many teachers believed that the Superstar Learning System was one of the most useful, practical, comprehensive, and easy-to-operate learning tools [32]. It was similar to other learning technologies, which not only had social functions such as rewarding, chatting, and group building but also provided powerful learning functions and favorable user experiences [50].

The Superstar Learning System is conducive to both teachers and students. Students used it to acquire knowledge, access information, and share a large number of resources. Teachers used it to assist teaching in class. In view of the issue of pre-class design, students were encouraged to enthusiastically practice before class. The delivery contents were supposed to be perused before class by students. The teacher's role was "needle-threading", "leak-checking, defect-filling", and "timely comment". Teachers should encourage and praise students' speeches and viewpoints. Of course, if individual students misunderstood some contents, teachers would correct them in a due course [32].

The Superstar Learning System-aided pedagogy might improve learning effectiveness by enhancing interactions. The traditional approach, in this study, was defined as the pedagogy where the teacher gave a lecture assisted with the multimedia projecting system. The PowerPoint lecture slides were presented through the projector on a large screen, by which students kept pace with the teacher. They responded to the teacher's questions by raising their hands. Peer interactions in class were limited. The traditional teaching method can no longer meet the needs of students. Through the pedagogical approach assisted with the Superstar Learning System, teachers, combining relevant knowledge foundation with a mobile app,

enhanced the learning interest, and improved the learning enthusiasm. In the classroom, teachers designed activities such as answering questions, voting for questions, and brainstorming based on teaching requirements and gave evaluation and corresponding scores according to the accuracy of students' answers [3].

Teachers designed learning activities via the Superstar Learning System to encourage students to actively participate. The Superstar Learning System enhanced learners' interest and enabled them to answer questions. In their spare time, teachers set up group discussion links, put forward expansive questions according to the knowledge they learned, and team members coordinated and cooperated to complete tasks, which not only exercised students' team cooperation ability but also consolidated discipline knowledge in time. Under the mobile information teaching mode, teachers used learning software to play related videos in class and simulate the learning environment. Students learned the specific operation process more intuitively and uploaded extracurricular resources such as PPTs. At the same time, they provided live video recordings. All data were used repeatedly by students to learn the corresponding knowledge points [45].

2.4 Effects of the superstar learning system in education

Mobile applications might lead to positive learning outcomes. Mobile application-assisted learning facilitated knowledge retention rate [23], enhanced student learning interest, cultivated student positive attitudes toward the mobile app-assisted instruction [26, 36, 37], and improved student academic achievements [14]. The Superstar Learning System, as a mobile learning application, might play a positive role in improving mobile learning outcomes.

The Superstar Learning System was demonstrated effective to improve academic achievements in various subjects. They included "Integrated English" [30], "Surveying and Mapping of Machine Parts" [2], "Botanical Experiments" [50], "Fault Diagnosis and Maintenance of Automotive Chassis Electronic Control System" [21], "Computer Assembly and Maintenance" [27], "English Reading" [48], "Business English Intensive Reading" [6], "Dyeing and Finishing Technology Experiments" [8], and "C Programming Course" [19]. The mobility and convenience of learning assisted with Superstar Learning System promoted learning outcomes.

2.5 The use of the superstar learning system in "Integrated English"

An appropriate design based on the Superstar Learning System improved the learning effectiveness of the course "Integrated English". A mixed teaching mode of Integrated English was constructed based on the Superstar Learning System from four aspects: online self-learning, classroom teaching, network interaction, and teaching evaluation, and a complete teaching mode based on the Superstar Learning System based on the mixed teaching concept. The teacher integrated the interactive function of the Superstar Learning System into the course delivery. The teaching practice showed that this model combined the advantages of mobile teaching with traditional classroom teaching, which may not only improve the teaching quality of the Integrated English course and promote students' learning autonomy but also meet the educational objectives in the information age [30].

2.6 The use of the superstar learning system in "Surveying and Mapping of Machine Parts"

The use of the Superstar Learning System improved learning and teaching of the course "Surveying and Mapping of Machine Parts". Taking information mobile cloud teaching as the carrier, students as the main body, and the Superstar Learning System as the platform, teaching practice of "Surveying and Mapping of Machine Parts" increased students' interest in learning and enhanced their enthusiasm and initiative in learning. This teaching practice also made the classroom dynamic and vivid, effectively promoted the reform of vocational teaching, and highlighted the advanced and creative network-based information-based teaching [2].

2.7 The use of the superstar learning system in "botanical experiments"

The use of the Superstar Learning System improved learning and teaching effectiveness of the course "Botanical Experiments". The application of the Superstar Learning System through the Mobile Learning Platform brought great convenience to botanical experimental teaching and learning. By adopting this new teaching mode based on the Superstar Learning System, classroom teaching got rid of the limitation of time and space to a certain extent. This mobile platform encouraged students to learn and communicate whenever and wherever they felt comfortable. As a result, the mobile platform effectively improved the quality of botanical experimental teaching and learning effects [50].

2.8 The use of the superstar learning system in "Computer Assembly and Maintenance"

The use of the Superstar Learning System improved the educational outcomes of the course "Computer Assembly and Maintenance". The Superstar Learning System satisfied the needs of information-based teaching of "Computer Assembly and Maintenance", which was conducive to improving students' learning effects. This Superstar Learning System-based platform promoted the development of information-based teaching [21]. Additionally, compared with the traditional teaching model, the mobile teaching model based on the Superstar Learning System greatly improved the students' learning enthusiasm and learning effects [27] due to its multiple functions and great convenience.

2.9 The use of the superstar learning system in "English Reading" and "C Programming"

The use of the Superstar Learning System improved learning outcomes of the course "English Reading" and "C Programming". Compared with the traditional teaching model, Mobile English Reading Teaching Model Based on the Superstar Learning System not only effectively promoted the interaction of English reading teaching and improved students' reading comprehension ability but also promoted students' active learning and cultivated students' self-learning and cooperative consciousness [48]. Furthermore, the Superstar Learning System-assisted multivariate and mixed teaching model provided an operable case for the reform of classroom teaching of the C Programming course in colleges and universities [19].

2.10 The use of the superstar learning system in "Business English Intensive Reading"

The use of the Superstar Learning System improved the educational outcomes of the course "Business English Intensive Reading". Superstar Company launched a platform combining the Superstar Learning System Universal with The Elegant Network Teaching Platform. It was proven a more specialized mobile online teaching platform for mobile terminals. It can be compatible with other related teaching application software developed by Superstar Company. The mixed teaching model based on the Superstar Learning System was conducive to improvements in teaching and learning efficiency [6]. Assisted by teachers and engineers, manufacturers might develop increasingly advanced platforms to facilitate learning and teaching.

2.11 The use of the superstar learning system in "Dyeing and Finishing Technology Experiments"

The use of the Superstar Learning System facilitated teaching and learning of the course "Dyeing and Finishing Technology Experiments". The functions of "The Superstar Learning System" such as "task", "homework", "statistics" and "discussion" provided great convenience for the course teaching of "Dyeing and Finishing Technology Experiments". It not only strengthened the mechanism of pre-class preview and after-class review but also fortified the interaction and discussion between teachers and students. At the same time, it also provided convenience for the implementation of designing and comprehensive experiments, which was worthy of application and promotion [8].

2.12 Negative findings of the superstar learning system

However, negative findings have also emerged. The Superstar Learning System platform-based teaching method required teachers and students to invest much time, and might not be applicable to every student. In the future, universities and teachers still needed to constantly explore and optimize this platform [15]. Gender differences in mobile learning outcomes caught the attention of researchers and practitioners [39]. Technology developers and course designers catered the use of Superstar Learning System to different needs of genders and maximized the mobile learning and teaching effectiveness and efficiency. They also considered mobile learners' self-efficacy, satisfaction, motivation, attitude, and performance when designing the mobile platform-based courses [40].

3 Research questions and hypotheses

Through the analyses of previous studies, we found that very few studies have been committed to the effects of the Superstar Learning System on learning interest, attitudes, and academic achievements. We, therefore, raised the research questions: (1) can the Superstar Learning System enhance more learning interest and cultivate more positive attitudes of students compared with the traditional educational technology – the multimedia projecting system? (2) can the Superstar Learning System lead to better academic achievements than the multimedia projecting system?

We proposed three null hypotheses: (1) the Superstar Learning System cannot enhance significantly more learning interest than the multimedia projecting system; (2) the Superstar Learning System cannot cultivate significantly more positive attitudes of students than the multimedia projecting system; (3) the Superstar Learning System cannot lead to significantly better academic achievements than the multimedia projecting system.

4 Research methods

This method section includes different subsections such as participants, research instruments, design, and procedure.

4.1 Participants

The Superstar Learning System has been developing fast and is widely used in China. We, therefore, recruited participants from China. We randomly selected 71 tertiary from a public university in Beijing, China. They were randomly assigned to two groups: Groups A and B. Group A (N = 36) received English language education via the Superstar Learning System, while Group B (N = 35) learned English via the multimedia projecting system. The significant difference in both learning assistance was that the former was installed on students' smartphones which were carried wherever they desired, while the latter was merely used in the classroom, which was not portable. The differences in College Entrance English Test Scores between groups A and B were not statistically significant because they were admitted based on the same criteria for English proficiency test scores. This was also evidenced by the pre-tests. The gender distribution in both groups was unbalanced, where females significantly outnumbered males in both Group A (F = 31, M = 5) and Group B (F = 29, M = 6) since it was normal that more females chose the English language as their major than males did. Participants in both groups had received formal English education for more than 10 years, and reported that they all had normal literacy and were at a normal psychological state.

4.2 Research instruments

Since this study aimed to address the effects of the Superstar Learning System on learning interest, learning attitudes, and academic achievements, we conducted a comparative study between the Superstar Learning System and the multimedia projecting system-assisted groups. Therefore, the research instruments used in this study included a scale to measure learning interest, a scale to measure learning attitudes, and a scale to measure academic achievements.

The scale to measure learning interest A questionnaire [9] was adapted to measure learning interest in both the Superstar Learning System and the multimedia projecting system. There were in total 5 items designed to obtain reliable data (Table 1) regarding learning interest, each of which was followed by a five-point Likert Scale, ranging from *strongly agree, agree, neutral, disagree,* to *strongly disagree.*

As shown in Table 1, the questionnaire was demonstrated internally reliable. Cronbach's Alpha coefficients normally range from 0 to 1. The farther the coefficient is from 1, the less reliable the data will be, and vice versa. It is suggested that the reliability is excellent if $\alpha \geq .90$, good if $\alpha \geq 0.8$, acceptable if $\alpha \geq 0.7$, questionable if $\alpha \leq 0.6$, and

Table 1 A scale to measure learning interest

N	Items	Answer	α
1	The Superstar Learning System/the multimedia projecting system-assisted learning is interesting.	A = strongly agree; B = agree; C = neutral; D = disagree; E = strongly disagree.	.78
2	Learning more about the Superstar Learning System/the multimedia projecting system is interesting.		
3	Viewing lecture notes through the Superstar Learning System/the multimedia projecting system is interesting.		
4	Viewing learning resources through the Superstar Learning System/the multimedia projecting system is interesting.		
5	Answering questions through the Superstar Learning System/the multimedia projecting system is interesting.		

unacceptable if $\alpha \leqq 0.5$ ([7]: 231). Since the coefficient of the five items is .78, the internal reliability for the scale is considered acceptable. The questionnaire is also considered externally valid ($KMO = 0.5, p < .01$).

The scale to measure learning attitudes According to previous studies (e.g. [9]), the measurement to identify learning attitudes needed a design containing multiple questions. Therefore, a questionnaire [9], containing five items, was adapted to measure learning attitudes toward both the Superstar Learning System and the multimedia projecting system (Table 2). Each item was followed by a five-point Likert Scale, ranging from *strongly agree, agree, neutral, disagree,* to *strongly disagree.* The reliability was considered *good* since the coefficient of the five items was *.83.* The questionnaire was also externally valid ($KMO = 0.5, p < .01$).

The scale to measure academic achievements College English Test Band Four (CET 4) has been proven internally reliable and externally valid to test the English language proficiency of learners since its birth in the 1980s [10]. CET 4 (December 2018) was thus adopted as a scale to measure both pre- and post-academic achievements of the English language. The reliability of the scale was considered *excellent* ($\alpha = .993$).

The CET 4 examination was composed of four types of questions: writing (15%), listening comprehension (35%), reading comprehension (35%), and translation (15%). Writing tests used subjects familiar to candidates, requiring candidates to write a short essay based on the information and tips provided (e.g. outlines, scenes, pictures, or charts). The listening

Table 2 A scale to measure learning attitudes

N	Items	Answer	α
1	The Superstar Learning System/the multimedia projecting system is valuable and worth using.	A = strongly agree; B = agree; C = neutral; D = disagree; E = strongly disagree.	.83
2	It is worth learning via the Superstar Learning System/the multimedia projecting system.		
3	It is important to learn more about the Superstar Learning System/the multimedia projecting system.		
4	I will actively engage in the Superstar Learning System/the multimedia projecting system-assisted learning.		
5	Everyone needs to use the Superstar Learning System/the multimedia projecting system.		

comprehension section consisted of 25 topics, including short news, long dialogue, and listening chapters. Reading comprehension included filling in blanks, long reading, and careful reading. The Chinese-English translation section aimed to test the ability to translate the information, covering the history, culture, economy, and social development.

5 Research procedure

Both groups received English education for one semester (16 credit hours) and CET 4 was administered to both groups before and after the semester. Learning interest and attitude scales were administered to both groups at the end of the semester. The only difference in the teaching process existed in the research instruments between both groups. Group A learned English aided with the Superstar Learning System, while Group B received a traditional teaching approach assisted with the multimedia projecting system. Both groups were taught by the same teacher who was familiar with both educational technologies. Other elements in teaching and learning were equivalent for both groups. The specific learning and the teaching process was presented in detail below.

5.1 Preview before class

As for Group A, before class, teachers and students needed to download the Superstar Learning System software. Teachers created a specific class and sent invitation codes to students. Students joined the class. Teachers would send related information, videos, and teaching PPTs to the class. Pre-class tasks were issued in advance, and students were reminded to preview the contents to be delivered in time by learning the function of "Notification". A pre-class quiz would be set up in class, on the one hand, to supervise students to complete the preview task. On the other hand, with the help of the Superstar Learning System, teachers grasped the situation of students' preview. According to the test results, teachers gave appropriate experience incentives to motivate students.

As for Group B, both teachers and students did not need to download any software before class. Rather, the teacher directly informed students of the contents that would be delivered in class and asked them to preview. No quiz would be designed, and teachers did not know the preview situation.

5.2 Teaching in class

As for Group A, teachers used the check-in function of the Superstar Learning System instead of the traditional time-consuming and inefficient roster check-in method. All students completed the check-in procedure in 1 min, made effective use of classroom time, and improved learning efficiency. In the learning process, teachers released rush answers to fully mobilize the enthusiasm of students. The random roll call was full of stimulation. Students correctly thought and talked only if they listened carefully in class. Through group speeches and group discussions, students spoke freely, which was conducive to the expansion of students' thinking and unlimited imagination. Teachers and students saw students' opinions via the Superstar Learning System. In the process of teaching, if teachers wanted every student to participate actively in teaching activities, they had to pay attention to the differences in individual students

[28]. Therefore, hierarchical teaching was very important. Teachers uploaded easy, moderate, and difficult teaching videos to the Superstar Learning System and students learned selectively according to their actual situation.

As for Group B, teachers had to conduct a roaster check-in if they would like to check students' attendance. Teachers delivered lectures by projecting the contents to a large screen in the form of a PPT. To know students' understandings, teachers had to judge based on students' answers or responses. Students had to follow the teacher rather than select the contents that they would like to learn. They also had to raise their hands before they spoke and interacted with peers in class. Teachers roughly knew the differences between individual students according to their own experiences and students' performance.

5.3 Evaluation of teaching after class

As for Group A, after class, teachers issued specific after-class exercises or online exams to help students review and consolidate their knowledge in time. The emergence of the Superstar Learning System built a bridge between teachers and students, which not only helped to improve the enthusiasm of students but also increased the emotional exchanges between teachers and students. After class, teachers solved the problems in teaching and mastered the students' learning situation through a questionnaire survey.

Besides, according to the number of times students answered questions, participated in discussions, and actively interacted in class, they were given corresponding experience values and objectively evaluated to record students' classroom performance and learning trajectory. Through data analysis, students understood their learning situation of related knowledge and studied the key and difficult points pertinently. Teachers used this as a basis to give more accurate results at the end of the term so that students' total scores were more objective and effective [47].

As for Group B, there was only single-line communication between teachers and students except for 45 minutes' interaction in class. Teachers projected the after-class assignment to the large screen for students to note down. In case students met up with problems, they can merely consult the teacher in the next class rather than consult the teacher instantly. Teachers might feel troublesome to jot down each student's performance and learning progress. Teachers, therefore, only provided rough results for each student when the term ended.

6 Results

The results were obtained from the pre-and post-tests to identify academic achievements, coupled with questionnaires to determine the learning interest and attitudes based on the proposed research hypotheses. To determine the method to analyze the data, it was necessary to test whether the data is normally distributed or not (Table 3).

As shown in Table 3, the data obtained regarding learning interest ($p < .01$), attitudes ($p < .01$), pre-academic achievements ($p = .01$), and post-academic achievements ($p < .01$) are not normally distributed at the significance level .05. Therefore, a Mann-Whitney U test, which does not require normal distribution of data, was conducted to determine whether there was a difference in learning interest, attitudes, pre-academic achievements, and post-academic achievements between Groups A and B (Table 4).

Table 3 Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Interest	.226	71	.000	.932	71	.001
Attitudes	.205	71	.000	.942	71	.003
Pre-achievements	.122	71	.010	.970	71	.082
Post-achievements	.157	71	.000	.929	71	.001

a. Lilliefors Significance Correction

Results of the analysis indicated that there were significant differences in learning interest ($z = -2.1934$, $p = .019$) and attitudes ($z = -2.614$, $p = .009$) between Group A (treatment group) and Group B (control group). No significant differences were revealed in pre-achievements between both groups ($z = -.127$, $p = .899$), while significant differences were found in post-achievements between both groups ($z = -5.194$, $p < .01$). This indicated that after treatment, Group A showed significantly more learning interest, more positive attitudes, and significantly better academic achievements than Group B. It shows that Group A assisted with the Superstar Learning System can lead to significantly higher learning interest, attitudes, and academic achievements than Group B assisted with the multimedia projecting system, the traditional educational technology.

Therefore, we rejected three null hypotheses and concluded that the Superstar Learning System can: (1) enhance significantly more learning interest than the multimedia projecting system, (2) cultivate significantly more positive attitudes of students than the multimedia projecting system, and (3) lead to significantly better academic achievements than the multimedia projecting system. We were not sure that the statistical result rejected the null research hypotheses due to the Superstar Learning System. There might be other possible influencing factors like the teacher, participants, and environment.

7 Discussion

The findings in this study are generally consistent with previous works. After approximately 2 years' education, students showed positive attitudes toward, and more intense interest in Mobile Application Development and 3-D Modeling-assisted learning [14]. It was also reported that the mobile app-assisted pedagogical approach increased student retention rates

Table 4 Differences in variables between Groups A and B

	Group	N	Mean Rank	Sum of Ranks	Z	Asymp. Sig. (2-tailed)
interest	Group A	36	41.51	1494.50	−2.351	.019
	Group B	35	30.33	1061.50		
attitudes	Group A	36	42.12	1516.50	−2.614	.009
	Group B	35	29.70	1039.50		
Pre-achievements	Group A	36	35.69	1285.00	−.127	.899
	Group B	35	36.31	1271.00		
Post-achievements	Group A	36	48.54	1747.50	−5.194	.00
	Group B	35	23.10	808.50		

and improved student academic achievements, and the use of the mobile app was positively correlated with their academic achievements [23].

Assisted with the Superstar Learning System, students tended to obtain better academic achievements, and cultivate an intense interest in, and positive attitudes toward learning. With mobile apps such as the Superstar Learning System installed either on their smartphones or computers, students had easy access to a sea of learning resources wherever and whenever they felt comfortable and convenient, which undoubtedly improved their positive attitude toward learning, enhanced their learning interest, and improved their academic achievements through engaging them in learning for longer periods. The colorful interfaces also attracted their attention to an abundant amount of knowledge and encouraged them to learn. It is, therefore, reasonable to find that students, assisted with the Superstar Learning System, can achieve significantly better learning outcomes than those without it.

Due to the attribute of multiple functions of the Superstar Learning System, teachers might have possibly improved the instruction effectiveness and efficiency with the Superstar Learning System. Teachers delivered the lecture notes to the Superstar Learning System for students to preview before class. In class, teachers also checked student attendance easily and swiftly through the Superstar Learning System compared with the multimedia projecting system. Through the Superstar Learning System, teachers presented the lecture contents in the form of PPTs, PDFs, WORDs, or other file types. They accessed a large number of educational resources in class instantly and share them with students on the mobile platform, creating a dynamic learning atmosphere. This cannot be realized through the multimedia projecting system. After class, teachers allotted assignments to students and evaluate their performance conveniently through the mobile platform. Beyond class, students' learning activities were available to a teacher, which helped teachers determine their teaching progress. These positive interactions between teachers and students certainly improved learning interest, formed positive learning attitudes, and led to better academic achievements.

Furthermore, the findings might be caused by the attribute that the Superstar Learning System was able to construct a virtual interactive space, or a virtual online school, for all learners. In this virtual school, many online multimedia classrooms were available for students to use. According to different needs, different courses were offered in these classrooms round the clock every day. All students and teachers who took this course entered the classroom at a specified time to access academic activities. In this virtual classroom, students not only received the contents of the teacher's lectures but also interacted with teachers. Questions, answers, and discussions were shared through communication. Meanwhile, students and teachers witnessed each other, as real as face-to-face in physical classrooms. In this classroom, there were many tools such as whiteboards and brushes which were used in academic activities. Document sharing enabled teachers to distribute prepared courseware contents to all students. The function of data sharing made online teaching more convenient and powerful than physical classroom teaching and learning.

The attribute of the Superstar Learning System might create a virtual learning environment which might have dramatically made learning convenient and efficient, leading to intense learning interest, positive attitude, and favorable academic achievements. Students did not have to carry heavy printed books and dictionaries to attend physical classes after a long and arduous journey. They chose a specific schedule and venue to learn at their own convenience. This had most likely enhanced their learning interest in and fostered their attitudes toward learning, followed by improved academic achievements.

The Superstar Learning System also improved learning interest, attitude, and academic achievement by providing a platform for convenient assignment completion and evaluation. Assisted with the Superstar Learning System, students completed the assignment by recording videos, typing words, and making choices. The platform automatically evaluated their assignment by preset correct answers, and related evaluation systems, which facilitated teachers' assessment of students' assignments.

8 Conclusion

This concluding part will summarize major findings, limitations of this study, and put forward suggestions for future research directions.

8.1 Major findings

The major findings are that the Superstar Learning System significantly surpasses the traditional multimedia projecting system in terms of the effects on learning interest, attitudes, and academic achievements. The study also discussed the rationales for the determining variables in both the Superstar Learning System and the multimedia projecting system-aided learning contexts.

8.2 Limitations

There are several limitations to this study. Although the research design is generally rigid, the sample is merely limited to Chinese English learners. This may have led to bias against the findings. Different teaching activities, various states of participants, and unstable environments may have also limited the reliability of the findings. Concepts of mobile learning have also been confusing due to the integration and adoption of mobile educational technologies. This may have caused conceptual conflicts in designing methods in both formal and informal learning contexts [29].

This study is also limited to the research design. There are other ways, excluded from this study, to judge the degree of students' interest in learning and the quality of their attitude in using the Superstar Learning System. Examples were semi-structured interviews to identify students' attitudes and interest [18], observation to detect students' attitudes and interest, [5], and machine learning models to measure students' attitudes [31]. We did not analyze the learning interest and attitudes of groups A and B from the pre-tests. Instead, we compared learning interest and attitudes between the control and experimental groups to identify whether there were any significant differences. The results might be weakened if the significant differences in post-achievements were caused by learning interest and attitudes at the initial stage of the experiments.

8.3 Future research directions

Future research can expand the sampling to various countries in the world and include multiple disciplines other than merely the English language. Interdisciplinary cooperation, involving statistics, computer sciences, education, linguistics, and related disciplines are also necessary to arrive at solid conclusions. In the future, researchers can also combine semi-structured

interviews, observation, and machine learning to measure attitudes, interest, motivation, and academic achievements to obtain precise results. Other factors such as self-efficacy, satisfaction, technology acceptance model, teaching presence, social presence, and cognitive presence [41] can also be incorporated into the mobile learning platform-based learning and teaching.

Future research can focus on how to enhance mobile teaching and learning plans, increase friendly interactions through mobile learning platforms, and make the interface of mobile learning platforms more friendly and concise. When designing innovative mobile learning platforms, teachers and designers can highlight ubiquitous mobile learning and the acceptance of mobile learning platforms [4]. In the future, designers can make vertical layout panels for the mobile learning platform since a vertical layout was more efficient than a horizontal one. Future design can be maximized through eye-tracking testing [49].

Funding Partial financial support was received from 2019 MOOC of Beijing Language and Culture University (MOOC201902) (Important) "Introduction to Linguistics"; "Introduction to Linguistics" of online and offline mixed courses in Beijing Language and Culture University in 2020; Special fund of Beijing Co-construction Project-Research and reform of the "Undergraduate Teaching Reform and Innovation Project" of Beijing higher education in 2020-innovative "multilingual +" excellent talent training system (202010032003); The research project of Graduate Students of Beijing Language and Culture University "Xi Jinping: The Governance of China" (SJTS202108).

Data availability The data and material are available and we submitted them to the submission system.

Declarations

Conflicts of interests/competing interests The author has no relevant financial or non-financial interests to disclose.
The author has no competing interests to declare that are relevant to the content of this article.
The author certifies that he has no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.
The author has no financial or proprietary interests in any material discussed in this article.

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