

Research On English Learning Strategies Based On Task-Based Language Teaching Method– A Case Study Of Chinese And Kyrgyzstan Students Using Mobile Games To Promote Language Learning

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Abstract

Based on the pedagogical concept of task-based language learning, this study uses the technological products that students commonly use as auxiliary tools for task-based teaching, in order to study their enhancement effects on second language learning (using English learning as an example). This study implemented a quasi-experimental pretest and posttest design to investigate whether a mobile game-based second language learning strategy can improve high school students' learning motivation and achievement. Selecting a suitable game and adding appropriate content for game-based English learning were the 2 key considerations for achieving the teaching goal. The experimental group comprised 38 students, whereas the control group comprised 40 students. The experimental period was 8 weeks. Through statistical methods, the results verified the positive effectiveness of a mobile game-based learning strategy for promoting high school students' second language learning, consisting of motivation and achievement improvement. Conversely, this study found that the effectiveness of the mobile game-based learning strategy was not significant for students who did not like to play games. Finally, several findings and suggestions were proposed for future applications.

Keywords: *language learning, mobile game-based learning, learning motivation.*

Introduction

With the collapse of the Soviet Union in 1991 and the independence of the five Central Asian countries, the awakening of Juche's national consciousness set off a de-Russification upsurge and the implementation of writing reforms. At the same time, driven by economic globalization, English as a strong foreign language has gradually become more and more important, and Russian is no longer dominant. In order to promote the comprehensive use of the national language and ensure that all ethnic groups receive education in their mother tongue while mastering the official language, Kyrgyzstan is currently implementing a multilingual education model.

Task-based teaching emphasizes authentic and real language, where students must use the target language to complete meaningful tasks, such as calling to order products, arranging schedules, creating flowcharts, and so on. This method trains foreign language teachers to assess students' performance not based on the accuracy of language, but rather on whether the task has been successfully completed, for example, whether a specific product has actually been ordered.

In 2011, Kyrgyzstan began a pilot project on a multilingual education model. Kyrgyzstan's International Chinese Education Policy Language policies can be both explicit and hidden. The so-called policy on implicit language education refers to the fact that there are no clear written regulations, but that the language attitude and linguistic ideology are reflected in the words of the document or expressed through certain behaviors. The trend in the development of this implicit language education policy is to achieve it through task-based language teaching.

Since the Belt and Road Initiative was launched in 2013, the development of Chinese education in Kyrgyzstan has accelerated in the past decade. In the initial stage, international Chinese education

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in Kyrgyzstan was mainly concentrated in universities. However, Chinese education has been established as a subject in Kyrgyzstan's higher education and is gradually improving and developing. With the rapid development of Kyrgyzstan's friendly relations with China, the demand for professionals with knowledge of Chinese in the labor market has increased. In 2004, the Department of Chinese at Bishkek University of Humanities developed into the Department of Kyrgyzstan and China, with majors in international relations, orientalism, Chinese studies, and translation. Since Chinese is not a compulsory course in every primary and secondary school/university, the Confucius Institute offers credit and non-credit courses in middle schools and universities. In 2014, Kyrgyz State Technical University opened the Confucius Classroom, which was favored by all teachers and students in the university. Since 2010, the Department of Chinese Language and Literature at the University of Manas, Kyrgyzstan-Turkey has been working closely with the Confucius Institute. In January 2015, the Department opened a multi-media Confucius Classroom equipped with the latest technology to deepen students' understanding of Chinese language and culture.

Lyceum "Akylman" is a Kyrgyz State Professional Education Organization, a Kyrgyz English-language secondary school inaugurated by Kyrgyz President Sader-Zhapparov. Enrollment is from students who have graduated from the sixth grade of middle school. The enrollment of students from all regions will be based on the results of the annual competitive selection, and the teachers will also be selected through competition. "By opening such secondary schools, the state takes care of gifted children and helps them discover their own intelligence, deepen their knowledge in areas of interest, and grow into multi-talented people. Implementing task-based teaching according to the interests of gifted students is the most effective teaching method, especially for improving learning outcomes in foreign languages (primarily English).

This is an immeasurable contribution to human development." "Our country. If we can identify gifted children from all over the country who go unnoticed for some reason, and help them further showcase their talents, then the bright future of our country will be guaranteed." Said Sadel Zhapparov. Lyceum "Akylman" will focus its courses on mathematics, physics, chemistry, and biology. Our goal is to teach in English. In this nest of knowledge, we will attach great importance to national values." The head of state noted. Based on this policy direction, training teachers to use technological tools to implement task-based teaching is very important for the neglected gifted children across the country.

Games are attractive to students and can increase students' attention and persistence in learning. Gamification is the application of game elements to convert useful learning activities into games and provide greater challenges and stimulation for students (Behl *et al.*, 2022). In addition, studies investigating games in education have revealed several potential advantages, such as immediate feedback, productive learning, self-regulated learning and collaboration (Dele-Ajayi *et al.*, 2019). Several researchers have further indicated that learning content in subjects such as math, physics, language, and art is well suited for gamification (Silva, Rodrigues & Leal 2020).

Using mobile devices provides numerous learning advantages: flexibility, portability, low cost, small size, and user-friendliness. Researchers have been exploring how to utilize mobile devices to support language learning (Gupta, Khan & Agarwal 2021). Despite several disadvantages, such as small screen size and network quality dependence, mobile devices have been identified as effective tools for delivering language learning materials to students (Thornton & Houser, 2005). In addition, with 3G-4G technological growth and Wi-Fi support, mobile devices can accelerate student language acquisition.

Literature review

Task-based teaching method

The task-based teaching method incorporates the characteristics of the communicative teaching method and also includes the following three specific roles: (1) the designer of the tasks. (2) those who help students complete the tasks. (3) those who raise students' awareness of grammatical forms. Foreign language teaching teachers must learn to design three roles for students: (1) task participants. (2) supervisors. (3) risk-takers and innovators. Many tasks require students to create or interpret messages in the absence of language resources and experience, thus promoting the effectiveness of language learning.

In teaching activities, teachers should design specific and practical tasks centered around particular communication and language projects. Students complete these tasks through various forms of language activities such as expression, communication, negotiation, explanation, and inquiry, in

order to achieve the goal of learning and mastering the language. Task-based teaching methodology is formed by absorbing the advantages of various previous teaching methods, and it does not exclude other teaching methods.

Mobile learning

The researchers have explored how to use mobile technology to support language learning. Alade *et al.* (2020) indicated that mobile devices can create more active learning experiences to improve student engagement and course retention. Mobile-assisted language learning (MALL) refers to using mobile technology for language learning. Criollo-C *et al.* (2021) stated that MALL has excellent potential to provide students with rich, convenient, collaborative, contextual, and continual learning experiences in real time, both inside and outside the classroom. Moreover, several studies have been conducted to investigate the effectiveness of M-learning for language courses; these studies have involved mobile phones used in English education in Japan.

Game-based learning

Game-based learning involves various elements that are intended to increase student learning motivation, such as representation, game, play, goals, outcomes and feedback, win states, competition, problem solving, and story lines (Dele-Ajayi *et al.* 2019). Moreover, researchers have also indicated that games support several components of flow, such as clear goals, direct and immediate feedback, balance between ability level and challenge, and sense of control. These components can increase student engagement, and student engagement is strongly associated with student achievement (Behl *et al.*, 2022).

A study has been conducted to investigate how ubiquitous games influence English learning achievement; the evaluation results indicated that incorporating ubiquitous games into English learning could result in higher learning achievement compared with non-gaming methods (Tsai *et al.* 2016).

Because this study attempted to be distinct from past analysis practices, the demographic variables in this study were selected according to three considerations: interest, enjoyment, and time spent.

Interest

Interest is defined as a type of psychological state characterized by a high level of attention, intensive effort, and long-term participation in activities associated with feelings of pleasure and a sense of achievement. In the literature, interest is categorized as individual interest and situational interest. Individual interest refers to a relatively stable trait developed with respect to a particular subject or topic. This type of interest leads to persistence over long periods, attention, focus, and increased learning and enjoyment, even among young children. By contrast, situational interest is more immediate, affective, and transitory, depending on the task environment (Hidi & Harackiewicz, 2000). Therefore, based on the above considerations, 'interest in learning English' and 'interest in playing games' were selected as demographic variables in this study.

Enjoyment

Enjoyment has generally been found to be positively associated with learning achievement (Pekrun *et al.*, 2011) and motivation to learn. Games engage players in enjoyable activities, employing a set of rules for accomplishing various challenging objectives. The results of the research by Liu and Chu (2010) illustrated that students enjoyed the ubiquitous game because its virtual tutor and reality-based context made learning more interesting. Researchers have further indicated that student learning performance could be improved while maintaining game enjoyment by integrating learning content and strategies into the game-based learning environment (Wang & Chen, 2010).

Time spent

A study by Sandberg *et al.* (2011) indicated that students spent more time learning at home than they did in his initial study and obtained superior learning results on the posttest than they did on the pretest. Although few studies have focused on this topic, the present study employed 'time spent playing games per week' as crucial demographic variables.

Method

Research design

This study implemented a quasi-experimental pretest and posttest design involving an experimental group and control group. A mobile game-based English learning system, devised by integrating game elements into English teaching materials, was installed in students' smartphones. The students could use this system anywhere and anytime (Tsai *et al.* 2016).

The experimental period of this research was 8 weeks. In this period, the two groups had the same curriculum schedule and classroom courses. In the final 4 weeks, after the class, the students in the control group were given English learning tasks, such as worksheet assignments. The students in each group were instructed by the same teacher, who had 4-years of English teaching experience. Before the learning phase began, pretests on students' prior English knowledge and an English learning motivation questionnaire were administered to the experimental group. At the end of the learning phase, all the students completed posttests on English learning achievement, and the learning motivation questionnaire was again administered. Finally, an interview was conducted to further investigate the student opinions on the experiment.

Participants

The participants were 78 10th graders from a higher vocational school in China and an English-language secondary school in Kyrgyzstan. Two classes were involved in the experiment. One class had 40 students as the control group, while the other class had 38 students as the experimental group.

Demographic variables

This study employed five demographic variables: 'interest in learning English,' 'interest in playing games, and 'time spent playing games per week.' The operational definitions of the demographic variables were provided in Table 1.

Table 1 Operational definition of demographic variables

Variable	Option and statement
Interest in learning English	IN ⁻ (student is not interested in learning English), IN (student does not have specific interest in learning English), and IN ⁺ (student is interested in learning English).
Interest in playing games	IN ⁻ (student is not interested in playing games), IN (student does not have specific interest in playing games), and IN ⁺ (student is interested in playing games).
Enjoyment when playing the HELS	EN ⁻ (student does not enjoy when playing the HELS), EN (student does not have specific enjoyment when playing the HELS), and EN ⁺ (student enjoys when playing the HELS).
Time spent playing the HELS per week	3 or fewer hours, 3 to 7 hours, and 7 or more hours.
Time spent playing games per week	7 or fewer hours, 7 to 14 hours, and 14 or more hours.

Research question

The experiment aimed to investigate the following research questions on the impact of the mobile game-based English learning strategy on students' English learning:

RQ1: Does the mobile game-based English learning strategy influence learning motivation?

This first research question addressed the impact of the mobile game-based English learning strategy on student learning motivation.

RQ2: Does the mobile game-based English learning strategy affect learning achievement?

The second research question addressed the impact of the mobile game-based English learning strategy on students' learning achievement.

In order to understand the current state of experimental testing on students' learning of English and the use of technological products (mobile games), this is to serve as a basis for subsequent comparisons of the effectiveness of English learning and to propose measures for improvement.

The purpose of the third and fourth research questions were listed as the following:

RQ3: Do demographic variables affect students' English learning motivation?

RQ4: Do demographic variables influence students' English learning achievement?

Materials

Curriculum design

The course was an 8-week high school English course covering the alphabet, phonetic symbols, vocabulary, grammar, phrases, and sentence patterns. There were four 50-min courses, and the teacher taught one course unit per week. The experimental and control groups had the same learning material and curriculum schedule in the classroom. In the final 4 weeks, the teacher assigned the students in the control group worksheets and other work to finish after class.

System design and implementation

In the teacher module, teachers could use computers to access the server through the Internet to design, integrate, and manage teaching materials and games as learning activities through the learning administrator. Additionally, the mechanisms of competition and interaction among students were established in the learning activities. Moreover, the teacher could also view the content of student discussions on Facebook and provide appropriate feedback. The operation mode of games was based on *Monopoly and Chance*; which the students were asked a variety of questions that were based on the learning content to complete specific learning objectives (Tsai *et al.* 2016).

Pretest and posttest

The pretest evaluated students' English knowledge before the experimental period, whereas the posttest evaluated students' English learning achievements after the experimental period. The two tests were designed by two senior high school English teachers. The maximum possible score on each test was 100.

English learning motivation questionnaire

The learning motivation questionnaire was adapted from the MSLQ of Pintrich *et al.* (1991) to determine English learning motivational factors. This questionnaire was administered before and after the experimental period. As shown in Tsai *et al.* (2016), the learning motivation questionnaire consisted of five dimensions and their 25 items, displayed in Table 2. A 7-point Likert-scale, ranging from 7 for "strongly agree" to 1 for "strongly disagree," was employed to express respondent cognition.

Table 2 Items for English learning motivation questionnaire

Dimension	Item	Statement
Intrinsic orientation goal	I1	In the class, I like challengeable course material so that I am able to learn new things.
	I2	In the class, I like course material that can raise my curiosity, even though it is difficult to learn.
	I3	Trying to understand the content is satisfied for me in the class.
	I4	In the class, if I have the chance, I would choose this kind of learning, even though I can't get a good grade.
Extrinsic orientation goal	E1	The most satisfying thing for me right now is getting good grade in this class.
	E2	The most important thing for me right now is improving my grade.
	E3	I want to get better grade in this class than other students if possible.
	E4	I want to do well in the class because it is important to show my ability to my family, friends and others.
Task value	T1	I think I can use what I've learned in this class in other classes.

Dimension	Item	Statement
	T2	To learn the course material in this class is important for me.
	T3	I am interested in the course material.
	T4	I think the course material is useful for me to learn.
	T5	I like the main content of this course.
	T6	It is important to me to understand the main content of this course.
Control of learning beliefs	C1	If I learn in appropriate ways, I will be able to learn the course content in this class.
	C2	If I don't learn the course content, it is my fault.
	C3	If I learn hard enough, I will understand the content of the course.
	C4	If I don't understand the content of the course, it is because I didn't learn hard enough.
Self-efficacy of learning and performance	S1	In this class, I believe I can get good grade.
	S2	I believe I can understand the most difficult part in this class.
	S3	I believe I can understand the basic concepts taught in this class.
	S4	I believe I can understand the difficult content taught by teacher in this class.
	S5	I believe I can do well on assignment and test in this class.
	S6	I expect to do well in this class.
	S7	I believe I can master the skills taught in this class.

The result of reliability analysis on English learning motivation is presented in Table 3. The Cronbach's α values of the five dimensions were all greater than .700 (Nunnally, 1978), and the entire questionnaire's α value was .936.

Table 3 Cronbach's alpha of English learning motivation questionnaire

Dimension	Number of Items	Cronbach α
Intrinsic goal orientation	4	0.874
Extrinsic goal orientation	4	0.831
Task value	6	0.864
Control of learning beliefs	4	0.778
Self-efficacy for learning and performance	7	0.888

Interview

In the final phase of the experiment, an interview was conducted to explore student opinions, feelings, and perspectives on all the learning activities designed in this study.

Data analysis

The research questions proposed in this study were examined through statistical methods; the significance level was set at $p < .050$ for all test cases.

Results

The results were presented after completion of the sequence for answering the four aforementioned research questions.

Impact of learning strategies

English learning motivation

An independent samples t -test was conducted to examine the differences between the learning strategies in promoting student learning motivation. Table 4 presents the t -test data for learning motivation (posttest) under various learning strategies (groups). The results showed that the mean

values of the experimental group were higher than those of the control group and achieved the significance level ($p < .050$) in all dimensions.

Table 41 t-test data for the English learning motivation under various learning strategies

Dimension	Group	N	Mean	S.D.	t value	Sig.
Intrinsic goal orientation	Control	40	17.90	3.095	-5.654	.000
	Experimental	38	22.11	3.470		
Extrinsic goal orientation	Control	40	19.53	2.708	-3.815	.000
	Experimental	38	22.24	3.499		
Task value	Control	40	27.35	3.939	-3.038	.003
	Experimental	38	30.55	5.244		
Control of learning beliefs	Control	40	17.43	3.296	-4.389	.000
	Experimental	38	21.05	3.986		
Self-efficacy for learning and performance	Control	40	28.60	3.720	-5.149	.000
	Experimental	38	35.13	6.929		

Furthermore, a paired-sample *t*-test was used to investigate whether the learning motivation of the students in the experimental group improved before and after the experimental period. As shown in Tsai *et al.* (2016), the data illustrated that the mean values of the posttest were higher than those of the pretest and achieved the significance level ($p < .050$) in all dimensions.

English learning achievement

An independent samples *t*-test was conducted to examine the differences between the learning strategies (groups) in promoting students' English learning achievement. Table 5 presents the *t*-test data. The results showed that no significant difference was observed between the two groups regarding pretest scores ($t = 1.086$, $p > .050$). Consequently, it was speculated that the students in the two groups possessed equivalent knowledge of English before the experiment. However, the results in Table 5 indicate a significant difference in mean posttest scores between the two groups ($t = -5.149$, $p < .050$); the experimental group received significantly higher mean posttest scores than the control group did.

Table 5 t-test data for the English learning achievement under various learning strategies

	Group	N	Mean	S.D.	t value	Sig.
Pretest	Control	40	57.28	7.331	1.086	.389
	Experimental	38	56.47	5.520		
Posttest	Control	40	63.80	10.062	-5.149	.000
	Experimental	38	67.42	8.278		

Statistical analysis of the demographic variables

In order to understand the current state of experimental testing on students' learning of English and the use of technological products (mobile games), this is to serve as a basis for subsequent comparisons of the effectiveness of English learning and to propose measures for improvement.

The descriptive statistics of the demographic variable for the students in the experimental group are presented in Tables 6 and 7. As shown in Table 6, 92.1% of the students in the experimental group were interested in playing games and 89.5% enjoyed playing the HELS. Conversely, up to 34.2% of the students in the experimental group were uninterested in learning English. In Table 7, the data indicate that 60.5% and 81.6% of the students in the experimental group spent less than 14 hours/week playing games and 7 hours/week playing the HELS, respectively. For the degree of computer and game use (Cai, 2005), 'light use' was most commonly indicated (less than 115 min/day).

Table 6 Descriptive statistics about the experimental group students' interest and enjoyment

Statement	Interest in learning English		Interest in playing games		Enjoyment when playing the HELS	
	N	%	N	%	N	%
IN-/EN-	13	34.2	3	7.9	4	10.5
IN/EN	11	28.9	11	28.9	9	23.7
IN+/EN+	14	36.8	24	63.2	25	65.8

Note: IN- denotes that student is not interested in learning English/playing games; IN denotes that student does not have specific interest in learning English/playing games; IN+ denotes that student is interested in learning English/playing games. EN- denotes student does not enjoy when playing the HELS; EN denotes student does not have specific enjoyment when playing the HELS; EN+ denotes student enjoys when playing the HELS.

Table 7 Descriptive statistics about the experimental group students' time spent

Time spent playing the HELS per week	N	%	Time spent playing games per week	N	%
less 3 hours	12	31.6	less 7 hours	14	36.8
3-7 hours	19	50.0	7-14 hours	9	23.7
over 7 hours	7	18.4	over 14 hours	15	39.5

English learning motivation

Tsai *et al.* (2016) have proposed a quasi-experimental design in which a system called Happy English Learning System (HELs), which integrates English learning materials into a game-based context, was installed on students' smartphones with the goal of identifying the influence and predictive power of English learning motivation and achievement among Taiwanese vocational high school students. The results have evidenced the necessity of a long experimental period and sufficient external stimulation to enhance student learning effectiveness. For continuing this research topic, this study aimed at next investigating the effectiveness of a mobile game-based second language learning strategy in promoting the English learning motivation and achievement of high school students.

Table 8 displays the ANOVA data for English learning motivation under various demographic variables. The ANOVA results suggested a significant difference in English learning motivation under the demographic variables of 'interest in learning English', 'interest in playing games', 'enjoyment when playing the HELS', and 'time spent playing the HELS', respectively.

Furthermore, under 'interest in learning English', the students who were interested in learning English had a significantly higher mean value of English learning motivation than did the other students ($F = 5.540, p < .050$); For 'interest in playing games', the students who were interested in playing games had a significantly higher mean value of English learning motivation than did the other students ($F = 5.446, p < .050$); under 'enjoyment when playing the HELS', the students who enjoyed playing the HELS had a significantly higher mean value of English learning motivation than did the other students ($F = 6.463, p < .050$); and for 'time spent playing the HELS', the students who spent over 7 hours/week playing the HELS had a significantly higher mean value of English learning motivation than did the other students ($F = 6.102, p < .050$).

However, there was no significant difference in the mean value of English learning motivation among the students regardless of their time spent playing games ($F = .815, p > .050$).

Table 8 ANOVA data for the English learning motivation under various demographic variables

Demographic variable		Mean	S.D.	F	Scheffe's post hoc comparison
Interest in learning English	IN ⁻ (n=13)	124.01	3.567	5.540*	IN ⁺ >IN,IN ⁻
	IN (n=11)	125.55	3.641		
	IN ⁺ (n=14)	139.26	4.992		
Interest in playing games	IN ⁻ (n=3)	114.34	1.831	5.446*	IN ⁺ >IN,IN ⁻
	IN (n=11)	124.27	4.067		
	IN ⁺ (n=24)	136.31	4.615		
Enjoyment when playing the HELS	EN ⁻ (n=4)	123.53	3.349	6.463*	EN ⁺ >EN,EN ⁻
	EN (n=9)	120.55	3.262		
	EN ⁺ (n=25)	141.30	4.699		
Time spent playing the HELS	HS3 ⁻ (n=12)	124.33	3.990	6.102*	H7 ⁺ >H3 ⁺ ,H3 ⁻
	HS3 ⁺ (n=19)	128.69	4.233		
	HS7 ⁺ (n=7)	149.14	4.104		
Time spent playing games	HG7 ⁻ (n=14)	127.43	4.758	.815	-
	HG7 ⁺ (n=9)	130.00	3.895		
	HG14 ⁺ (n=15)	135.13	4.882		

* $p < .050$

Note: IN⁻ denotes that student is not interested in learning English/playing games; IN denotes that student does not have specific interest in learning English/playing games; IN⁺ denotes that student is interested in learning English/playing games. EN⁻ denotes student does not enjoy when playing the HELS; EN denotes student does not have specific enjoyment when playing the HELS; EN⁺ denotes student enjoys when playing the HELS. HS3⁻ denotes student spends less than 3 hours/week playing the HELS; HS3⁺ denotes student spends 3-7 hours/week playing the HELS; HS7⁺ denotes student spends over 7 hours/week playing the HELS. HG7⁻ denotes student spends less than 7 hours/week playing games; HG7⁺ denotes student spends 7-14 hours/week playing games; HG14⁺ denotes student spends over 14 hours/week playing games.

English learning achievement

Table 9 presents the ANOVA data for English learning achievement under various demographic variables. The ANOVA results suggested that a significant difference existed in the mean English posttest scores under the demographic variables of 'interest in learning English', 'interest in playing games', 'enjoyment when playing the HELS', and 'time spent playing the HELS'. The results revealed that higher interest in learning English correlated with higher English posttest scores for the students ($F = 43.387, p < .050$). The students who were interested in learning English had the highest mean English posttest score (mean = 74.64), whereas the students who were uninterested in learning English had the lowest mean English posttest score (mean = 58.46).

Table 9 ANOVA data for the English learning achievement under various demographic variables

Demographic variable		Mean	S.D.	F	Scheffe's post hoc comparison
Interest in learning English	IN ⁻ (n=13)	58.46	6.398	43.387*	IN ⁺ >IN>IN ⁻
	IN (n=11)	69.00	1.612		
	IN ⁺ (n=14)	74.64	4.012		
Interest in playing games	IN ⁻ (n=3)	63.00	6.557	10.064*	IN ⁺ >IN,IN ⁻
	IN (n=11)	60.55	7.815		

Enjoyment when playing the HELS	IN ⁺ (n=24)	71.21	6.283	55.667*	EN ⁺ >EN>EN ⁻
	EN ⁻ (n=4)	50.00	3.367		
Time spent playing the HELS	EN (n=9)	62.78	2.819	11.702*	H7 ⁺ >H3 ⁺ >H3 ⁻
	EN ⁺ (n=25)	71.96	4.596		
	HS3 ⁻ (n=12)	60.25	7.021		
Time spent playing games	HS3 ⁺ (n=19)	69.63	5.718	1.023	-
	HS7 ⁺ (n=7)	74.00	8.000		
	HG7 ⁻ (n=14)	66.14	6.689		
	HG7 ⁺ (n=9)	70.89	3.822		
	HG14 ⁺ (n=15)	66.67	9.985		

* $p < .050$

Note: IN⁻ denotes that student is not interested in learning English/playing games; IN denotes that student does not have specific interest in learning English/playing games; IN⁺ denotes that student is interested in learning English/playing games. EN⁻ denotes student does not enjoy when playing the HELS; EN denotes student does not have specific enjoyment when playing the HELS; EN⁺ denotes student enjoys when playing the HELS. HS3⁻ denotes student spends less than 3 hours/week playing the HELS; HS3⁺ denotes student spends 3-7 hours/week playing the HELS; HS7⁺ denotes student spends over 7 hours/week playing the HELS. HG7⁻ denotes student spends less than 7 hours/week playing games; HG7⁺ denotes student spends 7-14 hours/week playing games; HG14⁺ denotes student spends over 14 hours/week playing games.

Under 'interest in playing games', the students who were interested in playing games had a significantly higher mean English posttest score than did the other students ($F = 10.064, p < .050$). Under 'enjoyment when playing the HELS', greater enjoyment when playing the HELS correlated with higher English posttest scores for the students ($F = 55.667, p < .050$). The students who enjoyed playing the HELS had the highest mean English posttest score (mean = 71.96), whereas the students who did not enjoy playing the HELS had the lowest mean English posttest score (mean = 50.00). Under 'time spent playing the HELS', more time spent playing the HELS correlated with higher English posttest scores for the students ($F = 11.702, p < .050$).

The students who spent over 7 hours/week playing the HELS had the highest mean English posttest score (mean = 74.00), whereas the students who spent few than 3 hours/week playing the HELS had the lowest mean English posttest score (mean = 60.25). However, there was no significant difference in the mean English posttest scores between the students regardless of time spent playing games ($F = 1.023, p > .050$).

Discussion

In this study, the traditional English learning strategy was applied for the students in the control group, whereas the mobile game-based English learning strategy, the HELS, was designed for the students in the experimental group. The first research question (**RQ1**) addressed the impact of the mobile game-based English learning strategy on student learning motivation. The results of the experiment suggested that the learning motivation of the students in the experimental group was significantly higher than that of the students in the control group. Furthermore, for the students in the experimental group, the results suggested that the posttest scores were significantly higher than the pretest scores.

In summary, the results revealed that the effectiveness of the mobile game-based English learning strategy in promoting the learning motivation of the high school students was significant. Moreover, the second research question (**RQ2**) addressed the impact of the mobile game-based English learning strategy on students' learning achievement. The results of this study revealed that the effectiveness of the mobile game-based English learning strategy in increasing the learning achievement of the high school students was significant.

The opinions of most of the students on the learning activities designed for the HELS were positive. The students felt that learning English through game play was interesting and that the learning activities designed for the HELS made them relaxed without becoming bored. The students also stated that

playing the games improved their motivation to learn English because of the integration of various types of learning content and games. In addition, the students identified communication through Facebook as a useful mechanism through which they could interact with one another and receive appropriate teacher feedback. These opinions highlighted the effectiveness of the mobile game-based English learning strategy in increasing the learning motivation and achievement of the high school students.

The experiment in this study verified the effectiveness of a mobile game-based learning strategy in increasing high school students' English learning. However, according to this study, two elements should be carefully considered. One is the selection of a suitable game, and the other is the addition of suitable content for game-based English learning. First, according to the high school students' opinion on game selection, adopting suitable games for designing an English learning strategy is highly crucial. This study adopted *Monopoly and Chance* as models, which were familiar and favored games among Taiwanese high school students.

Therefore, the experiment in this study was successful, as verified by the results. Moreover, a phenomenon was observed for the students' posttest answers: the scoring rate in the alphabet, phonetic symbol, and vocabulary exam unit was high, whereas that in the grammar, phrase, and sentence pattern unit was low. This phenomenon indicated the necessity of carefully considering what type of English learning content is suitable for game-based learning. In this experiment, the games *Monopoly and Chance* were useful media to assist in the learning of the alphabet, phonetic symbols, and vocabulary; however, they were not useful media for learning grammar, phrases, or sentence patterns. To achieve effective learning of grammar and sentence patterns, another enjoyable game, potentially one specifically designed for this context, is required.

Notably, regarding the mobile design of the HELS, the characteristic of ease of use was mentioned by only a few of the students. Most of the students claimed that, regarding ease of use, using the HELS felt natural because they used smartphones regularly in daily life; therefore, ease of use did not be merit special mention. Given this observation, the experiment in this study was validated; students' widespread use of smartphones enables numerous possibilities for mobile teaching and learning (Antee 2021).

For the third and fourth research questions (i.e., **RQ3**: 'Do demographic variables affect students' English learning motivation?'; **RQ4**: 'Do demographic variables influence students' English learning achievement?'), the results of the experiment suggested that 'time spent playing games' was the only demographic variable that did not cause differences in learning motivation and achievement, whereas the other four demographic variables affected students' learning motivation and achievement.

This study revealed that greater interest in learning English, more interest in playing games, higher enjoyment when playing the HELS, and more time spent playing the HELS all correlated with higher student learning motivation and achievement. This finding accorded with the results of previous studies (for examples, Dele-Ajayi *et al.*, 2019). Furthermore, the students stated that the challenging games designed for the HELS stimulated and encouraged them; accordingly, the learning context facilitated more rapid learning than other approaches they have applied (Romero-Rodríguez *et al.* 2021). Moreover, because of this learning context, the students who were not interested in learning English became willing to spend more time playing the HELS and finding it enjoyable.

Conclusion

This study examined the positive effectiveness of a mobile game-based English learning strategy in increasing the learning motivation and achievement of high school students. A discussion on how the applied system, the HELS, affected the students' learning motivation and achievement was also presented in this study. Notably, this study found that the effectiveness of a mobile game-based learning strategy was not significant for the students who did not enjoy playing games.

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