

The effects of ubiquitous games on junior students' achievement in English learning

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Abstract. This study aimed to investigate how ubiquitous games influence English learning achievement. An English curriculum was conducted on a school campus by using a ubiquitous learning environment called HELLO. Two groups of students participated in the learning activities prescribed in a curriculum by separately using ubiquitous game-based learning and non-gaming learning. During the experiment, tests were conducted for the students. The evaluation results of the learning outcomes demonstrated that ubiquitous game-based learning could achieve better learning outcomes than using non-gaming method.

Keywords: Augmented reality, English learning, Game-based learning, Ubiquitous game

1. Introduction

Because commerce, travel, and academic activities frequently, English has become the most important foreign language (EFL) in many non-English-speaking countries. The methods in which students' listening, speaking, reading and writing abilities can be improved are critical issues in these countries. Therefore, developing effective approaches to increasing practical opportunities in real contexts, and thus, enhancing students' English learning achievements has become an important research topic.

This study adopted appropriate learning environment and strategies in designing an effective curriculum. This study attempts to address the following research question: What is the difference between the learning achievements of our proposed learning method and those of the traditional learning method in English learning?

2. Methodology

This study adopted a quasi-experimental design. We divided students into two groups—an experimental group and a control group.

2.1. System architecture

A u-learning environment called HELLO was used for conducting ubiquitous learning in an English listening and speaking course. Fig. 1 illustrates the architecture of HELLO [4], [5]. HELLO possesses the following functionalities: Students' learning portfolios can be uploaded into the Evaluation Database (EDB) of the HELLO server, making them available for teachers to review. Teachers input materials and assessments into the Content Database (CDB) through the Content Agent, and Assessment Agent. Each student has a mobile device with which he or she can communicate with the HELLO server. From these mobile devices, students can access materials via a wireless local area network (WLAN). Students utilize a u-Browser tool to download news, comics, songs, and listening material from the HELLO server. They then use the u-Browser tool to play, listen to and watch learning materials. Students can use the u-Test tool to take

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tests. Students utilize the u-Speaker to practice conversation. Each student takes a PDA phone near a zone which is attached to a 2-D bar code. The u-QRcode tool on the PDA phone uses the phone camera to photograph the barcode and interpret the image as data. This data is used to access learning material from the server relevant to the location, and display it on the PDA phone.

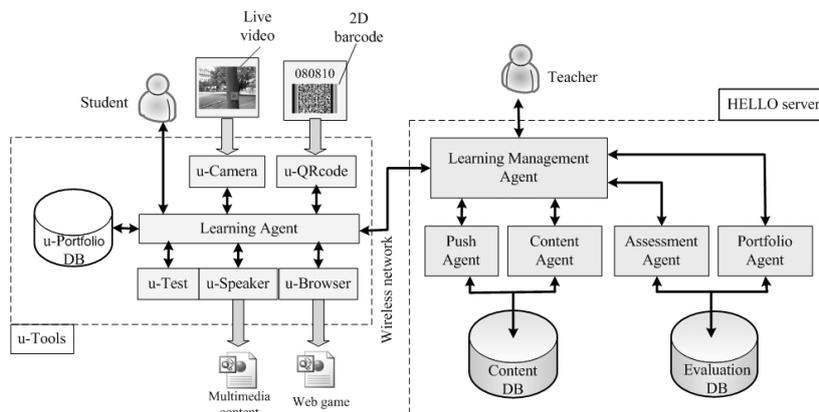


Fig. 1 System architecture of HELLO.

2.2. Curriculum design

Educational games encompass educational objectives and subject matter that have the potential to enable learning more learner-centered, easier, enjoyable, interesting, efficiency and effective [1][2][3]. Employing ubiquitous game-based learning (UGBL) in the course could enable more interesting, motivated, and effective learning as well as increase immersive and collaborative learning experience[1][2][3].

The curriculum included eight topics related to the library, health clinic, auditorium, computer classroom, laboratory, store, classroom, and playground zone. An eight-week experiment was conducted during class time, and a 45 minute course was conducted each week. The curriculum was named ‘My Campus’, and was designed in five phases. The students in the experimental group used gaming learning approach, while the students in the control group used a non-gaming learning approach (using printed materials and CD players).

The curriculum used tests to evaluate students’ learning achievement. The goal of the tests was to evaluate students’ English listening and speaking skills. Each test included a listening and a speaking section. The listening section was composed of twenty questions. The students listened to the questions, and then selected their answers from multiple choice options, and wrote them down on the question paper or on a PDA phone. The speaking section was composed of 10 questions. The students listened to the questions and recorded their spoken answers on a voice recorder or PDA phone, after which the teacher gave a grade, having listened to the answers.

3. Procedures

During the preparation phase 1, teachers administered a pre-test to the two groups in order to understand the prerequisite conditions of the students, and explained the experimental purpose, goals, outlines, and evaluation methods to the two groups.

During the phase 2, the experimental group used the HELLO to execute ‘Campus Environment’ game. Each student in the experimental group had a PDA phone installed, with u-Tools for English learning. The u-Tools included several tools which can be used to access self-study English songs, listening materials, and conversational materials from the HELLO server via the WLAN. When the students launched the game, a campus map appeared on the screen of each PDA phone. This map contained numerous zones, each of which was clearly marked. Students moved the character into the learning zone, and the u-Browser then opened zone-related materials. For instance, when a student selected the zone, ‘Library’, a library appeared on the PDA phone. The student could then choose the movies in order to practice an English conversation or watch an English movie clip. In contrast, the students in the control group learned zone-related audio conversations

by using CD/MP3 players and printed materials. The teachers administered Test #1 to both groups at the end of this phase.

During the phase 3, the students in the experimental group used the HELLO to conduct a treasure hunt game (named 'Campus Life' ubiquitous game). Students in the experimental group were asked to practice listening and speaking related to the learning zones. Each student used a PDA phone, and followed a guide map on the screen to play the game. For instance, when approaching the real 'Library' zone, a student could use his or her PDA phone to take a picture of the 2-D bar code beside the library, and then decrypt the 2-D bar code. The detected identification of the barcode was then sent to the HELLO server, which located the student and returned situation-related conversational material to the student's PDA phone. The virtual learning tutor (VLT) was then shown on the PDA screen. The VLT spoke the first sentence, and then the student spoke the next sentence following the prompt of conversation sentences in sequence. Meanwhile, the students in the control group continued to use CD/MP3 players and printed materials to learn conversations in the classroom. The teachers administered Test #2 to both groups at the end of this phase.

During the phase 4, the designed collaborative learning activity was a story relay race (named 'Campus Story'). Students in the experimental group used the HELLO to play the story relay race game. Each team in the experimental group had to select five zones on the map, and then each member had to visit one zone and create a piece of a story about each zone. Each member orally recorded the piece of the story on the PDA phone. Upon successfully completing a piece of a story in a given zone, each member handed his or her baton (PDA phone) to the next member, who listened to the previous story piece and walked to the next zone, continuing in this manner until all of the team members had passed through their five selected zones. In contrast, the students in the control group completed stories by using digital voice recorders in the classroom. The teachers assigned a grade to each team depending upon the quality of their story.

During the evaluation phase, the teachers administered a listening and speaking test to the students as a post-test, in order to evaluate the outcome of their learning.

4. Data Source and Analysis

Quantitative data included the test scores of both groups. The internal consistency reliability of the pre-test, test#1, test#2, test#3, and post-test were 0.78, 0.74, 0.82, 0.84, and 0.81 respectively with 64 samples [4], [5]. All of the Cronbach's α value of tests exceeded 0.7, indicating a high reliability of the tests used in this study. This study adopted Cronbach's α coefficient in order to evaluate the internal consistency reliability of the tests. Cronbach's α coefficient ranges between 0 and 1, and Nunnally suggests that 0.7 is an acceptable minimum reliability coefficient [6]. We conducted ANCOVA with a pre-test as a covariate to investigate the outcomes of students in different groups.

5. Results and Discussions

The result ($p > 0.05$) of Levene's test for the equality of variances indicates that the assumption of the homogeneity of variances in the groups is satisfied. In addition, the test results ($p > 0.05$) of between-subjects effects, which indicate the assumption of homogeneity of regression coefficients for the two groups, is satisfactory for the remainder of the tests. With this in hand, an ANCOVA analysis was performed using the pre-test as a covariate. Table 1 presents the mean grades and standard deviation of evaluations for each test [4], [5].

In Phase 1, the teachers distributed a pre-test to both groups of students. In Phase 2, the ANCOVA result of Test #1 ($F = 13.07, p < 0.05$) indicated that the average grades of the experimental group exceeded those of the control group by about six points. This difference was significant because it demonstrated the effectiveness of the HELLO in improving learning. According to the interviews, this improvement occurred because the HELLO provides many interesting learning materials.

In Phase 3, the ANCOVA result of Test #2 ($F = 20.17, p < 0.05$) indicated that the average grade of the experimental group significantly exceeded that of the control group by eight and a half points. According to the interviews, this occurred because the HELLO provides an interesting context-aware immersive activity which can improve the learning experience in listening and speaking, further increasing students' results.

In Phase 4, the ANCOVA result of Test #3 ($F = 11.68, p < 0.05$) indicated that the average grade of the experimental group exceeded that of the control group by eight points. According to the interviews, this occurred because the experimental group students practiced their speaking, collaborated in their tasks, and completed their creation in actual situations.

In Phase 5, the ANCOVA result ($F = 15.56, p < 0.05$) indicated that the average grade of the experimental group significantly exceeded that of the control group in the post-test by eight points.

Table 1. Mean grades and S.D. of evaluations for each test

Item	Experimental group			Control group		
	Mean	SD	SE	Mean	SD	SE
Pre-test	74.06	11.32	2.00	75.47	10.03	1.77
Test 1	82.03	5.37	0.95	76.66	6.35	1.12
Test 2	86.88	7.04	1.24	78.44	7.77	1.37
Test 3	85.63	9.57	1.69	77.53	9.76	1.72
Post-test	89.44	7.45	1.32	81.25	9.59	1.70

N=64, $F_{0.95}(1,61)=4.00, *p<0.05$

6. Conclusions and Future Work

This study aimed at investigating how ubiquitous games affects the learning outcomes of English listening and speaking. A case study was performed with the participation of three high school teachers and 64 high school juniors. The experimental results show that the use of ubiquitous games in learning can produce better learning outcomes than the non-gaming method, further demonstrating the effectiveness of HELLO [4], [5]. In future research, we will continue to work with high school English teachers in order to conduct further studies. We will set up multiple interactive touch screens at learning zones in campuses; thus, students can communicate with the virtual characters on the table PC in English and further increase their opportunities to learn English.

7. Acknowledgment

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8. References

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