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Exploring the Learning Benefits of Cloud Group Games in the Introduction to Computer Science in College

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Abstract

The Introduction to Computer Science is a compulsory subject for freshmen in most colleges in Taiwan; it mainly introduces theoretical knowledge such as basic computer applications. However, most teachers only use traditional lectures to teach, students are not willing to study theoretical courses, and in the end learning are only driven by tests. This study mainly investigated the interactive response system as a group game teaching tool to develop the teaching model of cloud group games and apply the model to the Introduction to Computer Science to explore the learning motivation and achievement of students. The study subject was 56 freshmen and the one-group pretest-posttest design was adopted to collect and analyze the data through quantification. The research results showed that students had a positive feeling for the Cloud Group Games as a supplementary learning tool in class, their learning achievement was significant before and after the test, and the system was considered more interesting than traditional lectures, enabling the students to focus on the course. The study also proposed relevant suggestions and future research directions at the end of the paper for the reference of future research.

Key words: GBL, IRS, Learning motivation, Learning achievement.

Introduction

Game-based learning is a core element to modern education and research, where learning through well-designed games and guidance along with positive learning contexts can make students to result in better learning achievement in more enjoyable environments and with higher learning efficiency. Integrating learning contexts with games can stimulate learners' motivation and promote learners' willingness to learn actively. Throughout the game process, learners are able to be physically and mentally immersed in the game situation and create a flow experience, gaining knowledge and skills throughout the process and thereby achieving the purpose of combining education with entertainment [1, 2]. To improve the lack of interaction between teachers and students in traditional lecture settings and to enhance learning efficiency, many researches have attempted to introduce the interactive response system in recent years. Based on this system, learners respond to teachers' questions in lectures via individual vehicles and teachers are able to quickly grasp the students' learning situation through the system and provide them with prompt feedback to improve learning achievement [3].

With the advancement of information technology, individual problem-solving using information technology has also become increasingly important. As such, many colleges require freshman to complete the prerequisite course "Introduction to Computer Science" which mainly introduces theoretical knowledge such as basic computer applications. However, through observations of teaching in practice, studies have found that most teachers only teach classes by using lecture-based teaching and other traditional methods. Such one-sided transmission of knowledge is not enough to motivate learners to learn actively. Therefore, how teachers attract learners' attention and stimulate interactions between teaching and learning is an issue worth discussing [4]. The purpose of this study is to develop a teaching model of cloud group game and apply this model to the first year college course "Introduction to Computer Science" to explore the learning motivation and achievement of students. By collecting data during the teaching process, data analysis results from this study may be used to modify and verify the model and be provided as reference for curriculum development-related future research.

Literature Review

A. Game-Based Learning (GBL)

Games are an effective and enjoyable learning method which enables people to build knowledge and skills in a natural way and to be immersed in the entertainment, thereby improving learning motivation and active learning participation [5]. Embodying learning contexts within games can improve learners' motivation and concentration through the interactions and fun of the games, where the learning process is no longer a dull rumination on words, thereby improving learning achievement and fulfilling the purpose of learning [1, 2]. Therefore, this study integrates GBL with the first year college course "Introduction to Computer Science" with an aim to stimulate students' motivation and improve learning achievement in a theoretical course.

B. Interactive Response System (IRS)

IRS is able to intensify interaction between teachers and students. The more increasing interaction between teachers and students, the better learning achievement for students [6]. IRS can provide learners with visual and auditory sensory stimulation activities. Multimedia visual and auditory stimuli combined with designing game activities, such as speed quizzes, competitions and various other evaluation methods

can improve learners' concentration and participation [3, 7]. Therefore, this study integrates IRS with game elements expects to effectively increase learners' motivation, concentration, participation, and solve the problem of the lack of interaction between teachers and students in traditional lecture.

Methodology

A. Experiment

This study adopted a one-group pretest-post-test design and focused on freshman majoring in multimedia design in a private college in northern Taiwan as its research subjects. A total of 56 students attended the course. Deducting the number of students who did not participate in the pretest and post-test as well as the invalid questionnaires, the completed statistical data included a total of 47 students. Based on the researcher's years of practical teaching experience, we found that students with a background in multimedia design have absolutely no interest in the Introduction to Computer Science, leading to decreased learning motivation, concentration and classroom participation. Therefore, this study investigated the interactive response system as a group game teaching tool to develop the teaching model of cloud group games and apply the model to the Introduction to Computer Science to explore the learning motivation and achievement of students. The cloud group game adopted in this study was Kahoot! [8], of which the biggest difference with other systems is that users can connect online and access the system through classroom or personal devices to participate in interactive learning. Kahoot! supports speed quizzes, competitive games and point-accumulating game activities with each team competing against each other. For the purpose of enhancing gameplay, total scoreboards were designed for this study: the accumulated points of each round of competition during the period of this experiment were added up, and the total score and current ranking were announced to the students in order to stimulate competition between the teams. Such virtual scores and competition activities were not enough to drive college students to pursue higher competition scores. Therefore, this study converted competition scores into team ranking and awarded extra credits to student grades based on the ranking when appropriate. Seemingly meaningless virtual scores were converted into effective and practical activities for students to earn extra credit for student grades, thereby stimulating student learning.

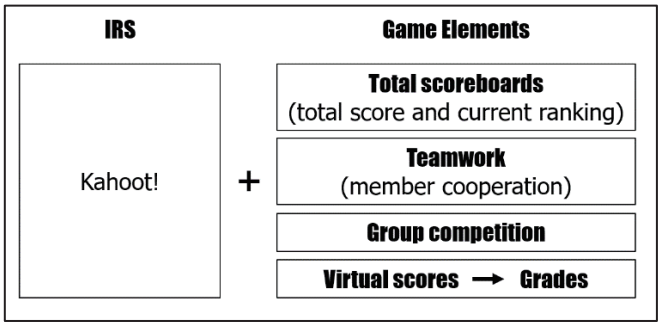

Fig. 1 The architecture of cloud group games.

B. Research Instrument

The Learning Motivation Scale was prepared by referencing to the Motivated Strategies for Learning Questionnaire [9]. It comprises of five aspects, including Intrinsic Goal Orientation (IGO), Extrinsic Goal Orientation (EGO), Task Value (TV), Control Beliefs (CB) and Self-Efficacy for Learning and Performance (SLP). The Learning Motivation Scale use the Likert five-point scale, with 5 points representing "strongly agree" to 1 point representing "strongly disagree". After completing the initial study questionnaire, six professionals (including 4 experts in information management and 2 experts in teaching and learning) were invited to provide opinions and modify wordings so that expert validity could be established. This was followed by a pretest, where the data was gathered and a reliability analysis was conducted for the questionnaire scale (Table I). For the Learning Motivation Scale, the total number of questions after that deleted was 21 and the Cronbach's α of the measures of the questionnaire was 0.94. The reliability of the questionnaire was high. The Introduction to Computer Science Test was based on Tiked Books Co. [10] teaching materials as the pretest and the post-test papers.

TABLE I
RELIABILITY TEST RESULTS FOR THE LEARNING MOTIVATION SCALE

Dimension	No. of items	Cronbach's Alpha
IGO	4	.69
EGO	3	.74
TV	5	.86
CB	3	.69
SLP	6	.91
Learning Motivation	21	.94

Analysis and Discussion on Differences in Students' Motivation and Achievement

To realize the difference in the effects of the cloud group game on students' motivation, the Learning Motivation Scale was implemented before and after the teaching experiment. The results are shown in Table II. According to the results, the pre-test average score for students' learning motivation before the teaching experiment is 3.50. All sub-item scores fall between 3.41-3.66, which is considerably low even if it is higher than the median (3). This falls in line with the researchers' years of observations of teaching in practice: Students with a background in multimedia design have a generally lower learning motivation towards the Introduction to Computer Science. The post-test average score for learning motivation is 3.72. All sub-item scores fall between 3.56 - 4.06, indicating that there was a significant improvement in students' learning motivation. Pre-test and post-test questionnaire results were tested using the paired samples t-test. The results show significant difference in students' learning motivation ($t(46) = -2.39$, $p = .021$, $d = -0.49$), suggesting that with the teaching model of this study, there was a considerable improvement in students' learning motivation in general and that students continued to maintain positive learning motivation. In addition, there is a significant difference in Intrinsic Goal Orientation ($t(46) = -3.82$, $p < .001$, $d = -0.79$) and Control Beliefs ($t(46) = -3.50$, $p = .001$, $d = -0.74$), indicating that students' intrinsic learning motivation increased after this study's experiment and that learning achievement is determined by how students viewed his or her own efforts and is not affected by the influences of others.

To understand the changes in the effects of the cloud group

TABLE II
PAIRED SAMPLES T-TEST TABLE: LEARNING MOTIVATION AND ACHIEVEMENT (N=47)

Dimension	Mean (S.D.)		df	t	p	d
	Pre-test	Post-test				
IGO	3.41(0.48)	3.82(0.55)	46	-3.82	.000	-0.79
EGO	3.51(0.59)	3.62(0.64)	46	-0.83	.431	-0.18
TV	3.52(0.47)	3.69(0.57)	46	-1.63	.111	-0.33
CB	3.66(0.49)	4.06(0.59)	46	-3.50	.001	-0.74
SLP	3.45(0.53)	3.56(0.63)	46	-0.97	.336	-0.19
Learning Motivation	3.50(0.39)	3.72(0.50)	46	-2.39	.021	-0.49
Learning achievement	30.36(8.27)	82.19(12.99)	46	-28.05	.000	-4.76

game on students' learning achievement, the Introduction to Computer Science Test was implemented before and after the teaching experiment. The results are shown in Table II. The post-test average score (M = 82.19) is significantly higher than the pre-test average score (M = 30.36). The pre-test and post-test average scores were tested using the paired samples t-test. The results show a significant difference ($t(46) = -28.05$, $p < .001$, $d = -4.76$), indicating that there was a considerable improvement in the students' learning achievement after the teaching experiment. Through the analysis of the two questionnaires, the teaching model of this study indeed increased students' learning motivation and achievement.

Conclusion

The purpose of this study was to develop a teaching model of cloud group game and applied this model to college students, who with a background in multimedia design have absolutely no interest in the Introduction to Computer Science, leading to decreased learning motivation, concentration and classroom participation, to explore the learning motivation and achievement of students. The teaching model was integrated with IRS-supported speed quizzes, competitive games, point-accumulation games, scoreboard rankings and other functions. In addition, the model joined the game elements such as group team cooperation, team competitions, total scoreboards and double-score point accumulation activities. According to the results of the Learning Motivation Scale analysis, there was a considerable improvement in students' learning motivation in general and that students continued to maintain positive learning motivation. Furthermore, the results of the Introduction to Computer Science Test analysis indicated that there was a considerable improvement in the students' learning achievement after the teaching experiment. The use of the cloud group game with competitive gameplay in the course indeed increased students' learning motivation and achievement.

One of the limitations of this study was the small number of subjects. Moreover, the teaching experiment in this research was only conducted on one group and so the results are insufficient for making further conclusions. It is suggested that further studies could focus on investigating the correlation between students' motivation and achievement, and it is conducted against an experimental group and a control group.

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