A Preliminary Study of Implementing Educational Game into Formal Classroom Settings

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Abstract: This study adopts the Keller's ARCS (Attention, Relevance, Confidence, and Satisfaction) motivational design framework to develop instructional strategies to integrate educational game learning into formal classroom settings. The experimental instruction lasts 8 weeks and there are 103 students in 6th grader involved. From the result of students' opinions, motivational instruction strategies developed in this study are recognized as helpful to their learning motivation. In this study, a total of twelve motivation guidelines was found and stipulated. Those may provide a rule of thumb for teachers when they consider incorporating educational games into their class and plan to maintain or enhance students' learning motivation.

Keywords: educational game, game learning, motivation strategies, classroom implementation

Introduction

The prevalence of the computer has changed what and how students learn. With its highly interactive nature, the computer provides diverse learning contexts and abundant surprises for learners to explore. These special attributes give learners opportunities to take risks and obtain subsequent rewards and empowerment [1]. Recently, many efforts have been made to take advantage of the features of computer games to provide learners a new mode of learning. Thus, educational games are receiving increased attention in education [2, 3].

Many experimental studies have shown that educational games are capable of helping learners to learn [4-6]. However, two pitfalls are prevalent. The first is the decrease of motivation after the initial period of excitement. Some studies have highlighted these phenomena [7]. The other is the mis-interpretation of the context in which educational games exist. Many people incorrectly see educational games as stand-alone packages that are designed to be played by students alone and are removed from teachers and the formal school settings.

To resolve above pitfalls, better designing interactions for teachers and more complete interventions are the keys. Many studies have suggested that the establishment of an adequate learning context may strengthen the connection between student's prior experiences and knowledge, and subsequently enhance their learning motivation [8, 9]. Teachers and schools should see educational games as an integrated part of a broader space of educational media and as a part of students' learning experiences, so that they may play a more direct role in facilitating students learning from educational games. By doing so, student's learning could be enhanced, and the educational games can be used more effectively.

The objectives of this study are to develop an instruction design, based on Keller's model, which includes four dimensions: Attention, Relevance, Confidence, and Satisfaction (ARCS) [10, 11]. The educational game used in this study, FormosaHope, is a role-playing game originally designed by our research group for learners to play in their spare time individually. This study used this educational game by incorporating it in formal schooling time. Several motivational strategies are developed throughout the whole process of playing educational games, and these strategies are considered to be helpful for students' learning. After the experiment, student's opinions toward each motivational assisting strategy are collected and reported. It is expected that the instructional design in this study may help teachers to develop their own instruction and to pave a way for educational games to be used effectively in formal educational settings.

1. Literature Review

1.1 Learning Motivation

Cognitivism regards learning motivation as an intermediate process between the learning environment (stimuli) and an individual's behavior (response). Several theories, which have emerged from different intellectual traditions, have been used to interpret such motivation. McClelland, Atkinson, and Lowell's theory of achievement motivation [12], have argued that one's intention determines the action. According to this theory, if one's need to achieve is stronger than her/his need to avoid failure, one is motivated to pursue the achievement. Later, Weiner purposed the attribution theory which emphasized that the outcomes of a task were evaluated with regard to the individual's perception of one's ability and effort, and also related to the role of the task demands, such as difficulty, consistency and precedent [13].

In addition to these, Eccles's expectancy-value models argued that achievement motivation is highly related to the expectancy for success and perceived task values, namely, in relation to these motivation behind an action [14]. Eccles also proposed a global concept of "value" and claimed that value can be divided into four components: interest, utility, attainment value and cost. Another theory is Bandura's self-efficacy theory, which focuses on expectancies for success [15]. This is a social cognitive model of motivation. According to this theory, individuals' confidences in their abilities are important factors to solve a problem or to finish a task.

1.2 ARCS Learning Motivational Model

The ARCS Learning Motivational Model was developed by Keller [10, 11]. This model integrates motivational theories and had been used in many studies [16, 17]. In this model, four fundamental elements that are used to enhance students' motivation are 1. Attention, 2. Relevance, 3. Confidence, and 4. Satisfaction. Each of the elements is defined as followings:

Attention: The first consideration of the ARCS motivation model is to attract students' attention. Some simple and novel events could be used to arouse student curiosity. During the process of learning, diverse activities should be considered to maintain students' feelings of novelty, thus the attention can be sustained.

Relevance: This step emphasizes instructional design should promote relevancy to learners to enhance motivation in learning. This could be achieved by connecting learning

activities with students' needs, interests, values, and etc. Planting there seeds in the minds of the learners strengthens motivation.

Confidence: Based on theories of attribution and self-efficacy, the more positive view learners have towards him/herself, the more chance the learner has in sticking to the task, resulting in success. The instructional design should allow learners to know the goal and to believe that the goal can be achieved, if enough effort (physical and/or intellectual) has been made.

Satisfaction: The learners' mental statuses after learning will influence learners' attitudes toward success. If the learner was satisfied with the learning experiences or learning outcome, the external and inner motivations were enhanced, benefiting future learning. The instructional design needs to consider providing adequate feedback to help students build up the feelings of satisfaction.

The ARCS model has the potential to remediation and is capable of enhances students' motivation and of improving learning efficacy [18].

2. Methodology

2.1 Samples

This study involved 103 students in the sixth grade. These students were from three classes of an elementary school in Taipei, Taiwan. The school is located in a metropolitan area and represents a good sample of schools in Taiwan.

2.2 The Educational Game- FormosaHope

The FormosaHope (FH) was developed by this research group. It is designed for 4th to 7th graders [19, 20]. This software integrates science, technology, and society in an educational game. The FH consists mainly of two parts. The first one is a role playing game and the second part is "Touring Taiwan Island." Both parts provide students' opportunities to explore a game and to learn science, technology, and society. A sample screenshot is shown in Figure 1

Figure 1. Screenshots of the Touring Taiwan

2.3 Motivational Design for Implementing Educational Game into Formal Classroom Settings

Researchers of this study analyzed content learning in the curriculum through FH, before designing specific activities addressing motivation in classroom settings. Based on an

analysis, these learning goals were met. The potential ARCS motivational activities were discussed and listed by a group of experienced teachers. The learning motivation activities used for scaffolding the FH in formal classroom settings were subsequently developed. The draft version was then examined and modified. The ARCS motivation activities developed in this study are shown as Table 1.

Table 1. The ARCS motivational activities incorporated in the educational game, FH

ARCS	Motivational Activities
Attention	1. Play the scenario video clips to introduce the background of the FH and the goal of avatar. 2. Demonstrate snapshots of the educational game. 3. Introduce the web-site of this game and show students share ideas and discuss the activities 4. Distribute the workbook to each student. 5. Put up posters around classroom. 6. Students are prompted to observe, to think, to discuss, and to write, etc…
Relevance	1. Connect the virtual environment with the real world, such as problem, through discussion of the information, and knowledge. 2. Give the rewards virtually and substantially. 3. Apply the learning from the educational game in the formal curriculum. 4. Group students for competition.
Confidence	1. Give clues for solving the educational game. 2. Give the check-list to help students complete the mission. 3. Set and announce the criteria for game playing. 4. Help slow players when they need help. 5. Share students' successes and failures with each other.
Satisfaction	1. Create a fair competition environment. 2. Invite students to share their successful experiences with the class. 3. Share their worksheets with each other. 4. Give positive feedbacks, such as oral encouragement privately or publicly, certificate, and etc…

These motivational activities were arranged and spread throughout the 8 week's experimental period.

2.4 Survey Instrument of Students' Recognition toward Motivational Activities

In order to measure students' perceptions of each motivational activity developed in the study, researchers designed a survey instrument, Students' Recognition toward Motivational Activities (SRMA), to document the kinds of motivational activities those were perceived by students as having greater impact, in terms of student motivation enhancement. The SRMA was given to all students after the experiment. A total of 102 out of 103 students returned the survey instrument.

This survey instrument has four items, which are based on ARCS. All of the motivational strategies that have been used in this experiment were reviewed and classified. The strategies relevant to each component were listed under the classified component for each student to check. A sample, Satisfaction Component, is as follows:

- Please view the following activities and check those you think have helped to enhance your sense of "satisfaction." (You can check more than one.)

□Certificate of merit or completion □The discussion on the web-site □The positive praise from teacher □Public announcement when each stage was cleared □ substantial prize when completing the mission □Teacher visits and observations □ Exchange of observation and evaluation through the workbook □Give away of the FH game □Give away of the opportunity for another game □Others (Please write down.)

2.5 Data analysis

The data was collected from 102 students' responses to the SRMA after the experiment. The frequency of each selection was calculated. The effectiveness of each motivational strategy for learning was decided based on the frequency.

3. Results and Discussion

3.1 Results

Students' propensity toward each motivational activity is shown in Table 2. The frequency represents the number of students who think this motivational activity is important to enhance their motivation in the educational game. When more than half of all students (51 out of 102) think the item is important, an "*" shows the importance of the activity in enhancing students' motivation. For example, the second activity, Posters, received 80 agreements out of 102 students, and was regarded as an important one.

Table 2. Students' Recognition toward Each Motivational Activity

ARCS Components	Motivational Activity	Frequency	Over 50%
Attention	A1. Show the workbook	46	
	A2. Posters	80	*
	A3. Activities in the workbook	39	
	A4. Snapshots of game in the workbook	88	*
	A5. Video of Scenario	66	*
	A6. Discussion on the web	72	*
Relevance	R1. Worksheet- whom do you want to be?	82	*
	R2. Worksheet of visiting a real place	62	*
	R3. Worksheet- formulating a real world problem	33	
	R4. Group competition	88	*
	R5. Introduce game structure and the goal	38	
	R6. Worksheet- Create you own specialty	49	

	R7. Given substantial rewards	89	*
Confidence	C1. Check-list of the goal	41	
	C2. Given certificate of merit or completion	93	*
	C3. Check-list of the experience values or missions	77	*
	C4. Group poster preparation and sharing	72	*
	C5. Criteria for evaluation and awarding	67	*
	C6. Worksheet- Let's make a game!	43	
	C7. Group supportive learning	84	*
	C8. Explain the learning goal of the educational game	53	*
Satisfaction	S1. Given certificate of merit or completion	88	*
	S2. The positive praise from teacher	86	*
	S3. Give substantial award when completing the mission	91	*
	S4. Exchange observation and evaluation of worksheet book	69	*
	S5. Give away the opportunity of playing other game	41	
	S6. The discussion on the web-site	32	
	S7. Public announcement when clear each stage	46	
	S8. Teacher visiting and observing	74	*
	S9. Give away the FH game	83	*

(N=102)

In these 30 motivational strategies, 20 received recognition from more than half of the students; 10 did not. These indicate the relative importance of items.

3.2 Discussion

The results are shown in Table 2 indicates that the motivational strategies based on an ARCS framework are well recognized by students as enhancing motivation.

Looking into students' responses in each component of the ARCS, we found some interesting and meaningful messages.

For the Attention aspect, these include: 1. Clear and short images or information (ex: A2- posters and A4-snapshots) are useful in catching students' attention, not long ones (A5-video clips). 2. Books (or large amount of readings) are not appreciated by most of students (A1 and A3) in educational games. However, this is not to be interpreted as meaning that the reading materials are workless. 3. Students' communication is helpful to maintain their sense of attention. The result of A6 shows that discussion on the web attracts attention (72 out of 102). In this study, the web-type discussion happens throughout the 8

weeks period. The above results imply that maintaining long-term attention requires student communication.

The results in the Relevance aspect indicate four ways of enhancing student feelings of relevance. 1. Strengthen the connection between the game player and the avatar (R1), 2.Tighten the virtual environment and the player's real world (R2), and 3. Involve student in a competition (R4). And the last is to use an adequate reward system (R7). In this experiment, it is also noticed that the emotional aspect (R1, R2) is more potent then the intellectual aspect (R3, R6) for connecting students to the educational game. This implies that, for the purposes of making students feel the game is relevant to them, the four approaches mentioned above are useful. However, when looking solely at learning itself, further study of this approach to creating relevance is needed.

In the Confidence aspect, three parts are noticed. The first, giving clear criteria for evaluation and awarding (C5) is helpful to the students' confidence in accomplishing the task. The second, working in groups (C4 and C7) seems to be a useful approach to alleviate student discomfort. Third, the extrinsic goal orientation (C2 and C4) will bring students the sense of honor, and this is capable of building student confidence.

In the Satisfaction aspect, three types of rewards seem to be useful. First, the substantial rewards (S3 and S9). Second, the non-substantial rewards, such as giving certificate of merit (S1), teacher praise (S2), even just teacher's visits and observations (S8). The third, intrinsic reward, which is just simply sharing one's work or achievement with others (S4) is enough to lift students' feelings of satisfaction.

4. Conclusions

This study adopts Keller's ARCS motivational design framework to develop an instructional strategy to integrate an educational game into a formal classroom setting. The results from 102 students' experiences and responses showed that motivational instruction strategies developed in this study are recognized by students as helpful to their learning.

A total of twelve guidelines were found and stipulated in this study. Those may provide a rule of thumb for teachers when they consider incorporating educational games into their classes and plan to enhance or maintain student motivation.

Educational games are one form of many educational media. It has similar educational capabilities to promote emotional and intellectual growth as books, videos, lectures, etc. Educational games can be used by students in their spare time and, we argue, it can play a more positive role in formal educational settings. For fulfilling this goal, at least two pieces of research need to be done. The first is software selection. Teachers need to evaluate and select the right educational games; this has been addressed in some studies [21] and is feasible. The other is to incorporate educational games into classroom settings. In such circumstances, teachers may play the role as facilitators in the e-learning context. The ARCS offers teachers a framework, and the practical motivational strategies they need. This study provides fundamental information for further educational games in formal classroom settings. With this understanding, the isolation of games from classroom instruction may be ameliorated and the true value of educational games may be disclosed.

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