Is game-based assessment more attractive and less stressful for the students than the traditional exams?

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Abstract

Modern learning theories reveal the need to take into consideration and investigate the student's affective states (i.e. frustration, boredom, anxiety and others) during complex learning activities. This research is trying to detect high arousal, interpreted as intensive affective state or even anxiety, occurring during examinations. Furthermore, it compares students' anxiety while taking examinations in two ways a) the traditional way and b) playing a serious game. This work may be proved useful in the direction of combining the cognitive - pedagogical models with the educational design beyond entertainment. The affective response during educational activities is a supportive methodology for student and teacher self-regulation strategy. This article describes our broad approach towards a modern educational design and support of learning environments. Our main objective is to loosen the stranglehold student anxiety during the examinations. High anxiety sometimes may be the reason for bad performance. Therefore, we tried to apply a more loosen but interesting and engaging way of taking examinations by playing a serious game.

Keywords: serious games, game-based learning, modern educational design

Introduction

Usually for most of the people, taking exams is a very intensive procedure. High anxiety before a test is almost a common phenomenon but many people when the test begins are more relaxed and they concentrate on it. Unfortunately, there are people who cannot regulate their anxiety and because of this intensive affective state they fail to concentrate enough to their examination. High anxiety is a very complex emotional state having many complicated psychological and physiological causes with a usual effect which is bad performance (Eysenck & Calvo, 1992).

This research is exploring whether a novel way of taking exams by playing a computer-based game could support the students' self–regulation in order to dominate to their anxiety by giving them the opportunity to act in a more loosen and attracting context.

It is well known that people of all ages, occupations, and education levels, and especially children and young people (Fromme, 2003; Oblinger, 2004) usually have fun and relax playing computer games. It has been suggested that although a leisure activity, computer games can have a positive effect on a variety of players' skills, such as collaboration skills (Facer, 2003), memorization, and problem-solving skills (McFarlane et al., 2002). This is the main reason that recent research is trying to combine computer games and learning into serious games (Squire, 2003).

Game-Based Learning (GBL) or serious games constitute a rapidly growing category of learning tools. It is suggested that serious games should be as attractive as leisure games, since motivation itself is considered a factor that influences learning behavior and tolerance towards errors, or as Norman states "attractive things work better" (Norman, 2004).

T. A. Mikropoulos, N. Papachristos, A. Tsiara, P. Chalki (eds.), *Proceedings of the 10th Pan-Hellenic and International Conference "ICT in Education"*, Ioannina: HAICTE. 23-25 September 2016. ISSN 2529-0916, ISBN 978-960-88359-8-6.

According to Vogel et al. (2006), the interaction with computers itself can improve learning motivation, and if the learning process design resembles playing a game can enhance learning motivation even more. Moreover, Vogel et al. (2006) suggest that "play" is an important element of the game and also of learning motivation (Wang, 2008). This element supports the students' engagement to the learning process. Another important element is the "interactivity" between users and game programs which determines the level of users' participation in activities (Wang, 2008). Furthermore, Vogel et al. (2006) believe that "appropriate challenge" is also an important component because a game which brings learners "appropriate challenge" can scaffold their learning. A very difficult challenge may lead to students' frustration. On the other hand a very easy challenge may lead to students' boredom and high relaxation. Besides "play", "interactivity" and "appropriate challenge", "rewards and scores" are the final components of a game (Wang, 2008). Vogel et al. (2006) argue that "rewards and scores" cannot only provide learners with feedbacks, which make them know whether their answers are correct or wrong, but also serve as the motivating entity because when a student take higher scores or rewards as his/her target of efforts, he/she will learn more quickly and efficiently (Wang, 2008). In conclusion, according to Vogel et al. (2006) a game-based learning environment supports students' motivation and the four main components of a serious game design are "play", "interactivity", "appropriate challenge" and "rewards and scores" (Wang, 2008).

There are many types of digital games that support learning. Some of the most well-known are the epistemic games, the deep learning games in civilization and history, the science content learning games, the problem solving games and the assessment games (Shute & Ke, 2012).

In epistemic games, the players virtually experience the same things that professional practitioners do (e.g. a journalist or an engineer). Epistemic games are being developed by Shaffer and his research team at the University of Wisconsin-Madison (Shute & Ke, 2012; Shaffer, 2006). These games are trying to develop knowledge and skills which are necessary to a particular discipline or professional community. One example of an epistemic game is Urban Science. In Urban Science, players work as interns for an urban and regional planning center. They prepare planning proposals for the mayor of a city. As part of this game players need to consider various social and economic impacts of their decisions (Shute & Ke, 2012).

An example of a science content game is an online game called Quest Atlantis: Taiga Park. Taiga Park is an immersive digital game developed by Barab et al. (2007) at Indiana University (Barab et al., 2007; Barab et al., 2010; Shute & Ke, 2012). Taiga Park is a beautiful national park. The main issue of this game is that the players should investigate the reasons of a serious phenomenon like "the fish are dying in the Taiga River". The players must gather all the relevant information in order to make conclusions and suggestions for possible solutions to the problem (Shute & Ke, 2012).

In assessment games, the players usually interact with the game environment having impact to the values of game – specific variables like player life span, player score or permission to gain a "level up". Many of these games are collaborative. If the values of the game – specific variables are getting too low, the player would likely feel compelled to take action to boost them. Our proposed way of assessment is based on this design strategy in order to boost students to give their best and to achieve a better performance. The research questions of the present study are the following:

- What is the attitude of students towards game-based assessment?
- What is the impact of game-based assessment on students' test anxiety?

In the next sections, the method that was followed by this study is presented giving details about the experimental design, the instruments, the participants and the materials used, the procedure followed, the data analysis and the results. Finally, conclusions and future steps are presented.

Method

This paper focuses on assessing the attitude of students towards game-based assessment as compared to a traditional examination method, as well as measuring the perceived anxiety levels of the students during both methods.

Experimental design

The research method that was followed by this study was based on a 2x2 cross-over experimental design in which participants were separated into two almost equally sized groups (Jones & Kenward, 2014). The two groups were exposed to the two conditions in a different order. The first group participated in the game-based assessment first and then the traditional assessment whereas the second group participated in reverse order. This cross-over design eliminated any possible bias resulting from the order in which the subjects interact with the treatment. Figure 1, shows the design that was followed by the study.

Instruments

After the completion of the examination using the game and the traditional method, a semi-structured interview was conducted in order to collect qualitative data regarding the students' attitude and their anxiety levels. In particular, the questions of the interview were focused on students preferred method of examination between the two ones as well as which method made them feel less anxious.

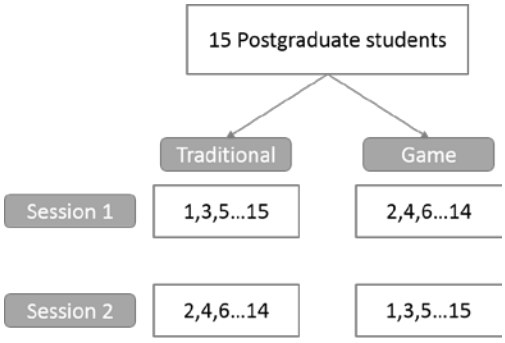

Figure 1. The design that was followed by the present study

Participants

The participants of the study were 15 postgraduate students attending a course related to multimedia systems. The attendance to the course was compulsory. There were 10 male students and 5 female students. The participants were computer science students and they were familiar with playing games but they did not use a game as assessment method before. The ages of the participants ranged from 23 years old to 45 years old (M = 31.87, SD = 7.62).

These data were derived from a demographics questionnaire that was administered to the participants.

Materials

The game that was used for the examination was a 3D quiz game with treasure hunting aspects. In particular, the students had to explore a virtual environment searching for objects that contain questions. When a user finds an object that includes a question then a pop up dialog window appears showing the question and three multiple answers. After the selection of an answer there was no feedback in order to avoid a possible anxiety burden that would accrue from the fact of knowing if an answer was correct or not. Figure 2 shows a student inside the game interacting with an object.

During the development of the game, several characteristics of educational games were incorporated into it. In particular, considering the structural elements of games as proposed by Prensky (2001) the game includes the following:

- a goal (the players have to find and answer questions)
- rules (constraints that the game places on move/actions)
- outcomes (the players have to make specific actions to achieve the goals of the game)
- feedback (the players are aware of the remaining questions and time also the assistant objects give them guidance on how they should move)
- challenge (the avatars of the players are all in the same environment, although the students cannot interact with each other they are able to see the presence of the others something that creates a sense of challenge)
- interaction (the players can interact with the virtual world of the game and see the presence of the other players)
- representation/story (the story is based on the classic concept of finding hidden treasures on an island)

The traditional method of examination included the use of an online test where students had to answer a list of multiple choice questions. The two methods were identical in terms of examination type, and differed only in that the first one followed a gaming approach, while the second one did not.

Procedure

The study was conducted in a computer laboratory where every computer had access to the game using an appropriate client as well as to the online test via a web browser. The implementation part of the activity was undertaken by the authors, as one of them was the instructor of the course. The students had been informed about the study almost one month before its execution and they had gladly agreed to participate in the experiment. Almost one week before the execution of the study the participants received a guide explaining all the aspects of the experiment in detail. Moreover, before the beginning of the examination the authors presented the game, explained the procedure that will be followed and answered the questions of the students.

As already mentioned, the study followed a cross-over design, thus, the participants were separated into two groups. The first group started the examination using the game whereas at the same time the other group was tested using the traditional method. After the end of the first session the groups changed examination method. After the completion of the second session, a semi-structured interview including all the students was conducted. The interview lasted about half an hour and the students participated one by one.

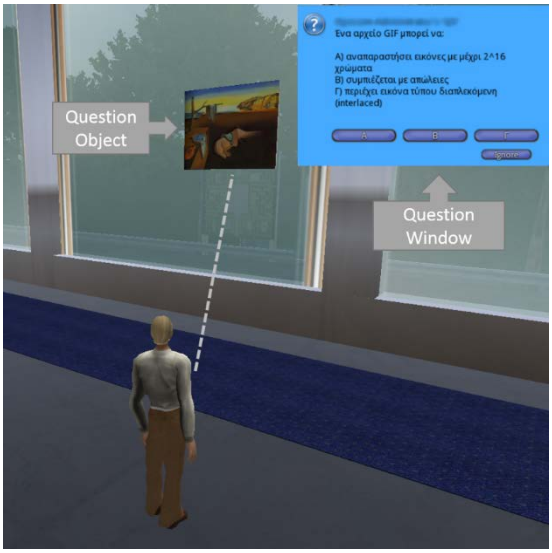

Figure 2. The user interacts with an object that contains a question

Data analysis

The qualitative data that were recorded during the interview were then analyzed following the open-coding process of the constant comparative method (Corbin & Strauss, 1990), in search of common themes. Afterwards, a frequency analysis was performed in order to calculate the repetition of the themes that were observed. In the questions regarding the preferred method of examination and the method that made students feel less anxious the themes were obvious as each student had to select one between the two methods.

Results

The analysis of the data collected from the interview are presented in Table 1, which shows the list of themes and their corresponding frequency of appearance.

Table 1. The themes derived from the interview with the students.

Theme	Frequency
I would prefer to use the game as an examination method.	80.00%
During the examination using the game I felt less anxious.	73.33%
The most interesting aspect of the game was the interactivity (sense of competition).	46.67%
The most interesting aspect of the game was the ability to fly.	40.00%

Overall, the students had a positive attitude towards the use of game-based assessment as an examination method. The fact that they were able to observe the avatars of their classmates trying to find and answer questions, generated a sense of competition. According

to the answers of the students, this sense of competition was the reason for a part of the participants to find the game-based assessment more interesting.
The students stated that they felt less anxious during gamified assessment. Their explanation for the reduced anxiety was that the game made them feel that they were not under examination. According to them, the reason for this was the fact that in their mind the traditional assessment was intrinsically linked with test anxiety, whereas, the game-based assessment was a new experience for them.
Figure 3 depicts the results regarding the preferred method of assessment as well as the results concerning the method that made students feel less anxious, as derived from the qualitative analysis.

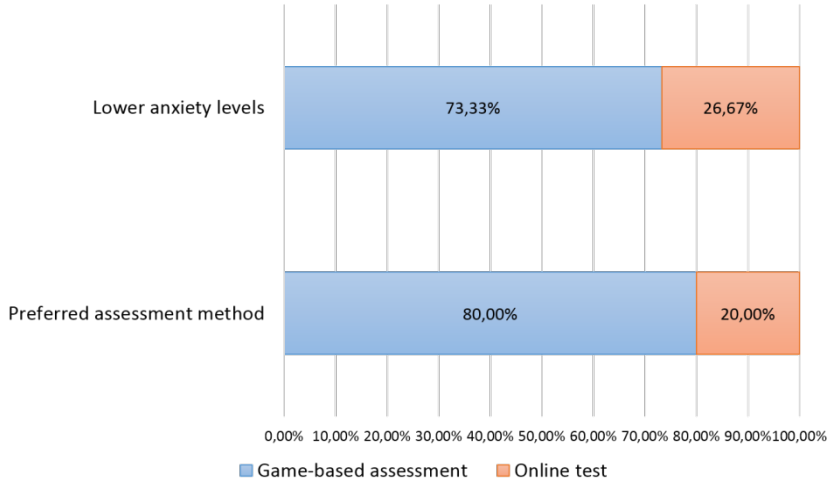

Figure 3. A depiction of the qualitative results regarding preferred method of assessment and lower anxiety levels.

Discussion and conclusions

The present study investigated the impact of game-based assessment on students' test anxiety. The methodology that was used utilized a cross-over design where the participants were examined using game-based assessment as well as traditional examination. The participants of the study were 15 postgraduate students attending a course related to multimedia systems. The collection of data was based on an interview that was conducted after the experiment.
The results of the analysis of the data revealed that the students had a general positive attitude towards the utilization of game-based assessment. The 80.00% of the participants stated that they would prefer to be examined using a game instead of the traditional method. Moreover, the 73.33% of the participants felt less anxious when they were assessed using the game compared to the online test. The results of the present study support the findings of previous studies. In particular, the study of Wang (2008) showed that the students have a positive attitude towards game-based assessment as games are able to successfully evoke students' motivation to actively participate in the examination. Furthermore, Smits and Charlier (2011) evaluated whether the use of a game as summative assessment instrument have a positive effect on students' test anxiety. The results of their

study showed that test anxiety scores were significantly lower when students were assessed by a board game.

The implication of the present study is that game-based assessment can have beneficial effects on students' test anxiety. Moreover, the study revealed that students seem to find more attractive and enjoyable the game-based assessment than the traditional examination method. The results of the current study can help educators and instructional designers to reach a better understanding on the effectiveness of educational games as assessment methods.

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