Multi-Modal Game Based Learning: Satisfaction and Users Achievement Approach

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Abstract: E-learning as the process of conveying information to the learner typically relies heavily upon textual materials. This dependency on one modal as means to attract students is not effective anymore, because it lacks to important elements that should be incorporated to get high quality results. Researcher on the other hand suggested a number of guiding principle targeted to improve capturing learners' attention. Therefore these guiding principles do not consider the entertainment as one of the dimension that helps to attract student’s attention and stimulate their memory. Therefore this study with the consideration to the guidelines presented will study the affect of entertainment as new medium through four interfaces in order to explore the influence of edutainment in helping orient learner attention. User achievement and user satisfaction were measured within each game. The results showed potential effect on the user performance.

Key-Words: - Avatar, E-learning, Edutainment, Entertainment,Multi-modal.

1 Introduction
E-learning has become more prevalent and has changed significantly through advances in Internet technology. The higher education sector incorporated these technologies to provide a richer and more engaging educational experience to learners everywhere in the world [1]. On the other hand the lack of contact between students and teachers and between peers and dependency of e-learning systems on textual modal in conveying the learning materials are two of many reasons that makes e-learning unacceptable to some populations [2]. For that reason and to change and improve the communications between users and e-learning systems, a multimodal interfaces invented to resolve this type of problems. Besides text, speech, visual assistances, and earcons modalities, the avatars or representations of people was incorporated as an extra modal to offer visual and listening realm and block the gap which took place in online learning. Avatars move or gesture in two or three dimensional world, talk to each other and represents any kind of conversation it might occur between humans in the real world whether it was serious or funny. Avatars or Virtual worlds have been used in many environments such as teaching languages and architectural design, and also it has been successfully improved the social interaction among students [1]. Therefore to obtain higher effectiveness in catching the attention of the learner and enhance their attitude to online learning, creativity and innovation is required to enhance the mechanism of the way the educational materials are delivered [1]. In this study edutainment as new mechanism to deliver the learning materials will explored through four educational games to assist in helping orient and enhance learner attention and enthusiasm. User achievement and user satisfaction were measured and weighed for each game. The evaluations results will be presented here to reflect the effect of this experimental study on the user performance.

2 Related studies
In project conducted by [3] to investigate the use of game in schools, the focus was on understanding the role and the educational impact of cooperation of games and competition in a virtual environment. The project called SEE (Shrine Educational Experience) which is a joint project of Politecnico di Milano and the Israel Museum, Jerusalem. The project was about the Dead Sea Scrolls and the Qumran community, the scrolls were 2000 years old, which were found in 1947 in eleven caves near the Dead Sea (on the border between Israel and Jordan), not far from the archaeological site of Khirbet Qumran. This project designed or targeted internationally to high school students (from 12 to 19 years of age) to communicate with each other as group’s though this educational project which was based on relevant cultural contents. The project idea is to offer 4 groups from different countries and schools to interact or play and learn with each other online though 3D museum environment under
supervision of museum guide for 6-7 weeks. Each student represented in the 3D world by an avatar which can move around, interact within the 3D world and with other students. Moreover students can play games, answering quizzes, experiences the advanced features made available by new technologies such as flying, seeing through the other avatars’ eyes, seeing from fixed cameras, but the way to communicate was only via chat.

To gain effective experience, the game style requires every team to work as one person to win; therefore it creates a competition environment between every two school players. The experimental organized of four cooperative sessions, which has been tested by over 1400 high-school students in Europe and Israel, and no doubt it helped in improving the learner engagement and retention.

Overall the experimental use of SEE has proved to be educationally effective in enhances and motivate the students curiosity and the ability of finding and discussing in details controversial issues.

Furthermore the students enjoyed and experienced social interaction as team in the playful and competitive environment. Finally game based learning provides evidence that is powerful motivator tool to study and to deliver the learning materials.

As result the study demonstrated that most users preferred interactive multimedia in comparison to traditional paper maps. Moreover users who not familiar with computers preferred to use a game-like control, and with a 3D interface user’s cognitive load significantly decreased compared to a 2D interface. In general the study came out with conclusion that using a games approach provided in mapping Geographical Information Systems (GIS) products provided a better understanding of a real place than a conventional map.

3 Experiment Procedure
To verify proposed hypothesis, four games based-learning interfaces designed and built, first game introduced with text and speech only (TS), second was with text and earcons only (TE), and third game integrated with text, speech and earcons (TSE) and finally fourth game was with text, speech, earcons and avatar (TSEA). The users must use these four games (dependent group) and they have to decide which interface is the best and enjoyable through questionnaire where they have to write their feedback. Moreover four lessons rotated between the four platforms, each lesson kept the same amount of information. All four interfaces introduced to the users with selected topics from geology, lesson one was “what is volcano”, lesson two was “earthquakes facts”, lessons three was “types of rocks” and lesson 4 was “how oil is formed”.

4 Experimental tasks
Each user was provided with four tasks (questions) to perform in each platform. Tasks were moderate in terms of difficulty. Nevertheless, the system provided users with three attempts for every task with a built-in clock. Each user was allowed to take up to 60 seconds to complete the task.

5 Platforms Design

5.1 First interface: A game with text and speech only (TS)
In this experimental design the user has to read and listen to specific lesson and directly must go to tasks (questions) which are designed to be game. The mechanism of this game starts when the users click specific button to start the game, the first question appears as text with speech in the middle of the circle shape in the centre of the screen. As the user read and listen the question, straightaway the first answer comes out as text with speech in another circle on the top of the screen for about 3-4 seconds. As soon as the second answer becomes visible with text and speech in another circle, the first answer (circle) disappears and so on with the remaining six answers. The correct answers are distributed randomly within random circles in specific task. By fast click on the chosen answer, the system generates immediate feedback notifying if this was the right or wrong answer. The system automatically jumps to the next question if the user answer was right and all circles disappears, and if the user answer was wrong , the game continues until the maximum time consumed, prompting user to go to next question and the game starts over with the second task. This game can be seen as wall watch and the answers rotate in clockwise direction. Snapshots of proposed game showed in Fig. 1 (a), (b) and (c).

5.2 Second interface: A game with text and earcons only (TE)
As described in the first interface, the same design is repeated, but here speech was replaced with earcons and also the way the game starts here are differs from the previous game. In this game the user must click on the middle of the circle to see the questions and click on the tone button to hear the tone and
start the game in the same time, bearing in mind that the question tone will be heard only once by user.

The tone used in these earcons was generated by software called visual music, by half the tones to two portions, the first half allocated to question and the other half assigned to the answer. In this design the user has two ways to answer, first by reading the text only or by using or click on the tone button grouped with each circle or answer. The remaining first game procedures described and time restrictions were used with this game as well. Snapshots of proposed game showed in Fig.2 (a), (b) and (c).

5.3 Third interface: A game with text, speech and earcons (TES)

This game is similar to interface two, but speech was included. In this game the user must click on the middle of the circle to see and listen to the question and click on the tone button to hear the tone and start the game in the same time, bearing in mind again that the question tone will be heard only once by user.

Two ways are available to the user to accomplish the tasks provided, first by reading the text and listing or by using or click on the tone button grouped with each circle or answer. Other features exactly were equivalent to the first game design as detailed earlier.

5.4 Fourth interface: A game with text, speech, earcons and avatars (TSEA)

Fourth interface or game is a third interface enriched with an avatar. The avatar (sound and human like expressions) with the other modals (text, speech, earcons) used in this platform to introduce the edutainment aspects displayed simultaneously on the screen. Besides reading to the user the questions and answers, avatars are designed and targeted to entertain the learner by jokes, some funny expressions and gesture. These avatars were integrated with Crazy Talk V5.1 software with the author speech and personal and other friend’s photographs.

6 Results and Analysis

Overall 48 volunteers took part in the study, which was over 8 weeks mostly in the Bradford University research laboratory. All of users utilized the four lessons and four edutainment conditions (games). Both conditions and lessons were distributed randomly for each user.

6.1 Users Profile

Users mostly were aged 25-44 and 100 % were males. The average age was 36 years with a standard deviation of 25.46%. Users were generally high educated level, Doctoral degree was 45.65%, and Masters was 58.70%. In terms of area of study, 39.18% of users were from computing and informatics department, 21.74% were from engineering in general, whereas communication and networking were 15.22 %. The remaining users were from different schools and department. 100% are using computer more than 10 hours per week. Whereas 95.65% using Internet more than 10 hours per week. 4.35% of users only had excellent knowledge about Geology, 23.91% were good, 58.70% limited, and 13.04% had no knowledge at all. Users who had knowledge about e-learning were 28.26%. Concerning avatar 63.04% had not knowledge, 28.26% limited, 8.70% were good, 0% were excellent.

7 Tasks Achievement

Fig. 5 shows that the mean user achievement for TE, TSE and TSEA conditions was a little higher in comparison to TS platforms.

Respectively, the figures are 91.67%, 93.48%, 95.65% and 96.73. The proportion of users who completed their tasks was as follows: TS 79.17%; TE 86.96%; TSE 91.30% and TSEA 91.30%. Whereas users who do not completed their tasks were respectively 16.67%, 13.04%, 8.70% and 8.69%. In terms of each task on its own the mean percentage of students who completed the four tasks was identical in all conditions. In general enhancement is noticeable for the performance of student in task 2 in condition TE and also task 3 in condition TSEA which was 100%, but still the other conditions the results are comparable.

8 Satisfaction

As we know satisfaction is a measurement of user’s pleasure and enjoyment, this has been done throughout questionnaire provided. Likert five-point scale with 10-items as general feedback presented asking to express their agreement with standard statements [6].

The average score for condition TS was 67.13%, TE was 70.72%, TSE was 72.83% and TSEA was 86.12%, please refer to Fig. 6. In addition to standard statement, the Likert five-point scale enriched by extra 5 and sometimes 8 statements that also expresses user opinion scored as normal average shown in Fig. 7. In condition TS the average user score was 3.37, TE was 3.75, TSE was4.02 and TSEA was 4.53. Overall the results showed positive affect in condition TSEA.
Fig. 1 example of first game (a) the game when the first question appears (b) the game when the first answer appears (c) the game when the sixth answer appears.

Fig. 2 example of first game (a) the game when the first question appears (b) the game when the second answer appears (c) the game when the sixth answer appears.

Fig. 5 General user achievement for all conditions

Fig. 6 SUS Scale results
Discussion

The focus of this experiment was to investigate the user involvement whilst experiences the edutainment features in multimodal e-learning systems, this was throughout two quantitative aspects, in particular user achievement and user satisfaction score, bearing in mind that the experimental circumstances is controlled to guarantee the validity, either by the platforms rotation method used or by lessons distribution mechanism provided. The experimental dependent variables measurements have been managed in order to acquire accurate results, that is has been done by incorporate fitted time design in all systems, and webcam camera facilitated to capture users response and recording their other any expressions. The outcome reported was positive and the tests accomplished also resulted significant outcomes. Analyzed data collected award us many excellent points to be covered here supported with in depth explanation. Users in terms of tasks achievement progress were elevated; in general there were no big differences of average users’ achievement between all conditions, but the TSEA condition gained the highest average measured up to condition TS, TE and TSE. Respectively in condition TS was 91.67%, condition TE was 93.48%, condition TSE was 95.65% and condition TSEA was 96.73%. Whereas the users whom completed their tasks without any mistake was in condition TS was 79.17%; TE was 86.96%; TSE was 91.30% and was TSEA 91.30%. In general enhancement is noticeable for the performance of student in condition TSE and TSEA but still in condition TE result is not bad, where in condition TS less valuable. Nevertheless the figure showed also missing data in all experimental platforms which was also respectively 4.35%, 3.26%, 2.17% and 3.26%.

A comparison of SUS scores between all four interface systems, found subjects rated condition TSEA higher than the other conditions. The average score for condition TSEA was 86.12%, condition TSE was 72.83, condition TE was 70.72% and TS was 67.13%. Moreover the additional statements provided were also higher around 4.52 in condition TSEA, then condition TSE 4.02, condition TE was 3.75 and lastly condition TS 3.37. As result of the data analyses there is no doubt that the condition TSEA (The game with test, speech, earcons and avatars interface) was the superlative platform. The second platform was TSE (The game with test, speech, earcons interface), third position was for TS (The game with test, speech interface) and finally TE (The game with test, earcons interface) was the most undesired platform.

Conclusion

The focus of this experiment was to investigate users’ achievement and users satisfaction, where exposed to an edutainment in a multimodal e-learning environment through four different platforms in order to explore deeper the affect of entertainment in cumulative students’ enjoyment. The four “edutainment” environments evaluated here were TSEA (The game with test, speech, earcons and avatars interface), the second platform was TSE (The game with test, speech, earcons interface); third position was for TS (The game with test, speech interface) and finally TE (The game with test, earcons interface).

References:

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