FACILITATING EXPLORATORY LEARNING IN SCHOOLS THROUGH VIRTUAL WORLDS: EXPERIENCES FROM A COURSE RUN AT A SCHOOL

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ABSTRACT

The following paper examines the results of a research study in which a virtual world, Quest Atlantis (QA), was used to engage students in exploratory learning to teach about water quality issues. The main aim of the research was to find out how new digital learning environments and educational technology, such as virtual worlds, can be introduced in schools; what will be the response of the administration, teachers, parents and students; what could be the best teaching methodology for these digital learning environments; and what could be possible hurdles and hindrances. The research was comprised of comparison between different teaching methods based on student outcomes and the results of a survey which was conducted at the end of the study. The research was too big to include all results in this paper thus the findings of the survey and observations of the researcher are presented here. The survey was answered by students (N=33) and it included questions about the learning environment, perceptions about the learning process and problems that the students might have encountered during the study. During the study, the students were divided into three different groups, or classes, and each group studied using a different teaching method. Thus, there were three teaching methodologies or learning strategies: direct instruction and using QA; group discussions in class and using QA; and self-exploration using QA. The results are presented on an overall basis and also on the basis of these teaching methods as it could have influenced the answers given by the students. The results of the survey shows that majority of the students liked learning through the virtual world, Quest Atlantis in this case, and would like to continue using it both at home and at their school. Irrespective of the teaching method used, they perceived that they learned a lot about water quality and think that they could not have learned more in a traditional class. The biggest hurdles or problems reported by students were: working in pairs; wrong time to conduct this research; short session times; and technical problems related to computers and the internet.

KEYWORDS

Virtual worlds, digital learning environments, exploratory learning, teaching methodologies.

1. INTRODUCTION

Educators all over the world throughout the history have been striving to make the process of learning more engaging for the learners. For this purpose, educators also try to make use of any new technology especially those which are popular among learners. However, integration of those technologies into the settings of formal learning institutions, schools and universities, can be a challenge. Virtual worlds are one of those technologies for which many researchers have proved its potential for education. For example, Iqbal et al (2010: 3199) presented learning gains in virtual worlds as is presented by many researchers. Barab et al (2008), Barab et al (2009), Hickey et al (2009), Arici (2008) have shown learning gains when learners used the virtual world of Quest Atlantis (QA). Similarly, Ketelhut et al (2005) has also shown learning gains using River City.

However, many researchers have indicated that there are many obstacles which hinder the integration of virtual worlds in the school or university settings. Dickey (2011: 15-17) discusses that visual representation, security and costs were main hindrances as perceived by the teachers in his research. Klopfer et al (2009: 18) presents 9 barriers to adoption for learning games which are curriculum requirements, attitudes, logistics, support for teachers, assessment, evidence, uses of games, limited view and social and cultural structures.

Technical problems, steep learning curve, student security and university liability was identified to be the major concerns in Second Life (Woods, 2010: 105-108). Koh et al (2012: 56) found that insufficient time, limited resources, high costs, non-relevance to curriculum, reactions from parents and no or less support from school are key reasons for not using games in schools in Singapore as perceived by teachers. Ryan (2008), a PhD student at Lancaster University, presented sixteen ways to incorporate Second life into a classroom.

Most of this research is conducted in western countries. These problems could amplify or more problems can arise in developing countries. Here a study is presented which is significant as it compares different teaching methods and also because it was carried out in Pakistan to find out the relevant problems in integrating virtual worlds in a developing world context. This paper presents a research in which students learned in QA through three different teaching methods. The research was focused on comparison of learning gains and experiences between these three different teaching methods. Here we present the experiences of the students and hindrances that they faced which were collected as survey answers.

1.1 About the Virtual World

The virtual world used in this research is Quest Atlantis (QA) which is currently maintained under the Atlantis Remixed Project (Atlantis Remixed Project: Online). QA engages students in, what Atlantis Remixed Project team defines as transformational play through content that is comprised of online, in QA virtual world and on websites, and off-line activities. The Atlantis Remixed Project team claims to have demonstrated learning gains in science, language arts and social studies.

1.1.1 The Topic

The topic chosen for this research was water quality which is known as 'Taiga: the water quality unit' in QA. The researchers wanted to choose a topic which was unfamiliar with the students in Pakistan. None of the students who took part in this study had ever learnt about water quality although some of them were familiar with the concepts of pH, acids and bases. They were unaware of the effects that water quality can have on the ecosystem.

The learning takes place in QA at 'Taiga National Park' where the park ranger had asked the students to help him to identify the reasons for declining number of all species of fish in 'Taiga River' (Taiga Unit Plan: Online).

Figure 1. Map of 'Taiga National Park'.

Along the banks of Taiga River live three main groups of people. 'Mulu' indigenous people use the river to grow crops and raise different animals. 'Build-Rite Lumber Company' cuts and logs the trees in the park. Lastly, there is a fishing company, 'K-Fly Fishing Company', which arranges fishing tours. 'Taiga National Park' also has a ranger station, lab and 3 water monitoring stations as is shown in Figure 1.

The material used in this research was provided by the Atlantis Remixed Project team in 'Taiga Unit Plan' (Taiga Unit Plan: Online) which is available online.

1.1.2 The Missions

There are five missions in 'Taiga: the water quality unit' but due to time constraints it was decided that the students will try to solve first three missions including an introduction week to using QA. The educational year in most of the schools in Karachi, Pakistan, runs from April to March. This study started in January and as the final exams were approaching thus the school administration was not ready to give more time.

The first mission is called 'Getting a handle on Taiga' and in this mission the students meet with all the stake holders of the Taiga National Park. They talk with all of them and get their respective versions of the possible problems of water quality and who may be responsible for the situation. In doing this, the students start understanding that it's not as straight as it might look initially and that the situation is complex. At the end of the mission the students have to fix responsibility for declining population of fish.

The students continue to talk with different people in the second mission, 'Digging deeper', and take photos of Taiga River. Then they compare the photos taken and try to analyze them in order to come up with a hypothesis. Students learn about distinguishing between guess and hypothesis.

In mission 3 students collect water samples from three different sampling sites and then take it to the park lab to analyze it. This mission is called 'Building a case' and students learn about and analyze 6 water quality indicators which are pH, nitrates, phosphates, dissolved oxygen, turbidity and temperature. Based on the results of the analysis the students inform the park ranger about the group responsible for the problems.

2. METHODOLOGY

The research had mainly two parts. Firstly, to compare different teaching methods based on student out comes. In order to do this the students (n=48; 27 male, 21 female) were divided into three classes which were organized according to three different teaching methods. Teaching method 1 (TM1) had 16 students. Teaching method 2 (TM2) had 15 students. While, teaching method 3 (TM3) was comprised of 17 students. The teaching methods are briefed later in this section.

The second part was to get an insight into student's experiences by asking them to answer a survey. The total number of students who answered the survey was 33 (19 male, 14 female). Out of that, 13 were from TM1, 12 were from TM2 and 8 were from TM3.

Although, the survey was supposed to be conducted online but the teachers suggested that it will be easier and quicker to do it on paper. Thus, the students took the survey on paper and later on their answers were put in the computer.

Throughout the study the researcher observed the whole learning process and had many discussions with owners, administration and teachers.

2.1 Context of Research

The research was carried out in a privately owned school in Pakistan by a university in Europe (Nordic countries. The name of the institution is not mentioned to maintain the anonymity of the author). On the contrary to Europe, the schools in the educational sector in Pakistan can be divided into government-owned or privately-owned. Privately-owned schools in Pakistan are considered to be of better quality as compared to the government-owned schools. Therefore, mostly all privately-owned schools, except those run by non-profit or charity organizations, charge a monthly fee to meet their expenses and to generate profit on their investments. In return they provide better facilities, teachers and resources.

This context of research is important to mention here because the researcher had to convince owners of the school, administration, teachers and parents about the importance of the research in order to justify using the resources of the school. In this research, certificates of participation were given to the school, teachers

and students. The school was also given a complimentary gift by the research unit which conducted this study. The students were so enthusiastic when they heard about this study that they played a crucial role in convincing their parents.

Another aspect that has to be mentioned here is that the teachers and a group of volunteers went through a week of training period in which they used Quest Atlantis as the teachers were not accustomed to playing video games and/or using virtual worlds. This proved to be very helpful when the research was carried out.

2.2 Teaching Methods

All students who took part in the study were divided into three groups or classes and each group or class learned through a different teaching method or learning method. These three methods can also be called classroom implementation strategies. These teaching methods are mentioned as under.

2.2.1 Teaching Method 1 (TM1): Explanatory Instruction and Exploratory Inquiry-Based Learning in QA

In this teaching method the students (n=16) learned through traditional direct instruction method where the teacher explained the topic and the main concepts in the class. After that, students went to the computer lab to use QA in pairs in which they undertook the missions.

2.2.2 Teaching Method 2 (TM2): Group Discussion and Exploratory Inquiry-Based Learning in QA

The students (n=15) used QA in the computer lab in groups of two (pairs) however one of the groups had three students. Afterwards, the students went into class where they took part in group discussions where they discussed the topic in larger groups consisting of three to four students and then shared their understanding with the whole class.

2.2.3 Teaching Method 3 (TM3): Self-Exploration Through Guided Inquiry Instruction Using QA

There were 17 students who were divided into groups of two (pairs) however one of the groups had three students in this teaching method. The students learned through self-exploration by using QA on their own and they were allowed to ask questions and get guidance from teachers if they wish to.

2.3 Survey Design

The survey can be hypothetically divided into three main parts. As the survey was supposed to be taken at the end of the comparison study, thus the survey contained questions about the experience of learning through a virtual world, QA in this case. First question asked the students whether they liked learning through QA or not? They had to respond by choosing one of the following: 'yes, it was very fantastic', 'yes, it was good', 'it was ok', 'no, it was not good' and 'not at all, it was really bad'. Another question was 'would they like the school to continue using QA?' And they had to choose between 'no, not at all. It is useless', 'yes, it is very good educational software' and 'may be. I am not sure'. Thus, the students had equal positive and negative and a neutral statement to choose from. The students were also asked whether they would be using QA at home or not. They answered by choosing 'yes, definitely', 'yes, sometimes', 'no, never' and 'I do not know'.

The other part of the survey asked students about their perception of learning through QA. They were asked how much they perceive that they have learned in this research. The answer choices were: 'I learned a lot'; 'I learned something'; 'I did not learned much'; 'I learned nothing at all'; and 'I do not know'. Thus, the students had equal positive and negative and a neutral statement to choose from. They were also asked whether they would prefer learning through 'traditional class', 'through QA' or 'through a combination of traditional class and QA'. There were two questions related to this theme, one about the perceived learning benefit and the other about enjoyment.

In a question they were also asked about the features of QA that they liked. The features about which the students were asked about were: graphics; teacher guidance system; missions / quests; gaming elements; interface; customization of the avatar; story; topic; answering system and the learning process.

The last main part of the survey was about the difficulties, hurdles and hindrances that the students faced during the study. They were asked about the problems that might have occurred due to the way it was conducted. They were also inquired about the problems that they encountered in QA or technical problems about computers and internet.

3. RESULTS AND DISCUSSION

The total number of students who answered the survey was 33 out of the 48 students who took part in the research. The students mainly liked learning through QA in all teaching methods and they would like to continue learning from QA. Three questions specific to the missions in QA were also asked from the students in the survey but there results are not presented here as they do not fit in the theme of this article. Main results are discussed under the following sections.

3.1 About Learning Process in QA

The students were asked three questions about the learning process. First question inquired if they believe that they have learnt in this research or not. A total of 18 (54.55 %) students agreed that they had learnt a lot in this study which is more than half of the students as is shown in Table 1. Eight (24.24 %) students expressed that they learnt something. If we combine the number of students who expressed that they had learnt a lot with those said that they had learnt something, then the total number of students, 26 (78.79 %), who expressed that they learnt using QA is quite large. On the contrary, only 6 (18.18 %) students mentioned that they did not learn much. There can be many reasons for not being sure if they learnt something or nothing. One of that could be that the topic was totally unfamiliar to them and it was not covered in a tradition course book as is in Pakistani schools the curriculum is strictly taught through an assigned book. Thus, if they were not learning from a pre-assigned book they were not sure what and how much were they learning. Curriculum requirements are one of the barriers to integrate video games, and educational technology, as was indicated by Klopfer et al (2009: 18). Secondly, they were not made aware of the post-test results which they could have compared with their peers.

Students of TM2, 8 (66.67 %), were more sure that they learnt a lot than students of TM1, 6 (46.15 %), or the students of TM3, 4 (50 %). Thus, one can infer that group discussions in class do result in a belief that one has leant a subject. This could be because the students get a chance to share and adjust what they have learnt through discussing with peers.

Table 1. How much do you think you learned about water quality from Quest Atlantis?

	I learned a lot	I learned something	I did not learned much	I learned nothing at all	I do not know
TM1 (n=13)	6 (46.15 %)	3 (23.08 %)	3 (23.08 %)	0	1 (7.69 %)
TM2 (n=12)	**8 (66.67 %)**	3 (25 %)	1 (8.33 %)	0	0
TM3 (n=8)	4 (50 %)	2 (25 %)	2 (25 %)	0	0
Total (n=33)	**18 (54.55 %)**	8 (24.24 %)	6 (18.18 %)	0	1 (3.03 %)

The students were also asked to specify in which of the following methods they could have learnt the most about water quality: traditional class learning; learning through QA; or a combination of both traditional class and QA. This was asked to find out their preferences after taking a course which involved a virtual world, in this case QA. There were 32 students who answered this question. Majority of the students, 22 (68.75 %) as is shown in Table 2, expressed that they could have learnt the most through QA across all teaching methods. Students of TM3, 7 (87.5 %) out of 8, believed the most that they could not have learnt more than learning through QA. A majority of students of TM1, 8 (66.67 %), and TM2, 7 (58.33 %), also thought the same.

Table 2. In which of the following method do you think you could have learned the most about water quality?

	Traditional class learning	Learning through Quest Atlantis (Taiga)	Traditional class learning + Learning through Quest Atlantis (Taiga)
TM1 (n=12)	1 (8.33 %)	8 (66.67 %)	3 (25 %)
TM2 (n=12)	1 (8.33 %)	7 (58.33 %)	4 (33.33 %)
TM3 (n=8)	1 (12.5 %)	**7 (87.5 %)**	0
Total (n=32)	3 (9.38 %)	**22 (68.75 %)**	7 (21.88 %)

In a similar question to that of the previous one, the students were asked about the method in which they could have enjoyed the most while learning about water quality. Surprisingly, most of the students of TM3, 5 (62.5 %), expressed that they could have enjoyed most in the traditional class learning as is shown in Table 3. this could be because, as the researcher observed, the students of TM3 were very unsure about whether they are going in the right direction or not during the study. This created a sense of uncertainty in them. This could be because they are not used of learning outside the class, that too, from a video game or a virtual world.

Most of the students of TM1, 8(61.54 %), and half of the students of TM2, 6 (50 %), thought that they could have enjoyed the most while learning through QA. one can infer from these results that it is necessary to hold simultaneous explanatory lessons in class to keep the confidence of the students in their learning process.

Table 3. In which of the following method do you think you could have enjoyed the most about water quality?

	Traditional class learning	Learning through Quest Atlantis (Taiga)	Traditional class learning + Learning through Quest Atlantis (Taiga)
TM1 (n=13)	2 (15.38 %)	8 (61.54 %)	3 (23.08 %)
TM2 (n=12)	2 (16.67 %)	6 (50 %)	4 (33.33 %)
TM3 (n=8)	**5 (62.5 %)**	2 (25 %)	1 (12.5 %)
Total (n=33)	9 (27.27 %)	**16 (48.48 %)**	8 (24.24 %)

3.2 About Likeness of QA

The students were inquired if they had liked using QA during this research or not. About half of them, 16 (48.48 %), agreed that QA is fantastic (Table 4). Another 10 students, 30.30 %, expressed that it was good to use QA. Thus, if we combine both who said it was fantastic and those who said it was good then most of the students, 26 (78.79 %), liked using QA. The number was again low for the TM3 group as only 3, 37.5 %, who agreed that using QA was a fantastic experience.

Table 4. Did you like using Quest Atlantis?

	Yes, it was very fantastic	Yes, it was good	It was ok	No, it was not good	Not at all, it was really bad
TM1 (n=13)	**7 (53.85 %)**	4 (30.78 %)	1 (7.69 %)	1 (7.69 %)	0
TM2 (n=12)	6 (50 %)	4 (33.33 %)	2 (16.67 %)	0	0
TM3 (n=8)	3 (37.5 %)	2 (25 %)	1 (12.5 %)	2 (25 %)	0
Total (n=33)	**16 (48.48 %)**	10 (30.30 %)	4 (12.12 %)	3 (9.09 %)	0

In another question, the students were asked if their school should continue to use QA or not. Most of the students, 21 (63.64 %), agreed that the school should continue to use QA (Table 5). The number was highest in the TM2 group where 10, 83.33 %, agreed with the statement and it was lowest in TM3 in which only 3, 37.5 %, agreed.

Table 5. Do you think that your school should continue to use Quest Atlantis?

	No, not at all. It is useless	Yes, it is very good educational software	May be. I am not sure
TM1 (n=13)	2 (15.38 %)	8 (61.54 %)	3 (23.08 %)
TM2 (n=12)	1 (8.33 %)	**10 (83.33 %)**	1 (8.33 %)
TM3 (n=8)	2 (25 %)	3 (37.5 %)	3 (37.5 %)
Total (n=33)	5 (15.15 %)	**21 (63.64 %)**	7 (21.21 %)

The students were also asked if they would be using QA at home or not and 41.67 %, 10, chose 'yes, definitely' while 19.17 %, 7, chose 'yes, sometimes'. It means most of the students, over 70 % of them, take QA as a legitimate virtual world for leisure as well.

These results show that overall, with the exception of TM3, most of the students liked using QA and they think that it is enjoyable and schools should use it in future. However, the way it shall be used in schools shall be considered carefully as it can affect the satisfaction of the students.

3.3 Features of QA that were Liked

The students expressed their likeness for different features of QA in a question in which they had to specify their level of likeness for ten features which were: missions / quests; graphics; teacher guidance system; gaming elements; topic; story; answering system; learning process; customization of avatar; and interface. 28 students answered this question.   Most of the students (n=28), 18 (64.29 %) liked the missions/quests the most (Table 6). Graphics was liked by 17, 60.71 %, and teacher guidance system was liked by16, 57.14 %, students. The most disliked was the interface as 12, 42.86 %, students said it was ok and about 21.43 % said that they did not liked it much. The interface of any game, and virtual worlds, should be simple enough (Kohler, 2012) but it seems it was not in the case of QA. The same feelings were conveyed to the researcher by the students and by the teachers many times during the research. One of the reasons could be that the students and teachers were using a virtual world for the first time.

Table 6. How much did you like the following in Quest Atlantis?

	Very much	It was O.K.	Not much	Not at all
Missions/ Quests	**18 (64.29 %)**	9 (32.14 %)	1 (3.57 %)	0
Graphics	17 (60.71 %)	7 (25 %)	3 (10.71 %)	1 (3.57 %)
Teacher guidance system	16 (57.14 %)	10 (35.71 %)	1 (3.57 %)	1 (3.57 %)
Gaming elements	15 (53.57 %)	11 (39.29 %)	2 (7.14 %)	0
Topic	13 (46.43 %)	12 (42.86 %)	3 (10.71 %)	0
Story	13 (46.43 %)	7 (25 %)	2 (7.14 %)	6 (21.43 %)
Answering system	12 (42.86 %)	11 (39.29 %)	2 (7.14 %)	3 (10.71 %)
Learning process	12 (42.86 %)	10 (35.71 %)	5 (17.86 %)	1 (3.57 %)
Customization of the avatar	11 (39.29 %)	11 (39.29 %)	4 (14.29 %)	2 (7.14 %)
Interface	10 (35.71 %)	12 (42.86 %)	6 (21.43 %)	0

3.4 Problems and Hindrances

The problems that were mentioned in the survey can be largely divided into the ones due to the design of the research and the technical problems. The owner of the school, administration, teachers, students, 13 (39.39 %), and parents, all of them expressed to the researcher that it was a wrong time to conduct this research as final exams of the students were near and the school nor their students wanted to divert their attention as promotion of the students to the next grade depends on that. 14 students, 42.42 %, also mentioned that working in pairs was problematic. The main reason for that, as was mentioned by students during the study, was that the students could use only one QA account to proceed. The student having the other account was feeling left behind and some students tried QA from home to cover the difference. Students and teachers also complained about the short session times as was also mentioned by Koh et al (2012: 56). Each session was about 40 minutes long as per guidelines from Atlantis Remixed t team but it proved to be short on many occasions. It is recommended that each session shall be at least 60 minutes long for non-native speakers of English.

Most of the students, 16 (48.48 %), and teachers also complained about the slowness of the internet. Although, the internet had sufficient speed but the bandwidth proved to be lacking when all computers tried to access QA at the same time. This resulted in QA getting stuck many times or the answers not sent properly. The computers barely met the minimum requirements and had to be upgraded for this study which resulted in some spending for the school. The technical problems were also a cause of concern in Second Life (Woods, 2010: 105-108) and have to be sorted out to make the experience better.

4. CONCLUSION

This was an important study for many reasons. Firstly, it was one of the few researches that have been conducted in developing nations on the use of virtual worlds in education especially at schools. Given the Pakistani context, the research can prove to be very beneficial for future studies and can serve as a starting point to incorporate digital educational technology in schools. To do this, one must take into consideration the timing of research, the nature of school system, local context, curriculum and culture.

Mostly, students liked using virtual world in schools and would like to continue using it at their schools. However, the teaching methodology has to be chosen carefully to make sure the students are satisfied with the learning process and enjoy it too.

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