Interactive E-Learning with Integrated Virtual Reality

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Abstract- Computer technology has advanced to the extent that a vast number of people can interact with each other irrespective of their geographical location, made possible by the use of internet technology. One of the major breakthroughs with this advancement is the possibility of creating virtual classrooms for teaching and learning which is known as e-Learning. With E-learning approach, it is very easy to track the progress of students and they can learn at their own convenient time and place. Despite the fact that e learning is fast gaining recognition worldwide, it is not that popular with the education sector in Ghana. With the growing student population in Ghana, especially in tertiary institutions, the current infrastructure will not be enough to contain the students and the cost of building more infrastructures may deter some institutions from enrolling even deserving students. This makes it essential to adopt the e-Learning technology in Ghana. To ensure the learning is memorable and interactive, this research seeks to explore the use of scenario and engagement strategies with effective virtual reality techniques using All Nations University as a Case study.

Keywords- Virtual Reality, Interactive Learning, Scenario-Based Learning, Augmented Reality.

1. INTRODUCTION

Learning is the act of acquiring knowledge, either new knowledge or exploring and modifying an existing one. It is important to be coached or taught by experienced persons in an individual's area of interest to get better understanding and share ideas with peers of the same interest group. Traditionally, learning is done in a classroom where the instructor and students are physically present in a building to participate in the activities and interact with each other. Prospective students sometimes travel far and near to get educated in their chosen fields to gain more knowledge in these areas irrespective of the cost involved. Technology is fast advancing and becoming sophisticated especially in the process of learning. As technology advances, it has become necessary to equip students with adequate skills in order to cope in the community. In recent times, the knowledge people travel to look for is readily available online. Provided an individual has internet access, knowledge acquisition is just a click away. Because of this, educational institutions have taken this opportunity to provide a means of getting the traditional classroom learning experience in the comforts of the prospective students' homes irrespective of their geographical location, which is popularly called e-Learning. One thing that is necessary to consider with e-Learning is to maintain the interactiveness of the teaching and learning process by engaging students as though they are presents in a physical classroom 1.. For this reason, a lot of effort is being put into finding how best to implement this e-Learning technology. This research is to explore and contribute to the e-Learning community by exploring new virtual reality techniques in implementing effective e-Learning environment.

1.1 Creating Scenario-Based Learning

The following steps were proposed by Massey University of New Zealand's National Center for Teaching and Learning.

a. Identify the learning outcomes: It is important to identify what it is you want students to achieve on completion of the scenario, and then to work backwards from the learning outcomes to create the situation that will lead to this learning.

b. Decide on your format: Is your scenario going to be delivered in the face-to-face or online environments? What media (photographs, audio, video) and other resources will you need? If you are using an online scenario, will you provide other supporting activities, such as wikis, discussion forums, etc.?

c. Choosing a topic: Remember that non-routine tasks lend themselves to scenario-based learning. Consider using 'critical incidents' and challenging situations that have occurred in your subject area.
Identify the trigger event or situation: This will be the starting point of your scenario. As you create the scenario, identify decision points and key areas for feedback and student reflection. Creating a storyboard is an effective way to do this.

e. Peer-review your scenario: Ask colleagues to work through the scenario to ensure that it flows in the way you expect and achieves the outcomes you intended.

Scenario-based learning (SBL) is usually based using storylines around complex problems for students to solve. Students are usually required to apply their knowledge in the subject area, solving problems through critical thinking in a real world context. SBL is very flexible by giving students opportunity to come up with numerous feedback opportunities, based on the decisions they make at each stage in the problem solving process.

The aim of this research is to explore and identify best virtual reality techniques for creating a highly interactive and engaging e-Learning environment and also to develop a virtual reality based e-Learning environment by investigating and analyzing the needs of students and instructors for e-learning and factors affecting its adoption. Also, assessing why scenario based and engagement methods are of interest and how to use them effectively and exploring and coming up with virtual reality tools to enhance the engagement experience will be looked at.

2. RELATED WORK

Currently, we have Virtual Reality (VR) and Augmented Reality (AR). For VR, a user is made to experience a created environment, cutting access to the real environment 2. This is usually achieved through realistic 3D-images and stereoscopic sounds 3. Senses of touch and smell may also be simulated. AR comprises of overlaying the real environment with extra information. For instance, looking through special goggles which displays the size of an orange beside it when it is being looked at, or the distance of a particular object from a point, or information about an object in a museum displayed next to it when the user looks at it. That is, in the case of AR, there is a real object which has extra virtual information augmented to it.

Current e-learning methods involve logging in to a website, accessing reading materials and assignments, submitting assignments within a deadline, ability to ask direct questions to the online tutor. Some platforms support chat rooms, where e-learners can chat with each other as well as their tutors. Benefits include less infrastructure and funds needed to set them up, less funds needed to have an online education since travelling, accommodation and other costs are absent 4. Also one is able to learn at their own pace, and thus able to work or do other stuff alongside, which is a great benefit for part-time students. Requirement is to have a working internet connection, pc/laptop, basic computer skills such as creation of documents, browsing websites, sending emails etc. and a quiet spot where you can concentrate and work 5.

E-learning is gaining popularity fast in many developed countries. Some programmes run full blown certificate awarding courses online. Other platforms augment the traditional classroom learning. E-learning is a broader term encompassing online learning and other stuff. It falls under a bigger umbrella of Educational Technology.

Developing nations like Ghana have a much less widespread use of e-learning. This, of course, is mainly because of difficulty in accessing the internet. This problem is however fast declining. Generally low or lacking computer literacy is also a major factor. Currently, University of Ghana (UG) runs some sort of e-learning platform for the Distant Education students. These students however come to the University to write their end of semester exams when the regular students are on vacation. Sakai platform is also available for regular students for sharing of notes etc. KEWL was the platform that was used some time ago 6.

Come to think of it, the aforementioned platforms have not been much exploited by the students and lecturers. This may be because the stakeholders (students and lecturers) may not be readily willing to go through the extra training required to use these platforms. (The students would generally be forced to do so if the lecturers insisted). Also the lecturer may not see any extra benefit in using this platform, or may have a better alternative and as such would resort to not employing them. For (a) student(s) to convince a lecturer to use this platform would mean that the student has found significantly great potential benefits in using the platform 9. This would be a rare, but extremely remarkable situation. And this is what the proposed methodology seeks to address.
3. PROPOSED METHODOLOGY

This work is divided into four phases as shown in Figure 1 below. The processes involved are as follows:

**Phase 1:** This will involve data collection on needs of instructors and learners, identifying factors affecting the adoption of e-Learning, and analysis of learners’ behavior, their learning styles and the e-Learning application context.

**Phase 2:** This phase will involve development of effective e-learning methods to explore and come up with a more effective scenario-based learning as well as effective and efficient e-Learning engagement methods. Virtual reality concepts will be explored and integrated to make the learning experience exciting.

**Phase 3:** This is to evaluate performance of the developed methods to find out if they work efficiently as they are supposed to and perform assessment on the impact of the scenario-based and engagement method on e-learning.

**Phase 4:** This phase will deal with ethical issues involved with gathering and use of information to ensure that information retrieved is used and disseminated solely for the intended purpose to ensure that it is not abused.

The virtual learning architecture is illustrated in Figure 2 below. The system consists of a scenario-based e-learning model where contents are represented in scenarios as (story, pictures, videos) and into visualizations with the help of a virtual reality headset. An instructor authoring tool is designed for instructors to create effective slides that can accommodate class exercises and as a template for instructors even without programming knowledge to create e-learning contents. This information will be fed into the system so that the design of the system will be more suitable to its learners. The administrator module Learners can connect to the system and access uploaded tutorials and other teaching materials experiencing virtual reality visualizations of the contents of the materials uploaded. The Web Services are used for searching and making available the learning objects in the repositories in the e-learning system.

![Fig. 1. Proposed System Architecture](image1)

**Fig. 2. Virtual Learning Architecture**

In order to be able to properly address issues in e-learning implementation, it is expedient to know the exact outcome of the e-learning procedure, especially juxtaposing with the traditional classroom learning.

- For knowledge of course content, it must be 100% for both methods.
- Skill development is often necessary, and methods of developing skills under a particular course content also result in better retention of the course content (knowledge content).
- It may prove a challenge trying to develop skills in technical courses via online learning platforms, for instance, the inability to participate in Chemistry or Mechanical Testing Labs.
- It is uncertain to what extent it would help by watching these practical lab experiments in action via YouTube videos etc., as opposed to performing it oneself.
- Do-It-Yourself (DIY) at home practical works would be quite suitable but getting DIY equivalent of expensive lab equipment may not be possible.
Virtual Reality (VR) then could be looked at. It must be tested/ determined however, how much significant improvement this would have over watching of videos.

- Some students seem to need constant attention, reprimands, scolding before they would sit to study a course properly. How can such students be handled under e-learning?
- Would there need to be equivalent intimidating agents to keep them on their toes?

Else the content must be so much engaging to the student that they would themselves be in a hurry to carry it out. Now one of the major considerations is person-to-person interaction10.. Friendships and interactions as a result of classroom learning shape a person's thinking and lifestyle. With this opportunity virtually absent for e-learning, how can the lack thereof be addressed?

- Maybe the online learning should be such that a "class" of say 20 e-learners agree to work at specific times. In this way, there is a pseudo classmate interaction as well as online tutoring.
- Or can we say students having the ability to chat via chat rooms provided on e-learning platforms could be enough?
- Or can we just ride this off as the only disadvantage (if it may be seen as such) of e-learning and conclude that the missed interactions are not really essential?

The above observations would help create a better e-learning environment for students to engage in class activities properly. Some advantages of integrating virtual reality into e-learning environment are as follows. The following are some benefits of the proposed system.

Virtual reality creates a unique experience cannot be possible in a traditional classroom environment. It's just like living in a digital world and exploring different realities and encountering high-quality visualizations11..

Since it is a new technology which allows for an experience of a new reality, it stimulates interest in the learners thereby, making them focus on what is being taught through the use of the virtual reality. This is a great source of motivation for students to learn12..

Students will feel tempted to boast about their experience with virtual reality technology to others, so they will gladly engage in any learning activity that comes with virtual reality.

Unlike how students feel pressured by numerous assignments and tests in traditional classroom system, virtual reality experience will be more fun when viewing amazing visualizations and animations through their VR headset.

4. EXPECTED OUTCOME

The implementation of the above is expected to achieve great results for both students and lecturers in All Nations University College (ANUC) who will be engaged with the system. Already students are engaged in some online sessions where they are able to meet their instructors and other teaching assistance with help of the interactive online software. This has opened a new frontier in the university, getting students from other regions to have learning materials and other resources online. With virtual reality been introduced into the system, it is anticipated that students will be able to achieve the following in the classroom and the laboratory.

Classroom: The virtual classroom will play a significant role in the learning process reproducing conditions developed in a real university classroom. Students will be engaged to participate in the learning process, in which they have direct access to the educational material (images and text) through their interaction with a virtual lecturer. The educational material is presented by the virtual lecturer through a virtual board to students who gather at a particular designated location. The idea here is to try as much as possible to replicate what transpires in the classroom or lecture room so students are able to interact with the system.

Laboratory: The lab sessions are a little advance compared to the class / lecture session. This is due to the fact that students and instructors will be engaged more in such sessions. The laboratory engineering students will need to employ multi modal interface with holographic videos and images to aid the understanding of students. The key role is to allow students to attend virtual lab session via connected to the internet with little gadgets. The student is able to stop a particular video and take apart all part of a particular module i.e. an engine block and study the parts on see how these parts look like in real terms to aid their understanding.
5. CONCLUSION

With the full implementation of a virtual reality e-learning system in place in ANUC, student absenteeism will be a thing of the past. The system which student have showed interest and enthusiasm in some modules being piloted by the departments of computer science, electronics and communication engineering and computer engineering, had gain ground as students who took part in the pilot program expressed much excitement as it presented a new approach to their study and learn modality outside the classroom and allowed them to learn voluntarily on their own.

Students and lecturers are able to interact without necessarily being in the classroom and assess each other's work, especially that of the students. Challenges and issues that came up as the system was being implemented during the pilot basis are, the challenges to implementing ANUC e-learning and virtual reality amiss low or poor bandwidth to support the hosting or courses online, inadequate IT infrastructure, inadequate IT skills of some lecturers to integrate the traditional learning with the new approach, inadequate funds for implementation, inadequate IT staff to support the system, low motivation for lecturers to integrate with traditional methods of teaching and learning, high cost of accessibility of virtual system and hence an installation in at a central point called virtual hall. The piloted system could not yield much results in the face of the above challenges but ANUC will need a different approach to meet all these challenges and transform the institution into one of the leading universities in the country and the continent at large.

However, these challenges notwithstanding, and with a better ICT policy on eLearning approach at ANUC, they have a high chance of getting lots of student from across the continent as more students will like to enroll with their virtual reality class. This will bridge the barrier between their counterparts as they provide these learning centers fitted with these virtual reality halls to bring education closer to the new and discerning students.

REFERENCES


