Augmented Reality Based Computer Science Learning

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ABSTRACT

Education is the cornerstone upon which civilized societies are built. For thousands of years, education has been improving using various technologies. From word-of-mouth and stone tablets to books and computers, people are always trying to find innovative new ways to pass on information to the next generation using the technology of their time. Well, technology has progressed by leaps and bounds over the last half century, and people are just now catching up antiquated educative practices to better mesh with existing technologies. In 2022, online learning and online school are already commonplace, but is this the end-all of technology in the classroom? This project is aimed to discover what new possibilities are out there with the cutting-edge world of Augmented Reality (AR) and especially how it relates to education and teaching people more effectively.

1 INTRODUCTION

The technology to achieve AR even for the modest consumer has been around for over a decade by now. However, very little progress has been made as far as a mainstream adoption of AR technology in the classroom is concerned. AR technology has tremendous potential for "rapid information transfer" [5] which is essentially the textbook definition of education. AR technology may also be considered more exciting by students than a typical textbook reading and so it has the possibility to boost students' interest and interactions in a classroom. Not only this, but assignments and exercises can be made that were previously unthinkable. Think of a physics assignment that is trying to teach you about pulley systems. A textbook may have a few pictures and many paragraphs of text about these pulleys. But an augmented reality assignment could bring the pulleys to life, allowing you to really see what it looks life in real life without the need for setting up an experiment. This extremely simple example is just one of effectively infinite possibilities of using AR to better educate and engage with the world's students.

This project will aim to allow students to place 3D objects using AR to assist with education. This project will contribute a free, open-source way for teachers to increase interactivity in their lesson plans. It is the hope of this project that increasing the interactivity of lesson plans through the use of AR will cause an increased amount of interest and knowledge retention in students.

2 RELATED WORK

There has already been many applications and experiments concerning AR in an educative environment. As discussed by Kesim and Ozarslan, there are many different technologies in which AR or VR can be delivered. Head-mounted displays, handheld displays, and pinch gloves are all common ways of interacting with these technologies [3]. This paper discusses the possibility of "textbooks [becoming] dynamic sources of information." [3] With the technology available, "any existing book [can be] developed into an augmented reality edition." [3] This idea to take a traditional form of information dissemination and add on to it is using AR technology is what this project is based on.

A study performed in 2008 by Freitas Campos showed that AR in children's education suggested that it "is effective in maintaining high levels of motivation among children, and ... has a positive impact on the students' learning experience, especially among the weaker students." [4] This study followed 54 students between 7 and 8 years of age, and broke them into 2 groups, one who would be given a traditional lesson and one who would be given a lesson with the help of the AR technology. This study found that students' motivation was extremely high when using the AR technology, and students who were in the group that used the AR technology had a larger increase in test scores before versus after the experiment. This type of experiment is very similar to what I will be performing to determine if my application helps to increase knowledge retention and motivation.

AR in education has already been applied to a wide range of topics. Topics including astronomy, chemistry, biology, mathematics, and physics have already had applications developed that incorporate AR learning into a traditional educative environment. [2] It was found that in most of these cases, AR learning provided an increase in interest into a topic by would-be learners. It is thought by Kangdon Lee that AR in education has a vast potential to engage students moreso than other traditional ways of teaching.

3 METHODOLOGY

For this project, I will be performing a questionnaire after allowing 2 groups of adults to learn a concept. One group of adults will be learning a concept in a traditional fashion, through watching a lecture. Another group of adults will be learning in a more modern fashion, a lecture in conjunction with the AR application that is being developed. After each group of adults has finished, a questionnaire will be given that tests their understanding of the concept taught. This questionnaire will undergo statistical analysis using chi-square to determine if there is a significant difference in understanding between groups of adults.

The specific details of this user evaluation are as follows. The concept that will be taught will be how to draw control flow graphs from a specific (small) piece of pseudocode. There will be between 5 to 10 adults per group. Each group will be given 30 minutes of instruction time. The first group will only be given a lecture video to watch. The second group will be given a lecture video to watch, and the AR app in development. After 30 minutes, each group will be given a questionnaire that tests their understanding of how to draw control flow graphs. These questionnaires will also contain subjective questions about how motivated they felt, if they enjoyed the experience, and if they were paying attention or were bored. These questionnaires will then be analyzed to determine if either group performed better, and if any other conclusions can be made.

4 CONCLUSION

All in all, this project aims to serve students that are not engaged by traditional methods of teaching and show them that learning can be fun. The introduction of AR into educative environments provides a great potential for furthering lesson plans into the future. This application will be developed, and then an experiment involving 2

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groups of adults will be done to determine if this app could possibly be a help to any teachers.

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