Benefits of Using Virtual Reality Glasses for Chemistry Lessons

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ABSTRACT

This study aimed to evaluate virtual reality's impact on school students and analyze personal efficacy, self-esteem, and interest in an introductory chemistry course. We used a mixed-methods approach to improve our understanding of how these factors mediate pupils learning. The findings showed that the use of the virtual reality application positively impacted students' personal efficacy, self-esteem, interest, and anxiety. The implications of these findings speak to the potential value of using virtual reality applications in higher education, especially in situations where distance learning is the only option and where the costs of real laboratories cannot be afforded.

Keywords: Virtual reality, chemistry lesson, MEL Chemistry.

Introduction

We know that nowadays it is very difficult to surprise and interest the students just by standing in front of the blackboard and passing the lesson. To achieve this, the teacher only needs to know the subject. In addition to the specialty subject, the teacher is required to know psychology, pedagogy, and VR technologies. Because today's young people are interested in VR technologies and like them.

Since the gaming industry debuted affordable head-mounted displays (HMDs) like the HTC Vive, Oculus Rift, and Sony's PlayStation VR in 2016, virtual reality (VR) has grown in popularity [1]. The market income for the United States alone has increased by almost nineteen times over the past four years, from $ 62.1 million in 2014 to $ 1,160 million in 2018, and experts project that this growth will continue for another six times during the ensuing four years [2]. In addition to improving the gaming experience, VR has grown in popularity due to its adaptability. Target audiences including astronauts [3], software developers [4], real estate agents [5], and students in primary and secondary education [6] have all seen the emergence of VR labs in recent years. VR has a number of intriguing applications, particularly in the fields of training and education. Schools and universities are increasingly embracing virtual reality to train workers, in addition to businesses like Walmart and United Parcel Service [7,8]. For instance, the website Virtual Reality for Education provides information to educators. Several application possibilities in fields including astronomy, physics, engineering, biology, aeronautics, and aerospace are mentioned in the section on how to plan VR field excursions and VR tours [9].

Additionally, VR provides educators with chances like immersive introductions to philosophical concepts [10], instruction in the design of buildings [11], and remote learning that seems more immersive [12]. Researchers have emphasized the significance of constructivist learning methodologies in higher education, emphasizing experiential learning in particular [13], for which virtual reality (VR) could be an effective teaching tool. Experiential learning addresses the need for more than just

passive learning in the development of complex skills, therefore educators are increasingly looking for ways to restructure their curricula. Due to time restrictions or a lack of support staff, educators rarely integrate VR into their curricula, even though technology would enable students to actively participate in the learning environment and not just passively observe [14]. Researching the design and application of information technology is one of the main objectives of the Information Systems (IS) field, therefore IS researchers are faced with the task of figuring out how to effectively deploy and use VR in higher education. A search for "virtual reality" and "education" in the AIS electronic library yielded only eight hits for peer-reviewed conference papers and journal articles, despite Walsh and Pawlowski describing VR as "a technology in need of IS research" [15] more than ten years ago.1 Only Walsh developed design proposals for VR-based learning from these publications [16], and in doing so, he concentrated on technical issues like bandwidth and noise and how they affected learning, so there is still a dearth of social or organizational VR research [15].

This work-in-progress article presents findings from a design science project that intends to create a conceptual framework for the planning and application of virtual reality in education and to assess the framework through several field experiments. Based on the research of the literature, we identify and categorize the most often utilized design features for educational VR applications and show preliminary project outcomes. We also talk about how much these components help people learn skills like communication, problem-solving, procedural and declarative knowledge, and others.

Methods. At first, interested students were told to prepare for class and study d-orbital species. All interested and non-interested students could not explain the types of d orbitals in class. Although the most interested students were prepared for the topic at home, they could not explain the essence of d orbital types. In this situation, it was necessary to explain to the students the shape of the d orbital, and the trajectory of the electron. Therefore, the most optimal solution here is visualization. d orbitals were created in Blender and explained to students in VR glasses. The participants were 14 teenagers who were interested and uninterested in chemistry. The students followed theoretical lectures about the shapes of d orbitals during the lesson. Students can't answer to the question, What is the meaning of d_{yz}, d_{xy}, d_z^2, d_{xy}, d_x^2-d_y^2?". For this reason, firstly I make the shape of a d orbital with the program called Blender.

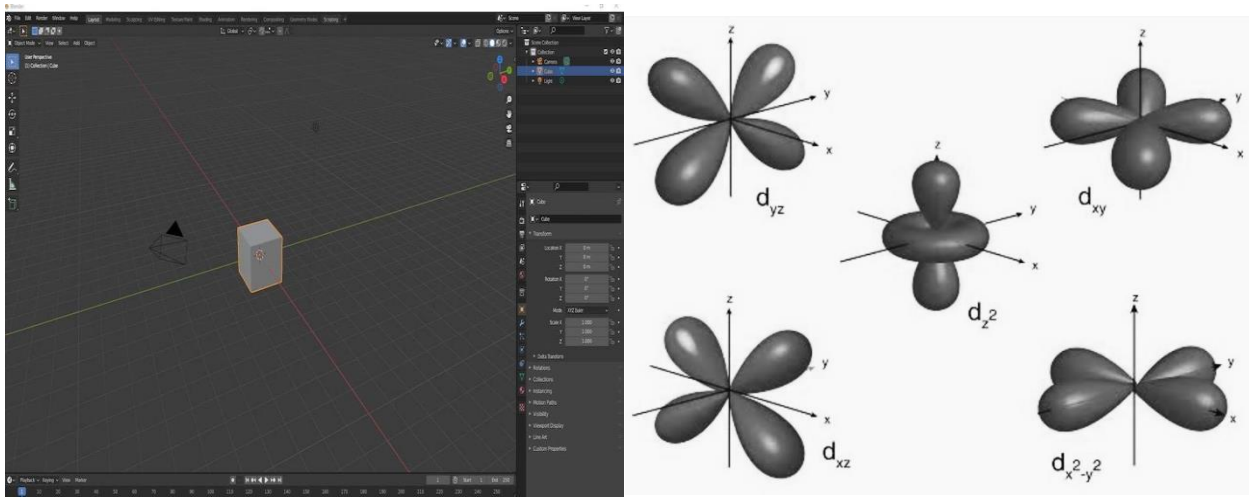

Figure 1. Screenshot of Blender desktop.

In this program, we can show the trajectory of the electron in the x,y, and z axes.

Secondly, we use the program MEL chemistry. MEL chemistry lessons were used to give

students a better understanding of the subject. Topics are explained very well in this program. But this program has only basic topics. The participants were 14 teenagers who were interested and uninterested in chemistry. The pupils followed theoretical lectures during the first week and completed solving examples in the second week. The course started with a practical on using the VR application. Firstly, we chose VR Shinecon glasses and downloaded the MEL chemistry program to the smartphone. VR Shinecon can work only with a smartphone. We chose this device for its cost. This device is cheaper than other devices.

Figure 2. Screenshot of MEL Chemistry desktop.

Result and Discussion. Overall, the findings showed that students started the study with high interest, in addition to high personal efficacy, and self-esteem, that was sustained over the course of the lesson. Moreover, the findings revealed that students started with relatively lower levels (medium level) of lab anxiety, which decreased by the end of the week. Since we were only able to measure these variables before and just after the course was complete, one can interpret these changes as a result of the combination of using VR as a pre-laboratory learning tool with the traditional lab sessions. Students who saw the topics in virtual glasses were able to explain the topic better. When students can explain a topic, they have a complete understanding of the topic. During the explanation, there was hardly any excitement in them. A student who is not interested in reading will understand the topic if he sees it in virtual glasses. Then he can explain. As a result, he became interested in science.

Conclusion. A person who can explain the theme to others understands about 90% of the theme. Kinesthetic learners who had difficulty understanding chemistry lost their fear after explaining the subject. As a result of the research, students' fear of chemistry disappeared and their interest in chemistry increased.

Literature.

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