ISSN- 2394-5125 VOL 08, ISSUE 03, 2021

VIRTUAL REALITY'S INFLUENCE ON EDUCATION

Jagvinder Singh[1], Rajveer Kaur[2]
[1,2]Guru Kashi University, Talwandi Sabo

ABSTRACT

In the education process, students face problems with understanding due to the complexity, necessity of abstract thinking and concepts. More and more educational centres around the world have started to introduce powerful new technology-based tools that help meet the needs of the diverse student population. Over the last several years, virtual reality (VR) has moved from being the purview of gaming to professional development. It plays an important role in teaching process, providing an interesting and engaging way of acquiring information. What follows is an overview of the big trend, opportunities and concerns associated with VR in education. We present new opportunities in VR and put together the most interesting, recent virtual reality applications used in education in relation to several education areas such as general, engineering and health-related education. Additionally, this survey contributes by presenting methods for creating scenarios and different approaches for testing and validation. Lastly, we conclude and discuss future directions of VR and its potential to improve the learning experience.

Keywords: virtual reality; education; immersive education

I. Introduction

The term education generally refers to the process of facilitating learning, acquiring knowledge, skills or positive values. The main goal of education is to prepare students for life, work and citizenship by training their knowledge and skills deemed necessary in the society. The educator's task is to improve qualifications, competencies and skills of graduates during the education path. Usually, classes are divided into two parts: theoretical and practical, such as exercises, laboratories or internships (Makransky, & Petersen, 2021). Theoretical courses consist of knowledge transfer in the form of lectures among a large group, which may contain discussions. Over time the needs of students and the the labour market forced changes in the education system. Basing of the wisdom of Confucius who said, "Tell me and I forget, show me and I may remember, let me take part and I understand", the practical part had been made a priority

VR is a powerful tool in supporting and facilitating learning and teaching processes. Many surveys and reports show that most students remembered what they saw in VR and concluded that VR is a more memorable environment than laboratory-based demonstrations. Ultimately, the laboratory-based method (a less efficient form of learning) results in deficiencies in fundamental knowledge and practice of graduates, which may lead to an inability to react to challenges that arise in future workplaces. An innovative method for teaching and learning based on VR is proposed to tackle the problems. One of the main challenges in providing quality learning experience is to access relevant resources, which is associated with additional expenses. In their daily practice, teachers frequently face unavailability of modern technologies that are currently in use on the market, such as expensive tools used in robotics, electronic components, chemical reagents, medical materials, etc (Bower, *et al.* 2020). Thus, their replicates in the form of 3D models with identical physical properties

ISSN- 2394-5125 VOL 08, ISSUE 03, 2021

transferred to VR technology may be applied mainly in developing communities and countries around the world. VR environment allows educators to conduct learning activities which are difficult to implement during regular laboratory lessons. What follows is an overview of the big trend, opportunities and concerns associated with VR technology in education.

II. Evaluation Methods

New implemented application should be tested among relevant stakeholders and specified number of potential users. The product should be evaluated, taking its functionality, effectiveness and capabilities into account. In 1996, John Brook presented System Usability Scale (SUS), which provides a reliable tool for measuring the usability. SUS consists of 10 item questionnaire with 5-point scales numbered from 1—strongly agree, to 5—strongly disagree. Based on the research, a SUS score above 68 is considered above the average and anything below 68 is below the average. Since then, it has been a widely used tool, as evidenced by the number of citations of the article. Unfortunately, although the tool is available, well-described and easy to use, there are precious few VR applications that are not evaluated or not evaluated enough. Based on this baseline, it would be necessary to develop SUS for VR and adapt it to the educational applications (Zhao, *et al.* 2020). Very often, testing procedure ends with several evaluating questions, less general or tailored for the purpose of specific application. For example, in, the authors presented an interactive training strategy for mechanical and electrical engineering education. The application was tested by a group of 60 students (20 male and 40 female) who did not have any previous experience with VR. During a single session, the student was supposed to go through each of the available exercises and complete the interview. A similar test was conducted among 15 academics. To investigate the long-term effects of their software, the authors conducted a study among sixth and seventh-grade students who took part in seven one-hour sessions over two weeks. The questionnaire, which included ratings and open questions, was divided into two parts: the first part focused on students' experience, and the second part was straight connected with the main goal of the study: a character customisation. Both parts were conducted twice, once at the beginning and once at the end of the experiment. The results showed how the presence or absence of character customisation might influence a learning system (Hernández-de-Menéndez, *et al.* 2019). Another comprehensive evaluation is presented where the authors examined the influence of VR field trips on middle school students' social studies academic achievement and motivation. The experiment was conducted among 76 seventh grade students from two different middle schools who participated in social studies instruction, using either the traditional lecture method or a VR system. All participants were assessed using the Instructional Materials Motivation Survey, and their teacher designed social studies test. The results demonstrated that students using VR obtained scored significantly higher than students educated in a traditional method on both their academic achievement and motivation.

III. Challenges and Issues

It was proved repeatedly that VR has great potential for positive educational outcomes by providing more engaging environment stimulating various perception points. Although, as long as it is a new delivery method for knowledge, it lacks the more in-depth research. In this section, we present VR advancements in education and summarise the most important issues and drawbacks of using VR technology as an educational tool. The majority of modern existing VR solutions are based on HMDs, which provide a total immersion through 3D

ISSN- 2394-5125 VOL 08, ISSUE 03, 2021

virtual environment imitating the reality. According to King, *et al.* 2018, one of the key issues that should be addressed in the very near feature is the lack of visual realism and realism of the dynamics and interaction. It can be concluded that existing techniques used to generate VR graphics and displaying technology are quite limited. Note that, psycho-visually, the human brain's construction allows us to detect even small unrealistic details, which can easily break the immersion. Thus, in the creation of the VR world, maximising the appearance of reality is an ongoing challenge. Realistic VR environments require computationally powerful hardware for rendering, which goes hand in hand with the price. According to Samadbeik, *et al.* 2018, high costs of developing or purchasing a VR system is a significant hurdle to overcome. Currently, tools providing high-end VR experiences, such as Oculus Rift or HTC Vive cost approximately $400–600, respectively; they should be supported by computationally powerful PC, which is still a relatively expensive alternative to conventional methods of teaching. However, using HMDs bright immersive VR experiences into the homes and classes with much lower cost and space requirements than previous generations of VR hardware (Liu, *et al.* 2020). VR technology is under constant development, seeking low-cost, wearable solutions for the mass market. Professional technology companies provide products that incorporate mobile phones. For example, Samsung Gear VR, Google Daydream, or a more low-end Google Cardboard, are more accessible than the above mentioned high-end solutions (e.g., HTC Vive or Oculus), they do not require an additional computer, only a low-cost headset with a phone. However, experiences or simulations generated on mobile may not match the ones generated on a PC concerning immersion. Additionally, the mobile solutions have minimal interaction capabilities in comparison with what is achievable with high-end solutions. Nonetheless, the trade-off between accessibility and price might be the key factor in using the mobile solutions by a wider audience. Educational simulations might not require the highest available quality but are rather based on the content of the experience and possibility to provide a large number of headsets for a class of students at a significantly lower cost compared to high-end HMDs. Human factor and physical side effects are another issues. Recent reports suggested that the use of HMDs may have unwanted physical/physiological side effects such as anxiety, stress, addiction isolation and mood changes (Lee, *et al.* 2020). Further, simulated motions can affect one perception of time and space, inducing dizziness and nausea, called VR sickness or cyber sickness. For instance, 150 subjects were tested in an immersed virtual environment for 20 min; 61% of subjects reported symptoms during 20-min immersion and a 10-min post-immersion; 5% percent of the subjects had to withdraw from the experiment because of severe symptoms. The authors suggested the use of adaptation and the anti-motion sickness drug to reduce this kind of side effects. HMD worn on the head, due to unnatural postural demands, may have a negative effect on dissociation of accommodation/convergence and cardiovascular change. However, there are only a few scientific studies presenting clinical trials on the effect of using HMDs. Notably, most of the scientific experiments were carried out using very early HMD technologies. Due to the technical advancements in HMD technology, new investigations are required in this domain. Furthermore, every man is unique and may have different perception; therefore, scenarios preparing for education, especially for kids or handicapped should be accurately examined and evaluated, consulted with professional psychologists and educators

IV. Conclusions

The education system has been evolving for centuries. It has always adapted to the available technology and needs of the students. We are now on the threshold of another development and it is a duty of scholars,

ISSN- 2394-5125 VOL 08, ISSUE 03, 2021

educators and teachers to embrace it and prepare for it. The generation that is starting education right now has been online for whole their lives. Digital world is as important and immersive as the real one. They are digital natives, born onto the world of mobile phones, omnipresent Internet and immediate access to most of desired information or data, is it music, video or content. Educating Generation Z is a challenge and it requires a completely different approach to maximise efficiency and engagement. There are numerous proven advantages of using VR technology in education (Makransky, &Lilleholt, 2018). First of all, VR provides outstanding visualisation, which cannot be obtained in traditional classroom. It reflects the world that young generations feels comfortable in. It is inclusive, allowing everybody, everywhere, regardless of status, financial situation and disability to participate in education process. It gives virtually unlimited access to information, books or articles. Modern technology used in classroom increases engagement, stimulates cooperation and involvement. It is used for highly efficient blended learning, encouraging self-study and individual pursuit of knowledge. Although using modern technology in education environment is clearly beneficial, it is not without risks or dangers. One of the main issue is the lack of flexibility. During traditional classes students may ask questions, receive answers, and take part in this discussion. Using a virtual reality headset with specific software, the students have to follow the rules and are not able to do anything else except what they are supposed to do. Some educators are naturally resistant to change and their involvement and active participation is crucial for successful introduction of technology into the classroom. Others might tend to over rely on technological developments, leading to lack of teacher–student interaction (Shen, *et al.* 2019). A human teacher is also a natural filter and moderator of information acquired by students, absolutely necessary to assess validity and relevance of obtained data. What is more, focusing too much on digital education solutions might distort the balance between teaching hard and soft skills, to the big advantage of the former, while the latter remains very important in the modern workplace. Although we might be tempted to replace all old-fashioned solutions with modern digital ones, there must be an equilibrium between state-of-the-art solutions and human interaction, mentoring and teacher–student relationship.

V. References

Bower, M., DeWitt, D., & Lai, J. W. (2020). Reasons associated with preservice teachers' intention to use immersive virtual reality in education. *British Journal of Educational Technology*, *51*(6), 2215-2233.

Hernández-de-Menéndez, M., Vallejo Guevara, A., & Morales-Menendez, R. (2019). Virtual reality laboratories: a review of experiences. *International Journal on Interactive Design and Manufacturing (IJIDeM)*, *13*(3), 947-966.

King, D., Tee, S., Falconer, L., Angell, C., Holley, D., & Mills, A. (2018). Virtual health education: Scaling practice to transform student learning: Using virtual reality learning environments in healthcare education to bridge the theory/practice gap and improve patient safety. *Nurse Education Today*, *71*, 7-9.

Lee, H., Jung, T. H., tom Dieck, M. C., & Chung, N. (2020). Experiencing immersive virtual reality in museums. *Information & Management*, *57*(5), 103229.

ISSN- 2394-5125 VOL 08, ISSUE 03, 2021

Liu, R., Wang, L., Lei, J., Wang, Q., & Ren, Y. (2020). Effects of an immersive virtual reality-based classroom on students' learning performance in science lessons. *British Journal of Educational Technology*, *51*(6), 2034-2049.

Makransky, G., &Lilleholt, L. (2018). A structural equation modeling investigation of the emotional value of immersive virtual reality in education. *Educational Technology Research and Development*, *66*(5), 1141-1164.

Makransky, G., & Petersen, G. B. (2021). The cognitive affective model of immersive learning (CAMIL): a theoretical research-based model of learning in immersive virtual reality. *Educational Psychology Review*, *33*(3), 937-958.

Samadbeik, M., Yaaghobi, D., Bastani, P., Abhari, S., Rezaee, R., &Garavand, A. (2018). The applications of virtual reality technology in medical groups teaching. *Journal of advances in medical education & professionalism*, *6*(3), 123.

Shen, C. W., Ho, J. T., Ly, P. T. M., &Kuo, T. C. (2019). Behavioural intentions of using virtual reality in learning: perspectives of acceptance of information technology and learning style. *Virtual Reality*, *23*(3), 313-324.

Zhao, J., Xu, X., Jiang, H., & Ding, Y. (2020). The effectiveness of virtual reality-based technology on anatomy teaching: a meta-analysis of randomized controlled studies. *BMC medical education*, *20*(1), 1-10.