ISSN: 2583-7354

International Journal of Emerging Knowledge Studies

Publisher's Home Page: https://www.ijeks.com/

Fully Open Access Research Paper

A STUDY ON THE EFFECT OF VIRTUAL REALITY SCIENCE MODULE ON OBSERVATION SKILLS OF HIGH SCHOOL STUDENTS

Mrs. R Premalatha[1*], Dr. Indu H[2]

[1]Researcher Scholar, Department of Education, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, India.

[1]Professor, Department of Education, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, India.

*Corresponding Author: rpremalatha93@gmail.com

Article Info: - Received : 15 December 2023 **Accepted** : 23 December 2023 **Published** : 30 December 2023

Abstract

Virtual reality is becoming common in developed countries as a smartphone accessory. Creating appropriate modules for VR will make it an effective educational tool. The undertaken study attempts to answer the question whether VR is capable of improving observational skills among students. The author has collected several articles based on this theme and has systematically shortlisted ten papers based on relevancy to the theme. The selected studies show that VR is more effective in memory training than desktops and is an effective alternative in online classes. Also, VR was able to considerably improve the memory in people with memory impairments indicating that it will be much more effective in young individuals. According to the findings of other experts, the use of virtual reality technologies in teaching cannot be ruled out. It has been shown that IVR via HMDs improves memory recall capacity (observational competence), making it a potential educational adjunct. A few unfavorable effects cannot be ignored and must be thoroughly investigated. Therefore, it can be stated that virtual reality has a significant impact on observational abilities and might be used in education with appropriate lesson modules.

Keywords: *Virtual Reality, Science Modules, HMD, Observational Skill, Memory Recall, IVR.*

1. INTRODUCTION

Immersive technologies, including Virtual Reality (VR), are becoming more pervasive in our everyday lives. VR has gained popularity in recent years. The term virtual reality (VR) refers to a technology that emphasises the experience of presence in a computer-generated simulation of a three-dimensional (3D) picture or environment **(Liu et al., 2020)**. High-end Head-Mounted Displays (HMDs) may now be used in classrooms due to the quick development of technology and decrease in price. VR is often divided into non-immersive VR and immersive VR (IVR). Full IVR displays, like HMDs, can increase the feeling of realism and immersion in virtual spaces **(Xu et al., 2015)**. This makes learning experiences that use IVR displays more immersive than those that don't.

Although virtual reality (VR) is not new, recent advancements in immersive technology (visualisation and interactivity) have made VR more appealing to academics. The most recent VR head-mounted displays

(HMDs), such as HTC Vive and Oculus Rift, provide users with a high level of immersion. Immersion is the participation of a user in a virtual environment in which his or her perception of time and the actual world is often separated, hence generating a sensation of "being" in the task environment. **Freina & Ott, (2015)** defines VR as a feeling of being physically present in a non-physical environment by surrounding the user of the VR system with visuals, music, or other stimuli such that a participant thinks he or she is "there."

Similarly, low-cost HMDs for smart phones, such as Samsung Gear VR and Google Cardboard, make immersive virtual worlds accessible to everybody. In addition, modern gadgets provide interactivity possibilities. Low-cost HMDs, such as Google Cardboard, provide gaze control or enable the user to interact with the virtual world by providing a magnetic switch, but high-end VR equipment, such as Oculus Touch, includes specialised controllers that facilitate game play. A recent inclination in education, worsened by the COVID-19 epidemic, has seen many schools replace hands-on laboratory activities with online or digital ones **(Hu-Au & Okita, 2021)**. Many researchers have explored the impact of VR modules in enhancing the various learning skills of students. In particular, the observation skill of students which includes recognizing and recalling ability is greatly influenced by using virtual reality tools.

2. LITERATURE REVIEW

Brugada-Ramentol et al., (2022) introduces Enhance VR, an IVR-based cognitive training and monitoring application that delivers brief daily cognitive workouts. The games are intended to train and monitor certain cognitive areas, such as memory, task flexibility, information processing, orientation, focus, problem solving, and motor control. The objective is to determine if cognitively demanding activities given in an IVR environment provide a realistic method for training and monitoring cognitive capacities. In contrast to screen-based applications, Immersive Virtual Reality (IVR) systems provide the user with body-related information, such as proprioceptive and visuomotor information, enabling an immersive and embodied experience of the world. This characteristic makes virtual reality a very desirable tool for cognitive training and neurorehabilitation applications.

Hasenbein et al., (2022) examined how three socially related classroom configurations (i.e., students' position in the classroom, visualisation style of virtual avatars, and virtual classmates' performance-related behaviour) influence students' gaze toward information presented in the IVR classroom using a large-scale eye-tracking data set (N = 278 sixth graders). The IVR configurations were consistently related with changes in learners' visual focus on peers or instructional material, as well as their general gaze distribution in the IVR classroom (Cohen's d varying from 0.28 to 2.04 for various IVR configurations and gaze attributes). Students' interest in the IVR lecture was negatively correlated with their gaze-based focus on classmates (d = 0.28); particularly, the greater the proportion of males among the observed peers, the poorer the students' situational self-concept (d = 0.24). In turn, gaze-based attention on instructional material was favourably associated with student performance after the IVR session (d = 0.26).

Gorman et al., (2021) observes that VR has the ability to improve the amount of time students can spend in (virtual) settings that are conducive to teaching and acquiring practical skills. With the constantly decreasing cost of VR equipment and the rising quality of virtual experiences, it looks that VR is on the verge of becoming a standard component of school curriculums. This article describes the building and testing of a virtual reality classroom for the delivery of a food-based lesson to New Zealand middle school pupils. Observation of students utilising the virtual classroom and a post-test survey are used to gather data with an emphasis on student engagement and motivation. Results indicate that students were very motivated and enjoyed using the VR classroom.

Lamers & Lanen, (2021) ponders on the adverse effects of switching between different environments such as VR and Non-VR while memorising. 51 participants were involved in the study. It was found that participants who underwent learning environment changes between VR and non-VR performed poorly (17% lower) compared to participants who learnt in a single environment. It was concluded that constantly switching between learning environments may have an adverse effect on memory recalling.

Boller et al., (2021) performed a memory training trial among elders who had memory complaints. A group of 20 were exposed to memory training through VR and were compared with the control group of 20 without memory training. A self-reporting questionnaire was used for evaluation. An increase in word recall was reported by the researchers among the participants who underwent VR memory training.

Krokos et al., (2019) examined if loading memory palaces into HMDs would improve the users recall ability compared to desktops. 40 respondents were used for the study. It was found that virtual memory palaces provided a much higher memory recall ability compared to desktops.

Makransky et al., (2019) examines the effects of incorporating immersive VR into virtual learning simulations and to discover if the principles of

multimedia learning apply to immersive VR. In addition, electroencephalography (EEG) was used to get a direct measurement of cognitive processes during learning. 52 university students participated in a experimental cross-panel design in which they learnt from a scientific simulation using either a desktop display (PC) or a head-mounted display (VR); and the simulations comprised on-screen text or on-screen text with narration. Students reported to be more present in the VR condition across both text versions (d = 1.30); yet, they learnt less (d = 0.80) and had considerably greater cognitive load based on the EEG measure (d = 0.59). Despite its motivational features (as measured by presence ratings), studying science in VR may overwhelm and distract the learner (as measured by EEG measurements of cognitive load), hence reducing the potential to generate learning results (as reflected in poorer learning outcome test performance).

Watson & Livingstone, (2018) created the Recovery Position Application (RPA) at the Interactive System Studio, University of Plymouth, to investigate the efficacy of VR platforms in facilitating observational learning of action sequences. The RPA shows two virtual avatars executing the recovery position's steps. RPA was tested on three distinct platforms in order to formatively assess the present functioning prototype and its potential educational use. 61 respondents in 3 groups of 20,20 and 21 participated in the study. Memory recall of motions was documented, and the RPA's usefulness was tested. Across all three platforms, the average recall of shown material after 10 minutes of programme use was 61.88 percent. Both the application's usefulness as a learning resource and its usability were rated positively or very favourably by participants.

Stepan et al., (2017) assess the efficacy, satisfaction, and motivation of immersive VR simulation in teaching neuroanatomy to medical students. Normal cerebral anatomy was reconstructed from human Digital Imaging and Communications in Medicine (DICOM) CT imaging and magnetic resonance imaging (MRI) into 3D VR formats integrated with the Oculus Rift VR System, which enables an immersive VR experience. 66 medical students participated in a randomised, controlled trial (33 in both the control and experimental groups). Relevant neuroanatomical structures were explored utilising either online textbooks or a virtual reality (VR) interactive model. Immersive virtual reality (VR) instructional tools provided a more favourable experience for students and increased their motivation.

Nolin et al., (2016) examine the link between performance on the virtual test and the accompanying sensation of presence and cybersickness reported by participants. Evaluate the possible impact of gender and age on performance on the test. The research was done with 102 second- through tenth-grade children and adolescents. Each participant was enrolled in a traditional educational programme. Results indicate concurrent and concept validity as well as temporal stability of the classroom-Continuous Performance Test (ClinicaVR) (CPT). Age had an influence on performance, but not gender. The exam induced little cyber sickness. ClinicaVR: Classroom-CPT is recommended as a test for assessing selective and sustained attention and inhibition in clinical and research settings.

3. MATERIALS AND METHODS

The current study focuses on the influence of using Virtual reality tools in a classroom environment to improve the learning experience. The researcher focuses on the observation skill specifically. A total of 35 papers were collected through exploratory search in databases such as PubMed, ScienceDirect, Psych INFO, Google Scholar etc. The articles selected were based on using virtual reality tools for enhancing human skills. The collected literature was checked for relevancy to VR, education or training and science process skills. From that, papers relevant to observation skills were shortlisted yielding 10 papers for review.

Table-1: Specifications of the included studies

Authors	Study task	VR Used	Comparison	Respondents	Skill Observed
(Nolin et al., 2016)	Assessing attention and inhibition	*ClinicaVR*	Regular classroom	102 (Grade 2 to 10)	Attention and Inhibition
(Stepan et al., 2017)	Study VR as a teaching tool for neuroanatomy	Oculus Rift VR System	3D model on screen	66 medical students	educational experience
(Watson & Livingstone, 2018)	Develop RPA to explore the effectiveness of VR platforms	Google Cardboard	Desktop PC	61 (6 females)	memory recall
(Krokos et al.,	Study if HMD	Head-	Desktop PC	40 (10 females)	memory recall

2019)	improved recall	Mounted display			
(Makransky et al., 2019)	consequences of adding immersive VR to Education	IVR	desktop display (PC)	52 university students	Attention
(Boller et al., 2021)	Assess the potential of IVR in memory training	IVR with memory exercise	VR without memory exercise	40 elder people (33 female)	Word recall
(Lamers & Lanen, 2021)	Adverse effects of mixing	HTC Vive Headset	Real life setting	51 (21 females)	Memory recall accuracy
(Gorman et al., 2021)	Develop VR classroom for food technology education	VR Classroom using Oculus Go device	Online class	12 (7 female)	Student Engagement
(Brugada-Ramentol et al., 2022)	IVR-based cognitive training	Enhance VR	Screen based application	-NA-	Information processing, Attention
(Hasenbein et al., 2022)	Assess students' visual attention and learning experiences	IVR with eye tracking	three social-related classroom configurations	274 students (Grade 6)	Visual attention

3.1. Study Attributes: The studies were selected based on themes such as employment of Virtual reality in comparison to a real class setting or an online class in desktop or laptop. Variables such as memory recall and student engagement were also included. The findings of these studies were used to construct a conclusion by the authors.

3.2. Respondents: Most of the studies included high school students or UG students except for one study where the recalling skill of elder people **(Boller et al., 2021)** were tested. All the studies used a mix of both male and female respondents.

3.3. Intervention attributes: Watson et al used a google cardboard and its respective platform, Krokos et al used an HMD while Boller et al used immersive VR. Lamers used an HMD (HTC vive headset) and Gorman and Stepan used an Oculus device. All these devices pertain to Virtual reality devices and were compared with either a real classroom, online class, or a non-immersive VR tool. A RPA (Recovery Position Application) based on memory recall of movements was developed using VR by **Watson & Livingstone, (2018)**. Memory palaces loaded into HMDs were employed by **Krokos et al., (2019)**. Memory based training applied through immersive VR was used by **Boller et al., (2021)**. **Lamers & Lanen, (2021)** studied the effect of changing between VR and Non-VR environments on memory recall and **Gorman et al., (2021)** studied student engagement in a food technology class after employing VR. **Brugada-Ramentol et al., (2022)** used enhance VR to study the attention span and information processing of participants.

4. DISCUSSIONS

Virtual reality tools are becoming inexpensive and easily accessible to the public. The extensive use of smartphones and its allied HMD accessories make using VR for education or training highly feasible. Most of the researchers claim that immersive VR is able to improve retention of facts or the recalling ability. Studies on recognising ability are scarce. It could be safely said that VR when used appropriately enhances the observation skills and can be used in education with appropriately designed modules.

Head mounted displays were more effective as immersive VR devices than normal VR modules and were highly superior compared to desktop displays for virtual modules. Almost every researcher observed an improvement in memory recall **(Boller et al., 2021; Krokos et al., 2019; Stepan et al., 2017; Watson & Livingstone, 2018)** and improved student engagement which reflects on better observation **(Gorman et al., 2021; Hasenbein et al., 2022; Nolin et al., 2016)**. But, using VR in a mixed environment such as switching between VR and non-VR while learning a single module had adverse effects on recalling ability **(Lamers & Lanen, 2021)** and created a higher cognitive load despite increases attention **(Makransky et al., 2019).**

It was also observed that the use of VR as an educational tool has been very scantily explored but has been examined extensively in a medicinal or psychological context and also for virtual trainings. Use of VR among Indian teachers is also rare and needs to be explored further.

5. CONCLUSIONS

Based on the observations from other researchers, employing virtual reality tools as educational tools cannot be ruled out. IVR using HMDs has been proven to improve memory recall ability (observational skill) notably making it a viable educational accessory. A few adverse effects also cannot be neglected and needs to be studied extensively. Hence it is concluded that virtual reality has a notable effect on observational skills and could be incorporated into education.

REFERENCES:

Boller, B., Ouellet, É., & Belleville, S. (2021). Using Virtual Reality to Assess and Promote Transfer of Memory Training in Older Adults With Memory Complaints: A Randomized Controlled Trial. In *Frontiers in Psychology* (Vol. 12). https://doi.org/10.3389/fpsyg.2021.627242

Brugada-Ramentol, V., Bozorgzadeh, A., & Jalali, H. (2022). Enhance VR: A Multisensory Approach to Cognitive Training and Monitoring. *Frontiers in Digital Health*, *4*. https://doi.org/10.3389/fdgth.2022.916052

Freina, L., & Ott, M. (2015). A literature review on immersive virtual reality in education: state of the art and perspectives. *The International Scientific Conference Elearning and Software for Education*, *1*(133), 10–1007.

Gorman, D., Hoermann, S., Lindeman, R. W., & Shahri, B. (2021). Using Virtual Reality to Enhance Food Technology Education. *International Journal of Technology and Design Education*, *32*(3), 1659–1677. https://doi.org/10.1007/s10798-021-09669-3

Hasenbein, L., Stark, P., Trautwein, U., Queiroz, A. C. M., Bailenson, J., Hahn, J.-U., & Göllner, R. (2022). Learning with simulated virtual classmates: Effects of social-related configurations on students' visual attention and learning experiences in an immersive virtual reality classroom. *Computers in Human Behavior*, *133*, 107282. https://doi.org/10.1016/j.chb.2022.107282

Hu-Au, E., & Okita, S. (2021). Exploring Differences in Student Learning and Behavior Between Real-life and Virtual Reality Chemistry Laboratories. *Journal of Science Education and Technology*, *30*(6), 862–876. https://doi.org/10.1007/s10956-021-09925-0

Krokos, E., Plaisant, C., & Varshney, A. (2019). Virtual memory palaces: immersion aids recall. In *Virtual Reality* (Vol. 23, Issue 1, pp. 1–15). https://doi.org/10.1007/s10055-018-0346-3

Lamers, M. H., & Lanen, M. (2021). Changing Between Virtual Reality and Real-World Adversely Affects Memory Recall Accuracy. *Frontiers in Virtual Reality*, *2*. https://doi.org/10.3389/frvir.2021.602087

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. https://doi.org/10.1111/bjet.13028

Makransky, G., Terkildsen, T. S., & Mayer, R. E. (2019). Adding immersive virtual reality to a science lab simulation causes more presence but less learning. *Learning and Instruction*, *60*, 225–236. https://doi.org/10.1016/j.learninstruc.2017.12.007

Nolin, P., Stipanicic, A., Henry, M., Lachapelle, Y., Lussier-Desrochers, D., Rizzo, A. "Skip," & Allain, P. (2016). ClinicaVR: Classroom-CPT: A virtual reality tool for assessing attention and inhibition in children and adolescents. *Computers in Human Behavior*, *59*, 327–333. https://doi.org/10.1016/j.chb.2016.02.023

Stepan, K., Zeiger, J., Hanchuk, S., Del Signore, A., Shrivastava, R., Govindaraj, S., & Iloreta, A. (2017). Immersive virtual reality as a teaching tool for neuroanatomy. *International Forum of Allergy & Rhinology*, *7*(10), 1006–1013. https://doi.org/10.1002/alr.21986

Watson, P., & Livingstone, D. (2018). Using mixed reality displays for observational learning of motor skills: A design research approach enhancing memory recall and usability. *Research in Learning Technology*, *26*. https://doi.org/10.25304/rlt.v26.2129

Xu, X., Chen, K. B., Lin, J.-H., & Radwin, R. G. (2015). The accuracy of the Oculus Rift virtual reality head-mounted display during cervical spine mobility measurement. *Journal of Biomechanics*, *48*(4), 721–724. https://doi.org/10.1016/j.jbiomech.2015.01.005

Cite this article as: Mrs. R Premalatha and Dr. Indu H (2023). A Study on the Effect of Virtual Reality Science Module on observation Skills of High School Students. International Journal of Emerging Knowledge Studies. 2(12), pp. 838-842.