



Exploring viability of Adapting VR in Classroom Education in India

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Abstract: *The passion to impart education to students using technology is ascending throughout the world. When it comes to incorporating innovation and use of technology in education, VR and AR seems to be the next keyword. Here education does not stop with exchange of information from teacher to student but rather immersing into the subject and learning through experience as stated in constructivist learning theory. Studies have shown that VR and AR can successfully create a better learning environment for students from all levels of the society. Application of VR and AR in education has been studied over the past 50 years and it is found that the amalgamation of advanced technology is always accompanied by certain challenges like cyber sickness, motion sickness, lack of realism, recognition inaccuracies etc. It also involves a lot of cost and space in the school environment to get introduced and adapted to this technology. Using exploratory research, this study aims to understand VR which is still an abstract term for many. It also explores the current scenario of its application in educational institutions in India.*

Keywords: Innovation; Blended learning; Technology in education; Digital divide; VR for learning; Health aspects

Introduction

COVID-lockdown has laid demand to foster online education which was never attempted by the majority of schools in India. Though the online video lessons were made available by the government in recent times, schools and parents relied upon only the classroom brick and mortar model of education. The situation throws open the need for adaptive learning by incorporating online platforms for disseminating lessons by both schools and colleges. The digital platform enables organisers to get connected with global experts and participants from various countries. In spite of a slow shift towards adaptive learning by students, there is a pressing need for incorporating blended learning methods in K-12 classes to enhance their understanding levels and to motivate their learning process in the physical absence of teacher and peer group. MEL Science has entered the Indian market with their chemistry practical kits and VR lessons. There are many off-school educational service providers who have developed interesting learning materials which facilitates student's learning ability effectively. Restriction of mobile phones in the classroom is no longer present and it has now become the only source of education for most of the students.

In the current digital mediated learning environment, Virtual Reality will be the next leap forward in education pedagogy. VR, the three dimensional participatory multi-sensory computer based simulated environment occurring in real time (David Passig, 2001), would motivate students to learn better by placing them in the interactive virtual world. VR facilitates students to understand complex science subjects like the study of an atom, with a high level of attention. Exploring the history of VR, its application in education, the current scenario of VR in India and



challenges in adapting to VR in education would help us to understand the role of VR in education in a better way.

Review of Literature

The technology developments are constantly challenging the perspective of varied people towards the world. Systematic Review of Literature focussing on its application in education has been selected along with few service providers interview. Osama Jalabi 2019, conducted a research study to enforce teaching VR technology in engineering education by giving the undergraduate students an assignment on 'Design of a kitchen' using 3D modelling and VR technologies that facilitates movement of people in wheelchairs keeping constraints of room size, budget and materials in mind. He found significant differences in reasoning and creativity skills between students who used VR for designing and CAD applications. He concluded his research recommending incorporating art design and VR technologies in the curriculum of engineering courses.

Kaminska Dorota 2019, along with nine research personnel, tested the learning taxonomies, remembering, understanding and application of acquired knowledge by exposing school children to three different teaching environments such as stereoscopic display on computer screen, A VR room to show Tsunami and an educator teaching virtual Egypt via google expedition. They suggest that new technologies like VR are necessary to maximise engagement of Z generation students. At the same time, equilibrium of human interaction and mentoring should be maintained to balance hard and soft skills along with enhanced state-of-the-art equipment. They conclude that VR is an efficient tool for blended learning that encourages self-study and pursuit of knowledge.

Ikhsan Jaslin (2020), along with two other research scientists, have identified that students' critical thinking level is significantly improved with the use of VR lab integrated hybrid learning as a supplement learning tool along with practical learning in a real laboratory. They conclude the research saying that use of VR labs in schools foster critical thinking ability. Gulbin Ozcan-Deniz (2019), has identified how VR lab aligns with Jefferson's Nexus learning principles of engaged / active learning, collaborative and connected learning, understanding the real world and grounded in the liberal arts. Wang Qinghai (2019), identified the pressing need to incorporate VR technology in art design courses in his Research and Development experiment on 'Application and Research of VR Technology in Art Design courses'. He identified that exposing art design students to VR technology and environment stimulated their independent and innovative thinking. He also proposes the idea of incorporating VR in teaching methods in art design courses to bring breakthrough in teaching objectives. There is tremendous scope for further research in Medical, Engineering, Art, Pedagogy and Social Sciences subjects related to VR technology.

Nora Jacobson (2005) and Simon K S Cheung (2013), explain how education in VR enhances motivation. Hsiu-Mei Huang (2010), describes how VR helps in memory retention. M Rizzo (2000), Gang Li (2019), states how VR induces deep learning. Panagiotis Apostolellis (2014) and Andrea Ferracani (2014), describe the enjoyment in learning through VR. Ikhsan Jaslin (2020), identified the significant differences in critical thinking induced by VR. Since VR in education is at its infancy stage many more researches are expected to be experimented in forthcoming years. There are many researchers who have experimented the use of VR in pedagogy. The exploratory study on these researches unveils the need for further studies in implementing VR in Indian educational scenario considering the majority of under privileged students across the country. David Passig (2016) examined children's cognitive modifiability when they are exposed to VR based learning environment. He states that there is significant improvement in the analogical thinking of students who used VR. Oliver Balet and Patrice



(2001), explored the art of storytelling from ancient time to the current digital technology mediated platforms. Radianti Jaziar (2020), has explored VR applications in higher education and its benefits considering the cost factor involved in procuring the VR devices. G Li and MA Khan (2019), pinpoints key gaps in the existing practice of implications of VR in curriculum inciting the future developments to be carried out by VR technology developers. They have also mentioned the problems in adopting VR in classroom and insist on the need for rapid adoption of VR technologies in educational institutions.

D Chen and F Yang (2020), analysed the current situation of film and TV post production studios in using VR technology. The study points out the need for bringing the VR technology in post-production facilitation. There is no mention on how visuals that are shot in cameras used for Film and TV can be used in VR content preparation. Johnson A (2002) states that VR can complement the real places and not replace them. The study indicates that VR technology makes children learn science enthusiastically making it more of their personal quest. Wang Qinghai (2019), identified that VR stimulates the interest in learning speciality courses in art design discipline. The study also states that VR creates an effective teaching environment that helps improve the learning efficiency of students who pursue art design courses. The study encourages both teachers and students of art design discipline, to conduct brainstorming sessions and research related to VR technologies to achieve their objectives.

Methodology

Since the research on exploring challenges in adopting VR in classroom education in India is at its infancy stage, exploratory research method is selected for this study. VR application in education has been investigated by only a few researchers which stipulates further insights into the subject to gain more understanding of the research problems. The primary research is focused on collecting data that helps in conceptual understanding of what VR is. Initially all the available information on VR in Education has been cited. The secondary research is aimed at Meta-analysis of available literature focusing on various research conducted on the role of VR in education. Several independent qualitative data were integrated for meta-analysis. The goal of this study is to explore the problems and the gaps left out in research studies and not actually derive a conclusion through the research.

An Overview on History of VR

The concept of VR has been imagined in short stories like 'The man who awoke (1933)', 'Pygmalion's Spectacles (1935)', and in films like 'Brainstorm (1983)', and 'Lawnmower Man (1993)'. The short story 'The man who awoke (1933)' written by Laurence Manning is about people programming their own way of life and living in a dream life. This plants the idea of creating a virtual space for an individual where he starts living in dream, thinking it is the real world. 'Pygmalion's Spectacles (1935)' written by Stanley G. Weinbaum, a science fiction writer talks about a pair of goggles. Albert Ludwig enables the viewers to interact with other characters in the movie and be a part of the movie instead of just watching the movie on big screen. This idea was probably the first imagination of the concept on augmented reality.

The film 'Brainstorm (1983)', a science fiction directed by Douglas Trumbull follows a team of scientists who invent a computer that can record human senses on a tape and others can experience the sense that was recorded on the tape. This lay the concept of getting into virtual sense using and external device. Another movie 'Lawnmower Man (1993)' follows a scientists who works for virtual space industries experiment on lawnmower man an innocent immature adult boy who works in lawn near his residence. This film depicts virtual reality space where the character gets immersed in the virtual space and augments the character into various activities. Though the story deals VR concept in a different aspect all together, the reality space that a



character gets into is exactly what VR and AR is all about. The later movies like Jurassic, Narnia and Jumanji deals with capturing humans into a completely new world. These stories prove the statement delivered by David Passig in one of his lectures that, “storytelling imagination ability of humans is the basis for all technology developments that’s happening all over the world”. The development of VR technology has been taking place ever since the invention of photography back in the 1800s. Charles Wheatstone invented Stereoscope in 1832, a binocular-like device which was improved by scientists David Brewster and Joseph L Bates which eventually developed into ‘View-Master’ by Sawyer's company.

This technology was further experimented in the movie ‘A Bicycle Ride through Brooklyn (1950)’ by Morton Heiling which was considered to be the first VR system known as Sensorama. He further developed a head mounted VR system in 1960 which laid the foundation for many experiments in Head- mount devices. The VR simulation was used in Flight Simulators by The United States in the 1960s. The ‘Virtuality Group’ company produced virtual reality games in the 1990s. Nintendo released table top portable game ‘Virtual Boy’ in 1995. The VR headset continues to take many developments over many decades. In 2010 with the invention of Oculus Rift by Palmer became a game changer in VR experience. Facebook (now Meta) bought Oculus rift in 2012 and popularized the device to the public. The commercialization of VR in games and machinery simulation has yielded only a limited fortune. It started yielding importance in education especially after the Google cardboard launch in 2016 which is widely used to see 360 degree videos. Google expedition has brought the virtual environment at ease in par with other technologies.

Present scenario of VR in India

Humans have constantly invented technologies that keep shaping their quality of life. The invention of digital technology is taking an enormous leap forward in human evolution that has evolved over twenty centuries of its existence. Social scientists and philosophers are of the opinion that the pace of growth after digital intervention especially from the beginning of 20th century is unimaginable. Of the many innovative inventions of the 20th century, virtual reality plays a key role in perceptual change of the physical world. When computers came into the market it was very expensive and only rich people were able to own computers. By the 1990s the use of computers got popularised among the public but still it was an expensive device to own by the middle class. The year 2011 became a game changer in education when the Tamil Nadu Government introduced the free laptop scheme for students who study at government schools and colleges. This scheme enabled access to computers that helped underprivileged students to acquire better skills. Understanding the potential content delivery of digital platforms and experiencing the deeper way of learning about the world through AR, VR, and MR technologies, United Nations Educational, Scientific and Cultural Organisation (UNESCO), Mahatma Gandhi Institute of Education for Peace and Sustainable Development (MGIEP) and Samsung India signed a MoU to build a curriculum for 28 heritage sites of India. Samsung India that had already setup more than 500 smart classes in Jawahar Navodaya Vidyalayas (JNV) will be providing VR content on heritage sites of India to these schools. This initiative has been carried out to provide opportunities for underprivileged rural students mainly taken into consideration of bridging the digital gap between the rural and urban schools.

MGIEP believes in transforming education for building peaceful and sustainable societies. It sees immersive experiences such as VR as an integral part of socio-emotional learning for the younger generation as they face challenges to build a peaceful and sustainable planet, says Anantha Duraiappah, Director, UNESCO MGIEP. As a pilot project they had screened 360 degree view of Konark Sun Temple in the year 2017 at TECH expo. They continue working on Virtual Reality Project aiming to bridge gap between rural and urban India



catering equal opportunities for all backgrounds. With the allotment of more than one million from Indian Government to modernize educational institutions with schemes like RISE and SWAYAM, there are opportunities for installing VR lab at schools and colleges which would help revitalizing infrastructure of educational systems in India. VR being found its base in many educational institutions in many developed countries, it is slowly emerging in Indian institutions since 2016. More than forty schools have setup their VR lab till date in collaboration with VR service providers.

Playshifu, a Bangalore based kinder educational service provider has used VR as their start-up entrepreneurship with the help of crowdfunding in the year 2016. They were successful in coming up with more than 400 wonders of the world taking learners into exploring culture, monuments, wildlife and more fun activities through their Shifu Orboot Augmented Reality product. STEM Wiz Pack, a combo pack of Count, Link and Letters is one of the most popular STEM based learning kit they launched in the market. Veative labs, another Indian cloud computing educational service provider is setting up VR labs in many schools in India and have collaborated over 20 countries worldwide in AR/VR projects. Ankur Agarwal, founder of Veative expresses that 'AR/VR has great potential in democratising the educational process and making it a personalised learning experience for learners to explore abstract concepts in a distraction-free environment and allow them to connect with the concept' in an interview for Inc42. Sushma Sharma, head of Veative labs Academics and Pedagogy division said,

“VR helps with the visualization problem that kids face. We install math labs in schools, and kids can use VR headsets to have personalised learning experiences. A child can play with figures, learn about probability, and calculate the volume of a sphere on top of a cuboid because they can actually see it”.

Veative has created more than 550 interactive STEM modules in subjects like, Physics, Chemistry, Biology, Mathematics and Secondary languages covering K12 curriculum related VR learning videos. Another cloud computing educational service provider, SkuGal, an IIT Patna incubated Start-up Company, is providing space VR experience to schools at request along with online ERP management solutions. Though virtual reality is used maximum in the gaming industry, its application in education is slowly gaining momentum in India. Vassili Philippov, founder and CEO of MEL science opines that virtual reality is the future of the education sector. Mel science is based in London and it gives educational videos enabling technology education in science. The videos use VR for explaining the underlying science. Further it is combined with real chemistry kits for better understanding and experience. MEL science is available as a subscription service which has video and VR experiences. It also firmly believes that chemistry labs are important as VR cannot replace that. Instead of using real instruments, burners and chemicals VR enables the use of virtual ones. What is new in learning through VR is that it explains the science behind how VR works. It places them inside the molecules where they can see how they react with each other. It lets them play with it, touch it, and even enable them to build their own atoms and see the results for themselves. Such a new learning experience cannot be possible in the real world.

Teachers here act as facilitators of learning and can explain to students why these reactions happen. When students find themselves inside a chemical reaction instead of seeing it on a black board it can facilitate more learning and understanding. Basic concepts become easily understood by children when VR is integrated in the classroom. They are able to feel and experience themselves, what happens even in a micro level and more interestingly they can even interact with them. When the experience is enterprising, what becomes a challenge is choosing the right platform. Since there are too many platforms, creators find it difficult to develop new applications. Mel chemistry VR is launched for Google daydream, and that is supported only on



a few phones. The only concern is safety of using VR headsets for a long period especially for children whose body is still developing. Yet there is no data available on safety concerns of children.

However, the Google platform has been using VR with success so long where more than one million students have experienced VR as part of their pilot study program with Google expedition in school. Experts have the opinion that though VR is in the initial stages of development in schools, it is going to be the future of school education in the next decade. Another pioneer in implementing VR in the classroom is ClassVR, which has produced standalone headsets which are fully ready. There is no need for any additional mobile device to use this. The headset alone gives a fully immersive VR experience. It is managed wirelessly and controlled by the teacher using the ClassVR teacher portal. It is designed for students of all ages. ClassVR also helps teachers to plan their lessons in a real time class room delivery platform. With a single ClassVR portal, access can be given to multiple headsets in the classroom. The teachers can send their lessons to multiple headsets through this portal and they can also view and monitor the progress of the students. It also provides training to teachers on how to implement VR teaching in the classroom successfully. The trainers know and understand the needs of the teachers and help them adapt to the new technologies.

The next pioneer in integrating VR in the classroom is Altairika, whose virtual encyclopedia promises to change the attitude of learning of children. It promises to make a better understanding of the world they are living. Altairika has produced virtual videos on astronomy, physics and biology with full immersion effect. These videos allow the students to teleport themselves to any part of the world and even beyond, virtually. Altairika works with a set of VR glasses, a WiFi router, a tablet to control the session and audio system. With these equipment the experience of VR can be felt anywhere right from kindergarten classroom to even at home. This VR experience facilitates creativity and stimulates curiosity of children. This modern technology has enabled easy learning of complex phenomena like photosynthesis, functions of the heart etc.

In the boom of VR scenario, where international players are in the race, it is quite interesting to note that Fusionvr Industry Machineries Simulation based in Chennai, is listed in India Forbes for its services in VR and AR. All these indicate that there are potential job opportunities in VR content creation in near future. Hence there is pressing need for implementing VR in Art Design courses like Viscom, TV production, Animation, Electronic Media and Multimedia etc.

Research of VR in India

There are tremendous scope for further research in Medical, Engineering, Arts, and Social Science subjects related to VR technology. Many researches have been attempted in pedagogy from other countries, but there are no studies found in India on pedagogy. The exploratory study on these researches unveils the need for further studies in implementing VR in the Indian educational scenario considering the majority of under privileged students across the country. The scope for research in pedagogy in context to the Indian educational scenario is plenty. There is very little research found on support systems for teachers to enforce the VR application in pedagogy approaches. There is scope on how the COVID-lockdown situation fosters adaptive learning through online that would need VR content to get the immersive feel in physical absence. VR being in its infancy stage but with a great future needs to be understood through research studies before we continue advancing in the field of education. There are many scopes on interdisciplinary research on VR Engineering and Health related issues on photophobia or photosensitivity. The health aspect of using VR directly related to lights and sound is migraine headache. So far no studies are found related to this.



Another major topic to be explored can be on people with hypermetropia, a long sight and refractive error of the human eye and the effect of Virtual Reality (VR) on them. There are plenty of research and development opportunities in VR technologies like how technology in cinema grew from celluloid to digital over a century that started in the year 1884, VR being in infancy stage a long future is waiting for those who wanted to develop VR Technology. VR being completely a new dimension of visual experience, the language of cinema has to be redefined to suit the VR environment. There is scope in the field of storytelling experiments using VR. As David Passing interprets that the technology developments are the results of storytelling intelligence of human beings. A lot of experiments could be executed on how to adopt the VR technology to the conventional 2D screen cinema technology.

Conclusion

The study gives an understanding of the pressing need for speedy implementation of VR technologies in educational institutions for Pedagogy, Research and Development purposes. To hold on the attention of current digital generation students, a blended learning that incorporates open source online material for their study purpose and adoptive learning towards new technologies like VR is expected to be implemented at k12 level itself. This study concludes that adopting new technologies and blending the teaching methods are mandated in the educational institutions sooner or later. The sprouted VR technologies in the Indian educational system will soon bloom.

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