

A Review of the Literature on Immersive Virtual Reality in Education: Current State and Future Prospects

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ABSTRACT- That's because the term "Virtual Reality" (VR) was being coined in mid-1950s, it really has evolved in numerous aspects, getting increasingly similar to the natural environment. Virtual reality is classified into two kinds: non-immersive & comprehensive. The earlier is a computer-based ecosystem which may well simulate places in real or envisioned realms, while the subsequent pushes the notion a stage forward by giving the sense of having ability to be present inside a non-physical realm. Although non-immersive VR could well be driven by a standard PC, immersion VR is still in its early stages as the required technology gets relatively consumer-friendly and economical. Utilizing gear including a headgear with eyewear was tough in the old days, however modern devices constantly getting developed to increase usefulness for the consumer. VR technology is based on three basic components: immersing, interactivity, and user involvement with the surroundings and narrative, has enormous potential in teaching because it encourages as well as fascinates pupils. Because of the high pricing of the gadgets plus their modest utility, the utilization of interactive VR in kids software has indeed been confined thus far. Immersive-VR is now available in a range of academic contexts because to latest techniques such as the commercialized Oculus Rift". The presented paper has undertaken a survey of several scientific literature on the advantages and prospects of adopting online VR in e-learning during the last twenty months. It highlights how vr technology in overall, particularly immersive VR in specific, has primarily been used for grownup teaching in special situations or for undergrads. The discussion then shifts to the possible pluses and minuses of employing elearning, with special emphasis on distinct target categories such as youngsters and those with intellectual disabilities. It concludes by offering techniques for testing these ideas.

KEYWORDS- Education, Educational Technology, Immersion, Virtual Reality.

I. INTRODUCTION

Considering the web-based Dictionary definition including from oxford website, virtual reality (VR) has so far been characterized as a microprocessor simulated modeling of a multi-dimensional illustration and perhaps even atmosphere which could indeed be conversed in a highly realistic or tangible manner by an individual donning particularly unique digital gear, including a headgear with a display inside it and accessories embedded

with detectors [1–3]. Even though the expression existed in the 1950s, the origin of the same usually is map out somewhere in 19th era, when the first 360-degree art as a panoramic frescos started to emerge. Just about couple of decade later, the Sensorama1 was a power-driven expedient that used several senses to produce a realistic VR involvement [4–6]. The system combined a three-dimensional, full-colour video with noises, scents, and the sense of motion, as well as the sensation of wind on the viewer's face, to create a multisensory experience of riding a motorbike. Since then, virtual reality has progressed in a number of ways, becoming more resembling to the actual world [7–10]. As computer power grows and Human Computer Interfaces become more comprehensive and adaptable, ICT and VR have grown inextricably linked.

The word "immersion" often cast-off in the prospect of virtual reality [11,12]. Jenett et al. refer to immersion in games as involvement in the gaming that yields a lack of attentiveness of time and of the actual realm, apart from a feeling of "being" in the assigned situation [13]. As soon as it emanates to VR, the term "immersion" is generally cast-off in the finer sense of "spatial immersion."

The impression of being materially existent in a nonphysical environ is known as spatial immersion in virtual reality. Those peoples who utilizes the VR system is most of the time surrounded by visuals, non-visuals, & supplementary incitements that create a highly engrossing experience [14–17]. When a player perceives the simulated environment as perceptually compelling, it seems genuine and real, and the player believes he or she is really there, this is known as spatial immersion. As from the discussions immersion seems to be a very important or major element of VR, VR may also be non-immersive when it puts the user in a 3D world that can be directly controlled, but it does so with a standard graphics workstation that includes a monitor, keyboard, and mouse [18–20]. We concentrate on immersive VR in this research since it is only through immersion that VR can achieve its full potential.

The Cave Autonomous Virtual Enviros (CAVE), in which the person who is using is in a chamber with projection screens on all four walls and the floor, are among the technologies that enable immersive VR (or flat displays) [21]. Wearing 3D glasses, the user senses as though they might be moving in the virtually real environment, free to travel around. CAVE enviros are still very costly, they need an out-and-out area, & they are not freely transportable. Due to such structures, it's

improbable to be extensively utilized in E&T [22]. CAVE expertise, for instance, is very much commonly employed in traditional & custom edification. VR bifocals or other similar sorts of Head Mounted Displays (HMD) should without any problems create the primitive consciousness of really being in the replicated milieu when combined with headphones. All five senses of the people ought to be engaged for a full immersion in a non-real atmosphere. On the other hand, most virtual reality situations in the present day do not cover all of these, centring only on two: hearing and sight.

In the past, utilizing HMDs or comparable technology was very thought-provoking. Alternatively if we consider, these practical implements were not commonly used and sometimes were extortionately costly. Their topographies, besides, remained such that they might often induce repugnance in the operators owing to an incongruity flanked by head motions and the accompanying change in the picture. This day and age, the profit & money-making creation Oculus Rift be responsible for an excellent computer-generated reproduction at an even-handed value, & supplementary cheap merchandises are being researched, constructing the use of such systems extra feasible in the areas of E&T as well. In addition, tools and techniques may now very easily make available systems with low latency and accurate movement tracking, enhancing the user's usability and allowing him to accomplish his emotional response. Considering the prospective for generating communication and inspiration, VR is extensively exploited in the areas of E&T. It also make available an excellent way for individuals who prefer kinaesthetic learning style & absorb and keep in mind new information.

II. LITRATURE REVIEW

This article presents the results of a review of the literature in the past two years on the assistances & possibilities of exhausting immersive VR in tutelage. The search was conducted using the terms “Immersive Virtual Reality Education”, “Oculus Rift Education,” & “Head Mounted Display Education”. The foremost thread, “Immersive Virtual Reality Education”, provided us a sense of how Immersive VR is used in education in general, including CAVE-based methods. The authors then endeavoured to concentrate on virtual reality bifocals, having an actual prominence on the Rift, which we often think as an incredibly intriguing implement in the red to its movability and price. Yet, since a search focusing only on the Oculus generally yields no outcomes, the authors after considering every angle decided to enlarge the exploration by substituting “Oculus Rift” with “Head Mounted Display.” The findings are captivating and will be explored further, but the search also bring forth several clarifications in support.

Succeeding a review of the online available web-based databases, an in-depth examination of the subject was conducted using the Scopus and Google Scholar outcomes.

On looking for “Immersive Virtual Reality Education,” the quantity of articles printed dribs with time: 44 in 2012, 29 in 2013, and 3 in 2014. The same is due to the fact that the online database searching was steered towards the end of 2013. Two articles are expected to be published in 2015. Many related works from 2013 are likely still missing from the databases.

A significant amount of i.e., 93 research paper works were researched in the UK & US, as seen in Figure 1. In period span that was considered, no countries excluding the above two has more than 12 research papers.

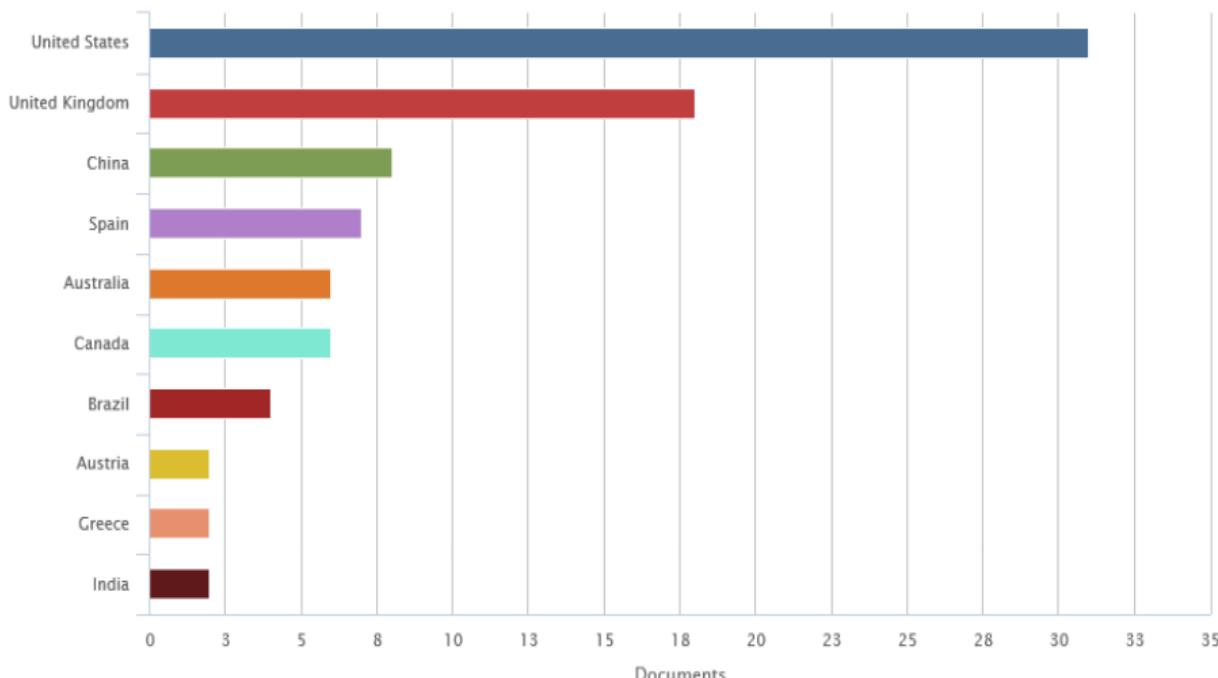


Fig. 1: Illustrates number of papers published per country on Immersive Virtual Reality Education.

Figure 2 depicts the spread of the selected texts across several subject categories. The Scopus archive contains

over 55% of papers within area of computational science & technology. Given almost everything of the prior studies

are about computer-based processes or contexts, numerous periodicals pertain to greater than one subject category, and Computing Technology was already appended to a considerable number of those.

However, while reading the articles related to any field or sub-field, substantial proportions are linked to the medicine line. As a matter of fact, we can observe that

almost 12% of the graphs are interlinked with medical items, but there are also 2.9 percent in neuro-science and 2.4 percent in nursing preparation. Additional 4% is epitomised within another group, which includes psychology related profession, dentistry related profession, and wellbeing related professions, among other things.

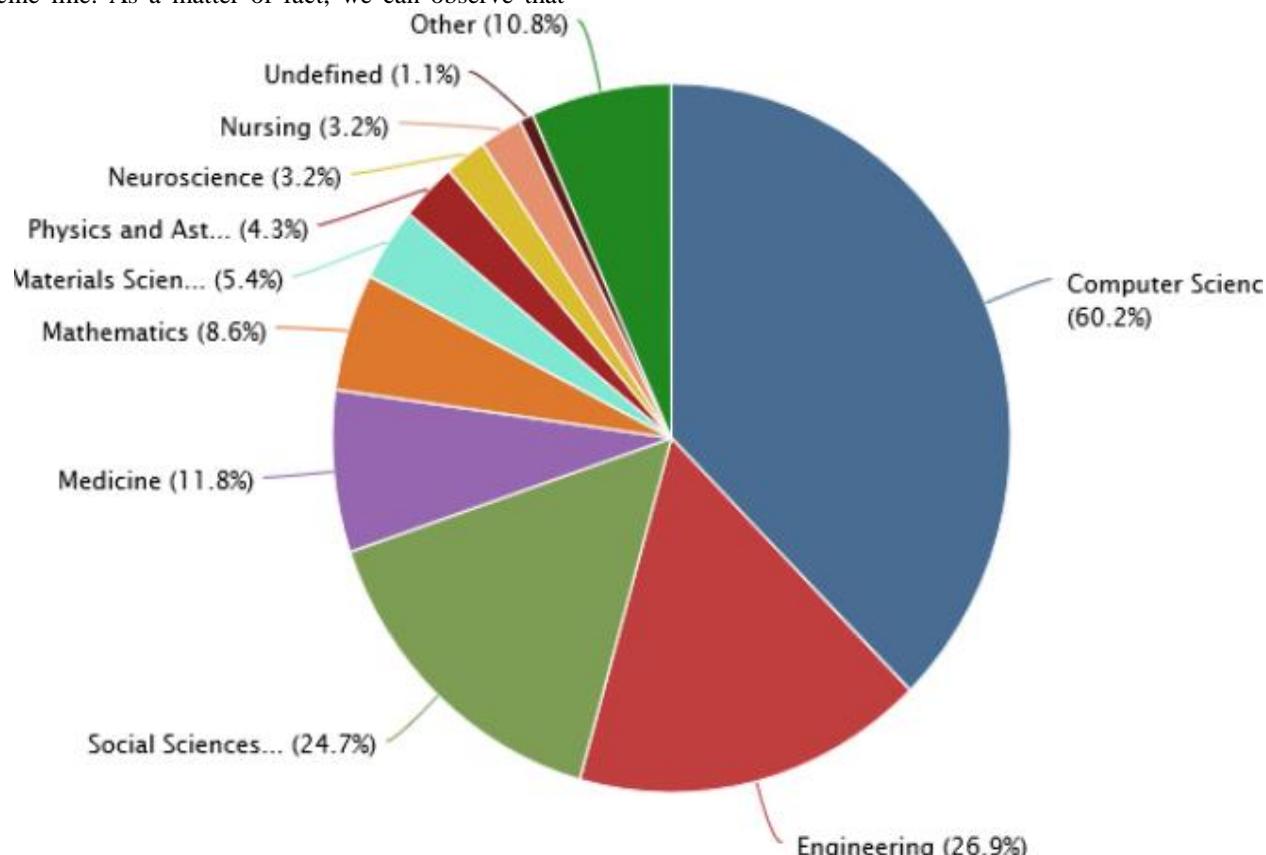


Fig. 2: Illustrates papers quantity along with area on Immersive Virtual Reality Education.

Approx. five articles were found while searching for “Oculus Rift Education.” One of the articles is solely concerned with engineering, while rest of them are concerned with Information Technology and another topic. We did not examine this data from any other perspective due to the limited number of findings. As known to all, Rift is a kind of a profit-making device that existed in the marketplace for a very shorter span of time, our search yielded a relatively restricted set of results.

Only 18 items were found for “Head Mounted Display Education,” with 9 referring to 2012 and 7

to 2013. As previously pointed out, many articles printed in 2013 might not have yet been included to the data base, the statistics indicate that there is likely a small rise in publications over time.

The majority of articles, as indicated in Fig. 3, were in book form in the USA, with a small quantity also in countries like Germany. It should be noted that almost nil in the United Kingdom. The same is particularly intriguing since, in the last pursuit, the UK expressed a curiosity in Immersive VR, whereas Germany's searching results yielded no outcomes.

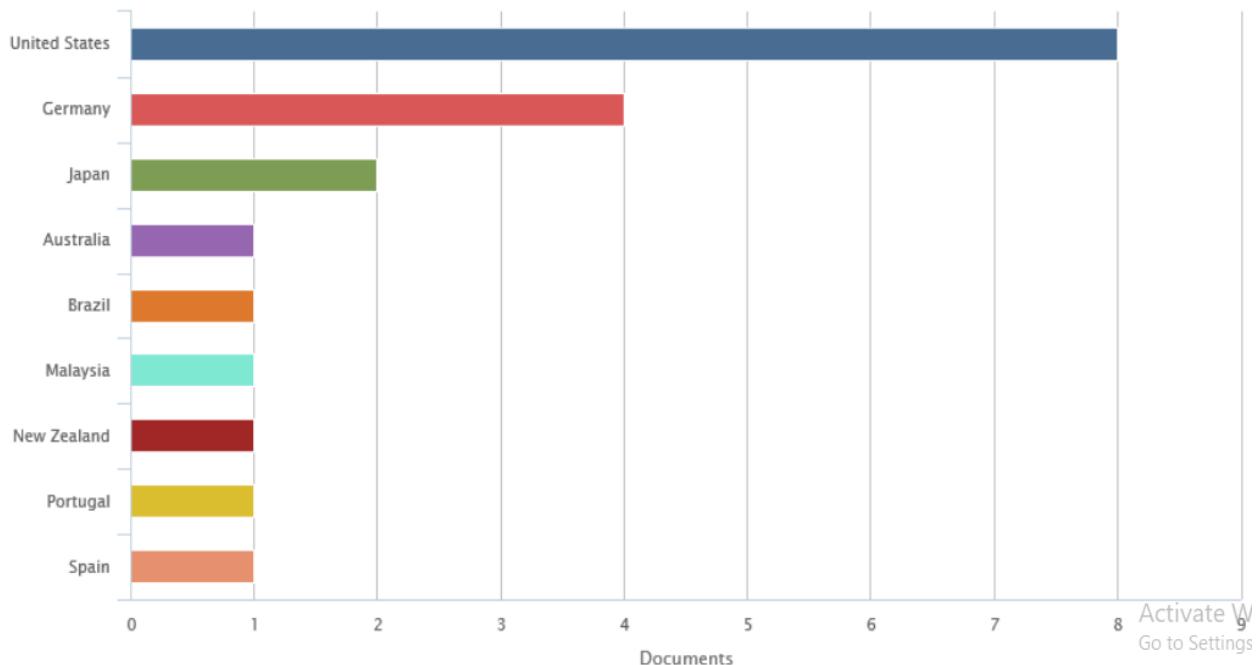


Fig. 3: Illustrates number of papers per country on Head Mounted Display Education.

According to Fig 4, the frequent topic is Computer Science, and there are a large amount of research or review papers relating to medicinal areas: when all

the papers that appear under various subject areas are added together, more than 22% of the papers selected are linked to medical problems.

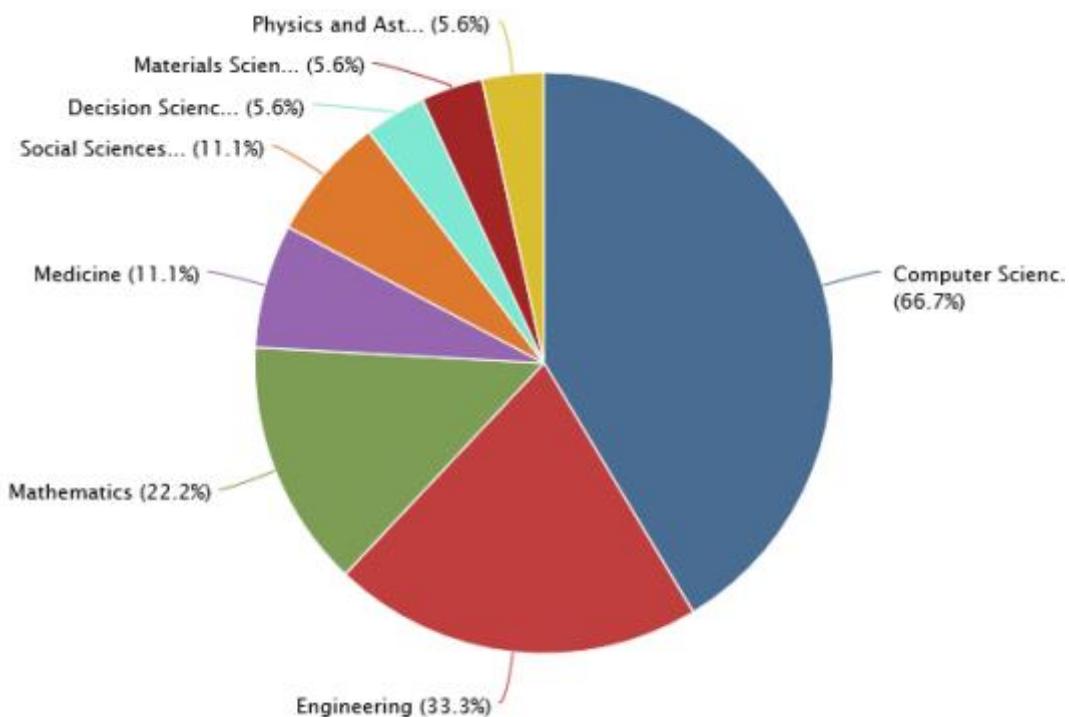


Fig. 4: Illustrates amount of research & review papers and topics on Head Mounted Display Education.

III. DISCUSSION

A. Target Population Addressed:

The reading of the chosen tutelages publicised that a momentous fraction of the same relate to institution of higher education learning, having focus on scientific topic instruction. This article will go through a few instances of such applications in more detail. Grown-up teaching & preparation seems to be an important expanse in which VR

appears to be extensively utilized. The same is always correct in a few key topics, which shall be deliberated further below. VR and AR permit someone to manoeuvre secretly around hazardous environs while getting knowledge to deal with the emotions and experimenting with the best explanations while being far off from the actual risks. There isn't much for pupils; the authors only identified a solitary article on a scheme for coaching physics to youngsters aged 9 to 13, and one more about a

VR gallery targeted at kids. One of the numerous reason for restricted utility of VR with youngest children is that they are presently growing and developing their 3D vision, as well as their hand-eye coordination and balance. The Oculus Rift's "health and safety warnings" take account of a suggestion that many kids under the 13 year age group should not use the implement.

Only a few studies have been discovered on handicapped people. Standren et al. printed in book form, an captivating criticism cum analysis on the use of VR for the recuperation of individuals with cerebral deficiencies (23). According to our investigation, virtually little has been done since then. Few other authors look at the usage of a CAVE-dependent technology for kids knowledge transferring with mild autism, apart from certain article looks at the use of technology applications for the education of children with autism and gives some examples (24,25). A HMD mostly cast-off in an AR system to transfer knowledge to emotionally defied group of people to serve eatables in any hotel. With respect to other impairments, the author merely recognized one article describing an app for challenged or differently abled students in a methodical laboratory that uses augmented reality based eye wears to enable them to read explanations in sign language.

B. Areas Addressed:

The majority of the articles chosen are in the respective subject field, and they describe detailed usage that have been deployed to achieve a specific educational or training goal. There are two types of adult vocational training programs: those directed at adults and those focused at university students. VR is frequently utilized in adult professional teaching preparation in all those sectors where the real scenario cannot be used for practice due to a lack of access or because it is extremely unsafe. An immersive learning environment for teaching basic corrosion prevention and control information to US army personnel and a CAVE-based system for teaching Mandarin are two examples. Other articles examine the influence of training while immersed in an actual environment on learners; for example. There haven't been many instances recorded at the high school level. We discovered various solutions that make use of an HMD, such as a system to assist instructors with classroom management or a haptic-augmented physics simulation. There's even talk of a 3D interactive virtual chemical lab.

Many articles discuss university-level education; we'll summarize a few of them here to give you a sense of what's going on. The conventional projector has been replaced by HMDs in a university Chinese class, boosting student motivation and control over the lecture. In various topics of a Computer Science degree, an intelligent learning environment has been designed and tested. The use of a virtual reality (VR) immersive environ to aid in making of architectural spatial experiences has been described. A virtual reality system with avatars make available a drill for pupils learning to interpret. A VR program aimed at both students and researchers graphically shows neutrino data, while another VR system based on the CAVE system allows users to experiment with the effects of relativity. The results reveal a substantial number of papers reporting applications in the medical disciplines, referring to both

university education and adult training. Virtual reality has been widely employed on a variety of levels in this country. According to a survey on the use of virtual reality in medical education and training, VR is being used to aid communication between medical personnel, surgical simulations, pain management, and a variety of treatments and rehabilitation interventions. Furthermore, VR is utilized directly on patients for both educational and rehabilitative reasons (e.g., an adult's dental hygiene instruction or general health information for adult healthcare training) (e.g. a VR based therapy for vestibular problems or breathing exercises for people with Chronic Obstructive Pulmonary Disease). Furthermore, virtual reality also improve doctor-patient communiqué and also allowing for remote monitoring.

Some of the articles chosen are linked to computer science research, namely virtual reality equipment, techniques, and solutions. Researchers call the sensation of being in a real place while in VR "presence," and it is this sensation that separates VR from 3D on a screen. Abrash investigated the technological criteria that VR devices must meet in order to provide the immersive experience. According to a research on the perception of the environment while wearing an HMD with AR, the actual world is not properly perceived, and there are social difficulties as a result of the technology worn on the body, but the system appears to improve orientation and spatial awareness. Other studies deal with CAVE-based environments: Kenyon shows a novel high-resolution CAVE, while Leigh et al. show a cylinder-based CAVE. Nan et al. investigate a hand-based alternative interface for usage in a CAVE system for design. The findings also suggest that virtual reality (VR) can play an important role in research by allowing researchers to observe and replicate phenomena that are not visible in real life. In medical study, virtual reality provides not just viewing but also movement within brain tissue. A research found that decreasing a person's height caused them to have more unfavourable opinions of themselves in contrast to other people, as well as higher degrees of paranoia, and another found that how we see our bodies affects how we play the drums.

IV. CONCLUSION

A review of the literature on the application of immersive VR & head-mounted displays in tutoring was done. Immersive VR has a lot of utility in knowledge gaining process: it usually gives the user a direct involvement and familiarity of objects & events that are physically out of our reach, it allows us to train in a safe environment whereas avoiding actual dangers, and it surges the individual's engrossment & enthusiasm, thanks to the game approach. According to the statistics, the large bulk of editorials focus on initiatives in higher education. There's never really a lot of study undertaken regarding infants and toddlers or disabilities. But since VR technology may disrupt kid's neuropsychological maturation, its deployment among these group should be limited. There existed no publications detailing testing involving kids below the age of 10, plus only a few involving youngsters aged ten to sixteen. Beginning in sixth grade, VR may give substantial advantages by enabling students to literally examine objects that would not be readily available in actual situations, helping pupils to nicely absorb and

remember them. However, a supervisor should always be ready at all occasions to arbitrate & supervise the use of the VR instruments, and the VR gear could perhaps be used for a limited duration. Studies are sometimes carried out to put certain theories to the question.

Impaired people are a population for whom virtual world has the potential to create a huge difference. Individuals with intellectual impairments infact may receive support greatly from adopting such methodology. Educating in a simulated space that is similar to the real one may aid in the reduction of knowledge transition difficulties. The mentioned situations do not seem to have a problem with knowledge transmission. A complete study to evaluate if VR strategies are actually easier to transmit than conventional approaches still isn't conducted.

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