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Viability of Augmented Reality and Virtual Reality in Education

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Abstract: Virtual Reality and Augmented Reality are not the latest inventions. However, various obstacles hindered its mainstream use. Recent technical advancements, along with the availability of affordable gear and software, have made AR and VR more practical and attractive in a variety of fields, including education; they have been relaunched with previously unfathomable promises. Because of the nature of AR and VR, new teaching and learning models that better fit the demands of the 21st century, students are on the horizon. We're on a mission to reimagine education. This paper explains why AR and VR are gaining popularity and why their use in education will become a reality soon.

IndexTerms **- Augmented Reality, Virtual Reality, Extended Reality, Immersive Learning, Education.**

I. INTRODUCTION

Virtual reality and augmented reality are not new technology. Daniel Vickers invented the first “virtual reality” headgear in the 1970s at the University of Utah. With two displays, the headgear allows the user to move his head to see the virtual scene shown to him. A different interface is created a few years later: the data glove (DataGlove). This 1982 gadget monitors the movement of the hand and fingers and transmits information to a computer (Fuchs, 2006).

Researchers Thomas Caudell and David Mizell invented the term "augmented reality" in 1990 to explain how the head-mounted displays used by electricians when constructing sophisticated wiring harnesses worked. And, the term "Virtual Reality" was proposed in the United States in the 1980s by Jaron Lanier [1]. AR and VR were the last technical crazes in the 1990s. However, various obstacles at the time prevented these technologies from being widely accepted by the public at large.

In this paper, we will argue for significant advancement in AR and VR and explain why they may finally be used in all disciplines, including education. We will investigate the evolution of certain AR technologies. As a result, we will attempt to determine if AR and VR are a reality and whether their implementation in education is practical or still a myth.

II. OBJECTIVES

Explain why AR and VR can finally be significantly implemented into education and learning, as well as how intriguing they are.

III. QUESTIONS TO BE ANSWERED

There are a few key questions that this research elevates:
• What makes augmented reality and virtual reality more than a myth?
• What makes AR and VR such a valuable addition to teaching and learning? What makes them more appropriate for students in the 21st century than previous learning methods?

IV. RESEARCH METHODOLOGY

A comparison of various 1990s technologies and their modern counterparts that have influenced the adoption of AR and VR.

V. OUTCOMES

The nature of AR and VR, as well as their current enhancements as a result of numerous technology breakthroughs, provides for a new style of learning that better fulfills the demands of the 21st-century student who desires entertainment, engagement, involvement, and object manipulation. However, successful adoption of AR and VR in education and learning will not occur until several technical and sociological difficulties are addressed, and education programs are better tailored to take full use of these technologies' potential.

VI. DISCUSSION

6.1 Augmented Reality (AR)

Unlike virtual reality, which provides complete immersion in the artificial world, augmented reality refers to a virtual interface in 2D or 3D that improves (or augments) what we perceive by superimposing more information (digital material) over the actual environment. Immersion in the virtual world is not complete because then we can always see the actual world around us.

AR works by filming the actual world and inverting live virtual objects, animations, messages, data, or noises that the user sees on the screen of a computer, smartphone, tablet, glasses, headset, or any other on-screen display system. Geolocation and integrated sensors keep the physical and virtual worlds in harmony (accelerometer, gyroscope) that detects the user's position and adapts the display to his movements

AR was formerly restricted to scientific research laboratories until 1999. The equipment was pricey, and the software was difficult enough that the average user couldn't work with it. H. Kato and Billinghurst's 1999 release of ARToolKit2 to the open-source community relaunched that technology. They suggested an augmented reality conferencing system at the time, which leverages the overlay of virtual pictures on the physical environment and enables participants to see and interact with virtual items simultaneously via a shared virtual whiteboard [2]. AR has captured the attention of a number of global actors in recent years, including Total Immersion, Wikitude, Layar, and many more. Since then, this technology has expanded and spread because to the ease of use of handsets. The production of augmented reality spectacles, such as Microsoft's HoloLens, has sparked interest in this technology. Promising initiatives are now underway that will enable the full use of this technology in all fields, including education.

Many studies have been conducted on how modern technologies may be used to enhance education, and many consider AR as a successful technique [3]. Numerous studies have shown that VR has a favorable influence on the learning process [4]. This technology allows users to engage with virtual or real-world items, learn via exploration, involvement, and interaction, and boost the learner's motivation and attention [5]. Education becomes more entertaining and profitable, especially when it comes to exploring abstract ideas or sophisticated phenomena, due to the opportunities for visualization and manifestation of concepts made available to the student by this technology [6], [7].

AR tools and applications, especially those devoted to teaching and learning, are many and rapidly evolving. According to experts, augmented reality will be the next computer platform in the near future. Immersive technologies based on VR and AR will replace screen machines such as PCs and phones. Microsoft's HoloLens augmented reality helmet has already taken this step. According to Pamela B. Davis (Dean, School of Medicine at Microsoft Build 2016), students will be able to study utilizing the most cutting-edge educational technologies, with HoloLens playing an important role. It might be the next great thing in medical education and many other professions. According to Oculus' John Carmack, the next five years will drive this field in unexpected directions, both technologically and creatively [8].

AR applications include entertainment (including video games), tourism, architecture, medical, education, and industry. It enables technicians, for example, to learn new techniques in real-world settings in the field of education and training. When confronted with a new device, the user may learn the disassembly technique step by step by seeing the instructions emerge in real-time.

For instance, HoloLens enables medical students to manipulate and view the human body with remarkable precision [9]. In the cultural area, augmented reality apps enable tourists or museum visitors to learn the history of locations or works just by directing their smartphone's camera to their location. AR has several educational advantages, according to Kurubacak and Altinpulluk [10]. These advantages are summarized for students as follows: courses that are enjoyable, reduced cognitive load, increased commitment and motivation in the course, increased opportunity to ask questions, increased interaction between students, new opportunities for individual learning, concretizing abstract concepts, and increased achievements. For instructors, these advantages include contributing to the development of creativity in students, assuring effective student involvement in the course, and allowing students to complete the course at their own pace.

6.2 Virtual Reality (VR)

A favorite definition, though restrictive, is to consider virtual reality as "human immersion in a synthetic world" [11]. This notion is particularly appealing to those who identify virtual reality with the wearing of a helmet. And it is precisely this circumstance that piques our curiosity in this work. When compared to the virtual reality trials of the 1990s, this technology has advanced significantly.

Virtual reality (VR) is a technology that allows us to immerse ourselves in an artificial environment, which can be a totally imagined cosmos or simply a replication of the actual world. The experience might be visual, aural, or even haptic1. This immersion

is accomplished by the use of a virtual reality headset, which sets a stereoscopic 3D display system in front of the eyes (on the nose). Some versions have sensors that detect head tracking, allowing the user to gaze around. The images are then recalculated in real-time to match the movement of the head or gaze.

Since the 1980s, VR has attempted to capture the public's attention, but without success. At the time, VR technologies were unknown to the general public, but they piqued the media's curiosity.

Since 2014, the development of more efficient and cheaper helmets has enhanced public-facing virtual reality. The developer version of the Oculus Rift headset was introduced in 2013, but it wasn't until March 2016 that this headgear became available to the general public. Google was the first to play the democratization card, offering in 2014 a model of cardboard VR headgear dubbed Google Cardboard, which is utilized with a smartphone as a display system. Other firms have now produced more advanced versions of the Cardboard, such as Samsung with its Gear VR (the mobile version of the Oculus Rift). Since 2016, public versions of VR headphones linked to a computer or gaming console have been offered on the market. Aside from Facebook's Oculus Rift headphones, other options include HTC's Vive and Sony's PlayStation VR. These high-end headphones are more costly and need the usage of a powerful computer or a new gaming console. Helmet projects that are less costly and work with underperforming PCs are in the works.

Only since 2012 has virtual reality appeared to be of interest. Several technological and economic advancements now allow for the usage of VR with adequate comfort to pique everyone's curiosity. On the one hand, there is the ease of use and power of computers and mobile phones. The extension of Internet access, on the other hand, as well as the speed of static and wireless connections. Not to mention the amount and diversity of material available in VR (due to advancements in other technologies and programming languages). At the same time, picture or video quality has significantly enhanced. The "head-tracking" has also advanced to the point that the usage of VR headgear is no longer inconvenient.

A significant advancement in the realm of virtual reality is the ability to transform the items of the synthetic environment using controllers such as Oculus Touch. This enables students, for example, to practice and learn in a more interactive manner by engaging with items in the virtual world.

According to Michael Abrash, leader of Oculus VR's scientific team, everything VR allows us to achieve today was theoretically unthinkable just a few years ago. The progress of virtual reality over the last five years has been quite astonishing. But what we will witness in the next years will be much more astounding. Abrash (2016).

Giants like Google, Facebook, HTC, and Sony (with their Cardboard, Oculus Rift, HTC Vive, and Playstation VR helmets) have breathed fresh life into this technology, promising true success this time. They are working on massive initiatives to enhance this technology and enable its application in a variety of fields, including education.

According to Citi, the VR industry for hardware, software, networks, and content would be worth $ 200 trillion by 2020. This technology has several applications, including training using simulators, simulation of surgical operations, architecture, archaeology with site reconstruction, virtual museum visits, phobia therapy, and different sorts of learning.

Why not do the same in the field of education as flight simulation, which has long been renowned for its usefulness in learning to fly when linked with actual flights? Michael Bodekaer wants to go even farther with his virtual lab, which allows scientists, whether seasoned or in training, to conduct tests and studies without putting themselves in danger, at a lower cost, and with better results.

The usefulness of using virtual reality in education and learning stems in part from the fact that it may improve and assist learning, expand memory capacity, and make better judgments while working in interesting and exciting environments. In truth, when we read textual material (on a printed paper, for example), our brain performs an interpretation process that boosts our cognitive work. When using virtual reality, the interpretation process is simplified since there are fewer symbols to decipher and the comprehension is more straightforward. For example, picturing the process of a machine's functioning is more effective than reading a written description. It is especially obvious when the image is in 3D / VR. Physical access to all we learn is not possible, which highlights the relevance of VR, which allows us to access whatever we want virtually as if we were really there. The student can, for example, investigate the moon, the ocean floor, or the status of a location in the past. This provides for a deeper knowledge of objects and phenomena with less cognitive effort on the part of the student and less cost for the learning institute. The learner seems to be more engaged, driven, and open to learning and communicating with others. Virtual reality-based learning has been proven to increase learners' level of attention by 100% and improve test results by 30%. VR will not only affect the way we enjoy ourselves, but it will also drastically alter how the kids study in and out of the classroom. However, knowing how to create and execute educational programs that are effectively suited to modern technology and best satisfy the needs of the 21st-century student will be required.

VII. Recent Advancements

AR and VR advancements affect not just hardware but also software. Rift Core 2.04 promises a more powerful, simple, and customized VR platform for Oculus. Rift Core 2.0 includes a completely new system interface, Oculus Dash, and Oculus Home. Dash fully utilizes touch and unlocks the full potential of computers, enabling manipulation of desktop programs from inside the VR world. Hand presence is a very effective method for direct manipulation. VR as a computing platform will soon be more than a pipe dream, thanks to Dash and Oculus Touch. Dash is intended to be a huge step forward for VR, transforming it into a fundamentally new computing platform that we will use every day to work, play, and communicate. On the other side, Oculus Home and Facebook Spaces5 demonstrate that VR may be utilized for all of our activities, including communication and sociability. Most of those who are skeptical about VR as just an entertainment medium should be intrigued by this.

Augment6, Layar7, and Blippar8 are just a few of the AR platforms that enable both developers and amateurs to build augmented reality apps and solutions. The development kits from Apple and Google (ARKit9 and ARCore10, respectively) will simply make it easier for developers to enhance AR content. Because of the competition between Google and Apple's AR platforms, these technologies will advance swiftly. AR-Kit and AR-Core will enable developers to create rich AR and VR content as well as a variety of apps.

Another factor that should aid in the popularisation of VR and AR is their ease of use. Google was the first to propose low-cost VR systems and headsets, beginning with Google cardboard in 2014. (The first VR platform and VR headset). Google Daydream (a VR platform and headgear that costs less than $50) was announced in 2016.

Because VR accessibility is critical, Oculus has been focusing on the development of new headsets that are more widely accessible. To benefit from the highest quality VR headsets, such as the Oculus Rift, we needed to possess a costly computer (that meets the needs of Oculus Rift). And the Oculus Rift was projected at $700. The Oculus Gear Vr also requires new Samsung smartphones (Samsung S6, S7, S8 or Note).

We no longer need a computer or a smartphone, owing to stand-alone headgear like the Oculus Go. Oculus Go provides a high-quality VR experience for less than $200 for the 32GB edition and $250 for the 64GB version. And the Oculus Rift is less expensive (about $400). Apple is developing an AR glass dubbed iGlass, which will be introduced shortly and will open up new possibilities for AR. We also observe the availability of 360° cameras, which enable anybody to shoot images or films in VR/360°. For $170, for example, the Samsung Gear 360 lets you to record high-quality VR photographs and movies (4K videos and 15 MP still images). Other virtual reality cameras cost less than $100.

VIII. CONCLUSION

The primary goal of this effort was to determine how far AR and VR have progressed and if they are now mature enough to be implemented into educational programs. Indeed, several recent hardware and software advancements indicate that AR and VR will be dependable enough as new computing platforms in the near future. This offers drastic changes and new teaching and learning paradigms that should meet the demands of the 21st-century student, who no longer thinks in the same manner as in the 20th or 19th centuries. The fact that digital behemoths like Facebook, Google, Microsoft, and Apple see VR and AR as promising investment opportunities bodes well for the future of these technologies.

It is apparent that proper integration of these technologies requires several adjustments and modifications not only on the part of engineers and specialists in AR and VR but also on the part of instructors and all those involved in the educational area. Engineers must design more comfortable and accessible VR and AR headsets. In reality, prolonged usage of the suggested VR and AR headgear causes considerable pain. Persons involved in education must develop more forward-thinking educational programs that are compatible with the nature of these technologies and meet the demands of the learner.

When used correctly, these technologies may improve modern educational settings and provide students with more learning possibilities. In both circumstances, it is guaranteed that AR and VR will transform the way we interact with the actual world in the next years and will be extensively accepted in all sectors. They will no longer be a myth, but rather a reality. What has been written about these technologies so far does not reflect their true potential. It's just the tip of the iceberg in terms of what they'll enable us to achieve in the near future.

REFERENCES

[1] P. Fuchs, G. Moreau and P. Guitton, Virtual Reality: Concepts and Technologies, Boca Raton: CRC Press, Inc., 2011.

[2] H. Kato and M. Billinghurst, "Marker Tracking and HMD Calibration for a video-based Augmented Reality Conferencing System," in Proceedings of the 2nd International Workshop on Augmented Reality (IWAR 99), San Francisco, USA, 1999. https://doi.org/10.1109/IWAR.1999.803809

[3] M. Dunleavy, C. Dede and R. Mitchell, "Affordances and limitations of immersive participatory augmented reality simulations for teaching and learning," Journal of Science Education and Technology, vol. 18, no. 1, pp. 7-22., 2009. https://doi.org/10.1007/s10956-008-9119-1

[4] H. Kaufmann and M. Papp, "Learning objects for education with augmented reality," in Proc. of EDEN (European Distance and E-Learning Network) Conference, Budapest, Hungry, 2006.

[5] S. Singhal, S. Bagga, P. Goyal and V. Saxena, "Augmented chemistry: Interactive education system," International Journal of Computer Applications, vol. 49, no. 15, pp. 1-5, 2012.

[6] E. Klopfer and K. Squire, "Environmental detectives: The development of an augmented reality platform for environmental simulations," Educational Technology Research and Development, vol. 56, no. 2, pp. 203-228, 2008. https://doi.org/10.1007/s11423-007-9037-6

[7] D. Sumadio and R. D. R. A., "Preliminary Evaluation on User Acceptance of the Augmented Reality use for Education," in Second International Conference on Computer Engineering and Applications, Bali Island, Indonesia, 2010.

[8] J. Carmack, "Virtual Reality Engineer Explains One Concept in 5 Levels of Difficulty | WIRED," [Online]. Available: https://www.youtube.com/watch?v=akveRNY6Ulw [Accessed 13 05 2018].

[9] M. Griswold, "Hololens in Medicine: amazing demo from Microsoft Build 2016 - YouTube," 2016. [Online]. Available: https://youtube/GBs471Ki8HE. [Accessed 18 06 2018].

[10] G. Kurubacak and H. Altinpulluk, Mobile Technologies and Augmented Reality in Open Education, I. S. Reference, Ed., Hershey, 2017. https://doi.org/10.4018/978-1-5225-2110-5

[11] R. J. Seidel and P. R. Chatelier, Virtual Reality, Training's Future?: Perspectives on Virtual Reality and Related Emerging Technologies, Berlin: Springer Science & Business Media, 1997. https://doi.org/10.1007/978-1-4899-0038-8