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ROLE OF AR AND VR IN THE REALM OF TECHNICAL EDUCATION

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ABSTRACT

In recent years, the primary research subjects involve for improving the lives of future generation youngsters to include excellence and creativity in the existing pedagogical system. Virtual reality plays an important part in introducing new educational ideas. To enhance the quality of teaching in aspects of relevant and interactive learning, the recent trend in educational technology is mostly cantered on e-learning and mobile-based learning approaches. Virtual reality is now widely utilised in a variety of fields, including education, healthcare, training, and entertainment. This study paper provides an overview and influence of virtual reality on the pedagogical sector, as well as its current and future aspects.

1. INTRODUCTION

Virtual Reality is a new advancement that is mostly used in creating a virtual environment that is similar to the real world. This technology is a direct substitute for conventional physical reality in the vast majority of situations where cost, energy, and other safety forecasts are critical. Virtual reality technology has increased its vertical in numerous types of education sectors in today's technical viewpoint, such as

1.Medicine 2. Technology education 3. History 4. Architecture 5. Natural sciences.

The fundamental advantage of virtual reality [1] beyond conventional education is that the student can experience the subject in a more engaging manner when it is tied to the context. Virtual reality ensures that the many aspects or methods of the topic under teaching are accurately shown. It gives the student a close-up look at a certain item in various settings, giving them a superb immersive sense and educational experience throughout the learning phase. Despite the fact that the phrase "virtual reality" was created in the 1980s, the technological revolution has occurred in recent decades as a result of growing cutting-edge technologies. Virtual reality is more suitable to its core because of the complete technology era's upside-down a lot of smart conduct. Due to its high influence on contemporary and dynamic scenarios,

it also keeping its step in the education sector Education has an important role in human development. Since ancient times, a variety of approaches have been used to disseminate information. In the present day, the learning phase in well-established classroom-based institutions such as schools and training facilities must be modernised. A lot of study has been done to influence the relevance of pedagogy in associated with knowledge acquisition in the digital tech community, which employs a variety of smart devices. Virtual reality connects all of the smart devices in the education area with the strength of a highly engaging and novel format for the peer group, ensuring that they are never bored throughout the learning process. The COVID-19 problem has already resulted in several adjustments in all applications, particularly in the realm of education. The traditional location-based classroom methodology is being replaced with global learning, in which information is accessible to any social circle anywhere in the world, regardless of time or distance.

According to a survey published by marketsandmarkets, the virtual reality business is predicted to increase from about USD 8.6 billion in 2019 to USD 51.6 billion by 2030, with a compound annual growth rate (CAGR) of 41.6 percent throughout the forecast time span. The following causes are the primary drivers of this substantial expenditure in the virtual reality market:

1) Evaluation of Head Mounted Displays (HMDs) in the entertainment and gaming industries [2].
2) Advancement of technology into the digital age, as well as the emergence of commercialised virtual reality products at reasonable pricing.
3) The shift in technology toward future smart gadgets allows for significant investment in the virtual reality and augmented reality fields.

The virtual reality industry is predicted to increase dramatically in the future years, according to a statistical analysis issued by the Statista Research Department on March 20, 2020. This is due to a big advance in technology to futuristic smart technologies. The incorporation of technology into the education profession [3] has resulted in significant improvements in recent years. Learning is now linked to high-tech equipment and software applications in contemporary schooling. To capture the interest of the educational community, a variety of novel technology solutions are integrated into instructional skills. Modern educational society continues to face several obstacles on a daily basis. One of the most difficult tasks is to get the learning culture to focus on the instruction without being distracted, so that they can get the skills they need from the course.

The following are the key aspects that contribute to distraction in the educational sector.

1) In a learning environment, there is a lack of excitement.
2) Learning materials do not effectively integrate the student with the idea being studied.
3) Difficulty picturing the useful value of a theoretical topic.
4) Owing to privacy and protection concerns, a few of the live performances are prohibited.
5) Pedagogy suffers from a lack of proper resources, which has an impact on genuine learning.
6) It is difficult for a person with exceptional needs to learn on their own and engage with their peers.
7)

2. TECHNOLOGY REVOLUTION IN EDUCATION OVERVIEW

Li Bian [4] provides an overview of information technology and its use in e-learning. E-learning is getting a lot of attention in higher education, particularly when it comes to distant learning. Education via e-learning may be given in a variety of ways, including:

1) Connections via phone
2) Meetings through videoconference
3) Tele-courses
4) Computer communications, for example.

Russell Gersten et al. [5] provide a comprehensive overview of numerous learning comprehension tactics for students, particularly those with learning impairments. Psychologists who work with human Intelligence, like Kolligian and Sternberg [6], have a propensity to focus on meta-cognitive and cognitive qualities and pay less attention to other elements that are critical for understanding, such as,

1) Recognise the structure of the text.

2) Vocabulary knowledge
3) The significance of reading fluency in cognition.
4) The study of context comprehension.
5) The significance of task resolution.

According to the research done in the 1980s, students with special needs have restricted abilities to distinguish between the following forms of textual arrangement and pattern.

1) Structure of narrative text
2) Structure of an expository text

The internet of things (IoT)-based digital learning system in education was described by Muhammed Ali Akbar et al. [7]. The Internet of Things (IoT) provides the door for the whole world to move toward digital transformation. The biggest problem in the digitalisation of the education industry is the creation of a control lab with complete automation technologies, particularly at the institution. To accommodate such a digital change, the whole syllabus and lab facilities have been reorganised. The learners will be equipped via three key components.

1) The start of Industry 4.0 and the Internet of Things.
2) Programming, setup, and machine-to-machine communication at the edge (M2M).
3) Representation of mobile and web-based apps, as well as their progress.

Snezana Scepanovic [8] discusses the fourth industrial revolution and schooling. Industry 4.0 has reformed the whole digital manufacturing process, allowing people to be more creative in the production process, value chain, and customer service interactions. Education plays a critical role in preparing the next generation to meet these technological challenges.

When comparing developments in the overall labour market over the previous five years in terms of automation, a lot of attention is paid to the required skill upgrades. According to the World Economic Forum, there have been several advancements in the primary skills emphasised by the corporate sector in the recent five years.

Higher education has progressed through numerous phases, including the elite period, mass education, and post-massification education. Higher education is primarily concerned with the transmission of skills for a wide variety of applications and productive tasks that have emerged as a result of recent technical and industrial advancements.

3. VIRTUAL REALITY APPLICATIONS IN VARIOUS PEDAGOGIES

Pavel Smutney et al. [9] studied virtual reality's utilisation in the education sector and different pedagogies. Virtual reality technologies, which are becoming more popular, have made learning more participatory and enjoyable. Currently, there has been a lot of progress and attention paid to the adoption of VR in the school sector and at all levels of pedagogy in order to build the necessary skills in the technological area.

The following are a few of the instructional uses of VR in the fields of engineering and sciences: Drone pilot training, portable robot's virtual operator station, mining, energy engineering, process engineering, and so on. As per the World Economic Forum, some skills are needed by the corporate sector, which are as follows:

1) Solving Complicated Problems
2) Coordinating with others in the solution of complex problems
3) Thinking Critically
4) Creativity in People Management
5) Critical Thinking in People Management
6) Negotiation in People Management
7) Emotional Intelligence Quality Control
8) Orientations to Customer Service
9) Service Orientation: Judgment & Decision-Making
10) Listening with Intent

11) Negotiation

12) Creativity

The digital age makes extensive use of digital devices and is constantly upgrading strategies that make information transmission more efficient, pleasant, and successful. Integrating virtual reality technology into the learning phase is a key concern in the future evolution of education. The benefit of using virtual reality technology in all stages of education and training is that it allows students to learn more effectively while also having more fun.

Lafranconi [10] outlined a variety of methods that educational institutions might reap the benefits of using virtual reality technology into their teaching platforms.

1) Immersive experience while learning visually
2) Emotional reaction to a virtual laboratory setting

S. AlAwadhi et al. [11] created a virtual reality-based program to improve learning skills by making them more informative and participatory. The student community may use these apps to conduct live experiments.

1) Take all online live 360-degree lectures
2) Learn more effectively by listening to pre-recorded lectures
3) Take a live campus tour Visit
4) Instructive laboratories throughout the world via virtual visit

The key educational institutional problems encountered in the traditional learning process include ensuring safety and safeguards when doing dangerous experiments and a lack of proper equipment. Disabled students have a hard time moving about on a regular basis. Hardware and software elements are included in the virtual reality system. The Oculus Rift is a virtual reality headgear that comes with a hardware module. Leap Motion is used as a gesture sensor, while the Ricoh Theta S is a 360-degree camera that can be combined with a computer and run on Unity 3D software. To secure the pedagogy's material from attackers, security [12-16] measures are required. To identify the individual using such a VR platform for teaching purposes, proper authentication and sign-up are used.

Virtual reality technology was used for physical training by Syed Faizan Ali et al. Virtual reality allows users to immerse, navigate, grasp, depict, and engage with 3D things in real time. The technology transforms the dynamic real-world environment into a virtual one. In a simulated platform, the user may engage with the actual world in a variety of ways, including: 1. Voice, 2. Movable body, and 3. Actions

Due to its interactive nature, virtual reality technology may be used to enhance any physical training. Virtual reality's major goal is to provide consumers with an immersive, real-time experience of a 3D-based virtual platform. There are three categories of virtual reality technologies.

1) Virtual reality that is completely immersive (IVR)
2) Semi Immersive Virtual Reality (SIVR)
3) Non-immersive VR is a kind of virtual reality that does not need us to be completely immersed (NIVR)

An IVR system allowed the user to completely immerse them in a 3D environment that was artificially generated, giving the impression of complete seclusion from the external world. The SIVR platform consists of large projectors and curved screens that are projected on 3 to 6 walls of cuboids rooms. The users of the NIVR system are not completely isolated from the actual world. In general, an IVR platform consists of a virtual reality-enabled headgear, such as Samsung VR or Google Cardboard, that uses a contemporary digital device or smart phone as a primary component to show and render artificially created realistically simulated environments. Syed Faizan Ali et al. [17] created a virtual reality-based physical training assistance system. This approach focuses on establishing physical training activities such as walking, jogging, and running into pedagogical modules with a high degree of precision.

For workforce pedagogy and instructional purposes, Daniel W. Carruth [18] enforced virtual reality technology. The affordable evolution of commercial virtual reality technology has pushed pedagogical instruction to new heights. The fundamental difficulty with conventional education is the technological challenges and prohibitive costs.

Virtual reality technology is dominating in future pedagogy because of its highly engaging and unique style of learning, which allows for a safe and risk-free training environment.

Martin Nemec et al. [19] provide a broad overview of how virtual reality technology may be used in teaching. Virtual reality methods are used in a variety of applications to improve the teaching experience. The following are a few of them:

1) Visualization of the human skeleton
2) Virtual reality is used to explore the planets of the solar system.
3) Interactive architectural visualisation
4) The nuclear power facility at nuclear power station

The use of VR technology at an industrial level teaching was examined by David Martinez Oliveira et al. The major research strategy is to use pedagogy to teach people how to maintain industrial equipment. The virtual reality-based system is primarily created using two methods: one using open-source software and the other using commercial ones.

Nalin Randeniya et al. established an innovative method of maintenance pedagogy for the train sector utilising virtual reality technology. Christopher D Wickens provides an overview of virtual reality in teaching.

4. AUGMENTED VERSUS VIRTUAL REALITY

Smart technologies add a new perspective to the way we see the world. Virtual reality and augmented reality are two examples of technologies that transform the traditional way of looking at the world into a more participatory and engaging experience, which is particularly beneficial to students. Augmented reality is a more advanced approach to bringing reality to life by incorporating additional digital information into a given picture via the use of suitable technology. The fundamental working technique of the AR software is the efficient use of smart phone cameras to put real-world situations in front of us, coupled with the inclusion of information in the form of text or photos on top of the present scene for further study. Various applications now employ augmented reality technologies to both amuse and educate users. Apps like Pokeman GO, for example, are made specifically for gaming, while Layar is a valuable information app.

Virtual reality, on the other hand, makes utilisation of computer technology to make a synthetic backdrop that seems to be a genuine setting. It's a whole other picture that's being shown to us as a simulated perspective rather than a genuine one. The virtual reality sceneries may be seen with a VR viewer such as the Oculus Rift, Google Cardboard, Samsung VR, HTC Vive, Daydream View, and others.

5. INTEGRATION OF VR AND AR IN EDUCATION

Rula Al-Azawi et al. [2] provide an overview of how virtual reality and augmented reality innovations are being integrated into different pedagogical methods in the educational sector, as well as the existing and future potential. Every day, new technologies are launched to increase the teaching and learning process's quality. Electronic learning (e-learning) and mobile learning are the primary emphasis of today's educational system (m-learning) as a means of passing on information. The majority of research works in the area of pedagogy that use augmented reality and virtual reality have a number of benefits, some of which are stated below:

1) Enables seamless interaction between virtual and physical environments, as well as the right usage of solid connections for targeted object management.
2) With appropriate supplementation, virtual annotations, and illustrations, it provides fantastic assistance to the teacher in the educational application to increase comprehension of topics.
3) Allow teaching experience to extend beyond classroom borders and time constraints.
4) Understanding the learning experience of any topic in a live way in the educational phase by including just 3D dynamic pictures.

Mixed reality is popularly called hybrid reality. Mixed reality's major goal is to integrate the greatest aspects of both augmented and virtual reality. Dr. Abraham G Campbell spoke on the future of mixed reality in educational environments. The primary goal of a multicast virtual classroom is to create a mixed reality setting wherein the teacher and the student are both virtual and real. The notion of mixed reality in education and its future prospects were examined by Steven Szu-Chi Chen et al.

The tiny site at the computer science department at University College Dublin was chosen for acceptable modelling using the Unity 3D engine, and the required modelling of texture mapping to the specified campus building was done

with Blendor, an open-source 3D modeller. The appropriate libraries are then added to the virtual platform to provide different functionality. For different reasons, a few have been mentioned here.

FlexiHub allows you to transmit a camera broadcast through one person to another. UNET: built-in networking tool

Leap Motion Controller + VIVE enables the system's shared whiteboard; Steam VR plugin – for the required scaling of the anticipated room size; Leap Motion plug-in—for the transmission of hand gestures, virtual writing, and 3D modelling interactions.

6. POLICY FRAMEWORK: NEP 2020 AND NETF

The National Education Policy (NEP) 2020 recognises the significance of emerging technologies, including AR and VR, in modernising technical education. It emphasises the integration of digital tools to enhance teaching methodologies and skill-based learning. The establishment of the National Educational Technology Forum (NETF) under NEP 2020 aims to promote technological advancements in education, advocating for the widespread adoption of AR and VR in classrooms (Ministry of Education, [20]). NETF serves as a platform for sharing best practices, research, and innovations in educational technology. By encouraging collaboration among policymakers, educators, and industry leaders, it ensures that technological interventions like AR and VR align with national educational goals.

7. CONCLUSION

Virtual reality-based educational systems provide both obstacles and opportunities for the digital generation's learners to engage in future teaching. According to the statistical report, the future direction of virtual reality in the field of education will be enormous, and advancements in leading technologies have made virtual reality tools more affordable in recent days, allowing any smart phone user to take advantage of the technology at a low cost.

Virtual reality-based teaching eliminates most of the challenges associated with traditional education in terms of student engagement, interaction, and attention on the topic. It promotes the learners' knowledge, attention, or absorption in the issue under discussion, as well as imparting the essential skills for the industrial sector. This study paper examines every facet of virtual reality from a pedagogical standpoint, including knowledge transfer, obstacles, and unique content outputs to end customers in the digital age

CONFLICT OF INTERESTS

None.

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REFERENCES

Sarkady D., Neuburger L., Egger R. (2021) Virtual Reality as a Travel Substitution Tool During COVID-19. In: Wörndl W., Koo C., Stienmetz J.L. (eds) Information and Communication Technologies in Tourism 2021. Springer, Cham. https://doi.org/10.1007/978-3-030-65785-7_44

Tao, G., Garrett, B., Taverner, T. et al. Immersive virtual reality health games: a narrative review of game design. J NeuroEngineering Rehabil 18, 31 (2021). https://doi.org/10.1186/s12984-020-00801-3

Hamilton, D., McKechnie, J., Edgerton, E. et al. Immersive virtual reality as a pedagogical tool in education: a systematic literature review of quantitative learning outcomes and experimental design. J. Comput. Educ. 8, 1–32 (2021). https://doi.org/10.1007/s40692-020-00169-2

L. Bian, "Information Technology and Its Application in E-learning," 2009 International Conference on Networking and Digital Society, 2009, pp. 293-296, doi: 10.1109/ICNDS.2009.79.

Gersten R, Jordan NC, Flojo JR. Early Identification and Interventions for Students With Mathematics Difficulties. Journal of Learning Disabilities. 2005;38(4):293-304. doi:10.1177/00222194050380040301

John Kolligian Jr. & Robert J. Sternberg (1991) Perceived Fraudulence in Young Adults: Is There an 'Imposter Syndrome'?, Journal of Personality Assessment, 56:2, 308-326, DOI: 10.1207/s15327752jpa5602_10

Ghaleb, S.M., Subramaniam, S., Zukarnain, Z.A. et al. Mobility management for IoT: a survey. J Wireless Com Network 2016, 165 (2016). https://doi.org/10.1186/s13638-016-0659-4

S. Scepanovič, "The Fourth Industrial Revolution and Education," 2019 8th Mediterranean Conference on Embedded Computing (MECO), 2019, pp. 1-4, doi: 10.1109/MECO.2019.8760114.

S. Iwin Thanakumar Joseph, S. B. E. Raj and J. M. Kiyasudeen, "Virtual Reality – A Paradigm shift in Education Pedagogy," 2020 Seventh International Conference on Information Technology Trends (ITT), 2020, pp. 72-79, doi: 10.1109/ITT51279.2020.9320880.

A/ Lafranconi et. al. "Medical Leardership – from inspiration to education", The Lancet, doi: 10.1016/S0140-6736(15)00483-3

S. AlAwadhi and A. Morris, "The Use of the UTAUT Model in the Adoption of E-Government Services in Kuwait," Proceedings of the 41st Annual Hawaii International Conference on System Sciences (HICSS 2008), 2008, pp. 219-219, doi: 10.1109/HICSS.2008.452.

S. Pramanik and S. S. Raja, "Analytical Study On Security Issues In Steganography ", think-india, vol. 22, no. 35, pp. 106-114, Dec. 2019.

S. Pramanik and S. Suresh Raja, "A Secured Image Steganography using Genetic Algorithm", Advances in Mathematics: Scientific Journal, vol. 9, issue 7, pp. 4533-4541, 2020.

S. Pramanik and S. K. Bandyopadhyay, "Image Steganography Using Wavelet Transform and Genetic Algorithm", International Journal of Innovative Research in Advanced Engineering, vol. 1 pp. 1-4, 2014.

S. Pramanik and S. K. Bandyopadhyay, "An Innovative Approach in Steganography", Scholars Journal of Engineering and Technology, pp. 276-280.9, 2014.

S. Pramanik and S. K. Bandyopadhyay, "Application of Steganography in Symmetric Key Cryptography with Genetic Algorithm", International Journals of Engineering and Technology, vol. 10, pp. 1791-1799, 2013.

S. F. Ali, S. A. Azmat, A. U. Noor, H. Siddiqui and S. Noor, "Virtual reality as a tool for physical training," 2017 First International Conference on Latest trends in Electrical Engineering and Computing Technologies (INTELLECT), 2017, pp. 1-6, doi: 10.1109/INTELLECT.2017.8277617.

Shuchisnigdha Deb, Lesley J. Strawderman, Daniel W. Carruth, Investigating pedestrian suggestions for external features on fully autonomous vehicles: A virtual reality experiment, Transportation Research Part F: Traffic Psychology and Behaviour, Volume 59, Part A, 2018, Pages 135-149, ISSN 1369-8478, https://doi.org/10.1016/j.trf.2018.08.016.

M. Němec, R. Fasuga, J. Trubač and J. Kratochvíl, "Using virtual reality in education," 2017 15th International Conference on Emerging eLearning Technologies and Applications (ICETA), 2017, pp. 1-6, doi: 10.1109/ICETA.2017.8102514.

Ministry of Education. 2020. National Education Policy-2020