REVIEW ON AUGMENTED REALITY AND VIRTUAL REALITY IN EDUCATION

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ABSTRACT

Because they provide fun, interactive, and attractive digital experiences, augmented reality (AR) and virtual reality (VR) have completely changed the way we learn. Latest technological developments and more affordable gadgets have made AR and VR more available and loved in fields including business, engineering, healthcare, and education. According to studies, people's learning preferences, as determined by instruments like the VARK model, can affect how well they use AR and VR to encourage creativity and learning. These technologies are opening the door for novel and more personalized teaching strategies that feed to the demands of today's students. Studies and applications of AR and VR have increased significantly between 2010 and 2022, according to research. But issues like extremely high prices, the requirement for personalization, and slow school absorbtion remain. Researchers have benefited from tools like as Vosviewer, which have made it easier to understand patterns in AR and VR studies, including who is conducting the research, which universities are working together, and what subjects are being look over. AR and VR helped boost up teaching during the COVID-19 pandemic by empowering meaningful interactions between students and digital content on PCs and mobile devices. It is expected that AR and VR will eventually replace conventional teaching techniques with more engaging resources including 3D models, animations, and sound effects as technology advances. In order to enhance learning chances for all, researchers are encouraged to solve problems and guarantee that new technologies are widely and successfully carry out in the classroom.

Keyword- *Augmented Reality (AR), Virtual Reality (VR), Education*

1. Introduction

Virtual reality (VR) and augmented reality (AR) are two game-changing technologies that have changed several industries, especially education. These technologies have been there since the 1970s and 1980s, when modification like the Data Glove and the first VR headset were created, but it has only been in recent years that hardware and software upgradations have allowed them to reach their full potential (Fuchs, 2006; Bryson, 1995). Since they provide inspiring and interactive learning experiences, augmented reality (AR), which overlaying digital content onto the physical world, and virtual reality (VR), which pour over users in computer-generated settings, are becoming more and more popular in education (Tan et al., 2022; Seidametova et al., 2021). By permitting students to interact with complicated content in ways other than standard techniques like lectures and textbooks, the exposure of AR and VR in education has created unique prospects to make better learning (Sun et al., 2022). Additionally, these technologies allow for content customisation based on individual learning preferences, causing in a more dynamic and fascinating setting (Childs et al., 2021). While AR strengthen the functionality of the actual world by adding digital features, VR completely purify users in a digital environment (Hantono et al., 2018; Kamińska et al., 2019). With profit across a variety of industries, including healthcare, manufacturing, and retail, both technologies have vast potential to close the knowledge gap between classroom education and practical experience (Antonioli et al., 2014). By permitting students to engage with 3D content, go on virtual field trips, and taking part in simulations, AR and VR have the potential to build up the educational process and increase students participation (Young et al., 2020; Gargrish et al., 2020). But there are still hurdle to get the better of, such as knowledge gaps on how new technologies affect cognition, especially in design education. Previous research has surveyed how user attributes, like learning preferences, impact the well organized use of interfaces. It has

been observed that students reaction with AR and VR technologies may be hit by their preference for visual or kinaesthetic learning styles (Bell, Koch, & Green, 2014; Drago & Wagner, 2004). These preferences have been estimated using the VARK Learning Styles assessment, which is based on the theory that learners who go for visual or kinaesthetic learning may be more likely to interact with AR and VR interfaces that suit their preferences. Even while AR and VR have exhibited great promise in the classroom, obstacles to their broad use still exist, including high implementation costs, the need for additional research comparing their relative advantage in educational settings, and the technical skills needed (Verner et al., 2022). Moreover, more research is required to fix how these technologies can help kids with specific needs, including those who have dyslexia, autism, or ADHD (Rega et al., 2018). By investigating how learner preferences affect the adoption of AR and VR, as well as their survival in the classroom, mainly for students with different learning styles and needs, this study tries to find to understand how these technologies can improve the innovative design process in education.

1.1 Virtual Reality

People can occupy themselves in artificial worlds, whether they are realistic or entirely fictional, thanks to a technology called virtual reality (VR). A headset that positions a 3D screen in front of the eyes is usually used to experience virtual reality (VR); some models track head movements to provide a more engaging experience. Despite being around since the 1980s, virtual reality (VR) only became widely popular in 2012 as a result of advancements in technology and reasonably priced devices like the Oculus Rift and Google Cardboard. Since then, VR's potential has spread to a number of industries, including education, where it provides more interesting and productive learning environments. Without the dangers of the real world, students can sharpen their skills in virtual settings like surgical or experimental simulations. It has been demonstrated that this immersive learning approach improves test scores and increases attention. It is expected that VR technology will have an even more impact on education and other sectors as it develops.

1.2 Augmented Reality

By superimposing virtual features such as images, animations, or data on top of our physical environment, augmented reality (AR) improves what we see in the actual world. Through gadgets like smart phones, tablets, or AR glasses, we may interact with virtual objects while still seeing the actual world, in contrast to virtual reality, which completely submerges us in an artificial environment. Thanks to developments in smart phones and tablets, augmented reality (AR) has gained popularity, and resources like Microsoft's HoloLens are promoting its application in education. By permitting students to view and engage with complicated topics in real-time, augmented reality (AR) is particularly useful for making learning more dynamic and interesting. Education and medical fields are already utilizing this technology, allowing students to see complex pictures of the human body or learn new skills through step-by-step instructions. AR promotes or supports creativity, increases motivation, and makes learning more enjoyable.

2. Purpose of Study

One of the major issues in AR VR technology is that many teachers do not have appropriate skills to use these technologies in teaching. Moreover, the usefulness of AR and VR may be limited by the way classes are planned and organized, which frequently fails to fully utilize these technologies. Another major issue is that minority students may not have access to AR and VR technologies in their schools, which makes it difficult for them to take use of these technologies. All things considered, these factors make it challenging to thoroughly investigate the ways in which AR and VR can enhance education. The advantages of AR and VR are not well known to many possible users, and also we do not have enough financial and social resources, especially for students who are impacted by the digital divide. More work is required to implement AR and VR at all educational levels, even if they have the potential to improve traditional education through experiential learning. In order to find or discover trends, leading nations, and research gaps, a bibliometric and content study of research trends in AR/VR in education is suggested, utilizing data from the Web of Science database. The motive of this analysis is to direct future research and enhance the use of AR and VR in the classroom.

3. Related works

According to the primary aim of this study, which reviewed the literature on VR and AR in education during the past ten years as well as its most ongoing developments and directions, relevant works have been compiled in the same field, including several goals and looking into certain reviews the use of VR and AR in education.

The key among the terms used to find related works were this title's variables. Concentrating on the most thorough educational research.

Related works to VR & AR in Education in recent years.

- Boyles (2017) review on VR & AR in Education- Describing how AR and AR can be used to improve learning and going over the benefits and drawbacks.
- Patel et al. (2020) review on VR, AR & mixed Reality in education- Summary the use of VR, AR, and mixed reality in education and people's capacity to adjust to these technologies
- Huang et al. (2019) review on AR & VR in Education - While augmented reality is better at handling audio information, virtual reality is more inclusive of physical presence.
- Guo et al. (2021) review on Extended reality in Education - Investigating the general productivity of XR as well as Ongoing progress and patterns in the field of education.
- Nguyen and Dang (2017) review on Setting up VR & AR learning environment- Creating a 3D curricular framework using VR and AR to pre-set real-world objects.
- Rau et al. (2018) review on Speed reading on VR & AR- Investigating VR and AR performance, finding that response times were longer there than on a desktop.
- Remolar et al. (2021) review on Learning throughout VR & AR- Strengthen visual appeal and gameplay while lifting up students motivation to learn.
- Beck (2019) review on Immersive learning - Technology integration, such as AR and VR, to improve educational settings.

4. Methodology

Using AR and VR to judge Learning Styles-

- Using the VARK learning styles assessment, Chandrasekera and Yoon's study inspect how AR and VR interfaces suits with various learning preferences. According to the study, kinaesthetic learners go for AR's tactile features, whereas visual learners profit from VR's visual signals. Thirty participants figure out design problems using AR and VR, exhibit how learning preferences impact creative engagement and technology acceptance.
- Applications in Education and Technological Viability- Elmqaddem survey how AR/VR technologies have changed since the 1990s, highlighting how they have become more reachable and how accessible their technology has become. The study analysis case studies showing how AR/VR increases experiential learning, including simulations and virtual field outing, while prioritize the need of removing educational and technological barrier.
- Both content analysis and bibliometrics- A bibliometric investigation by Zhao et al. investigated trends in AR/VR research with an emphasis on the use of these technologies in education and other fields. The study found a growth in AR/VR applications, such as virtual labs, STEM education, and special education, using technologies like Vosviewer. The importance of matching AR/VR apps with learning objectives and user pre conditions was marked by this study.
- Using a systematic literature review, the study's methodology concentrates on analyzing how augmented reality (AR) and virtual reality (VR) have progress in the field of education during the previous 12 years. In order to select 1,536 papers published between 2011 and 2022, the researchers used the Scopus database, screening them based on classification including document type and keywords like "education," "learning," "AR," and "VR." WordStat software was used for textual analysis and topic analysis in order to fetch and evaluate themes, keywords, and word frequency. The process also includes assessing growth trends, uses, and limitations of AR and VR in educational contexts, as well as formulating hypotheses based on previous research. The study planned to recognize research trends, gaps, and future aims for AR and VR technologies in education. It also shows the exponential growth in AR and VR research, mainly during the COVID-19 epidemic.

5. Discussion

Upgrading Involvement and Education-
Because AR and VR generate realistic, interactive experiences, their interesting qualities inspire interaction. For example, AR overlays raise real-world observations, such as studying anatomy, while virtual labs allow STEM students to perform experiments without any troubles.
Taking Learning Styles into Account AR/VR's flexibility serve a range of tastes. While kinaesthetic learners succeed in AR environments that attract tactile contact, visual learners get from VR's lifelike representations. This flexibility facilitates individuals learning paths.

Getting control of barriers instead of the great potential of AR and VR, hurdle still exist: Cost and Accessibility: Good AR/VR systems are still costly, which makes them unreachable in schools with less funding. Technical Expertise: Teachers regularly lack the education required to perfectly use augmented reality and virtual reality. Curriculum Integration: Systemic changes are necessary to match AR/VR applications with latest educational frameworks.

The paper's topic emphasize how AR and VR have rise quickly and become more remarkable in education during the last ten years. It draws awareness to two different phases: the slow extension of research from 2011 to 2016 and the quick increase from 2017 to 2022, mainly during the COVID-19 pandemic when there was a sharp rise in demand for cutting-edge learning technology. The investigation supports theories of how AR and VR can improve interaction and communication between teacher and student. These technologies accessibility and relevancy in current education are highlighted by the recognition of mobile applications and platforms as the primary means of execution. The study notice that there is not enough research on AR and VR's ability to modify learning environments both during and after the pandemic. The output also highlights the basic requirement of stronger integration tactics to control current barriers and make the most of these technologies for successful learning output. The talk ends by comparing the outputs to prior research and highlighting the importance of AR and VR in strengthening student engagement and adaptation in the classroom.

6. Future Directions

Research that compare AR and VR to discover which is further advantageous in certain circumstances. Creation of user-friendly, low-priced augmented reality and virtual reality technology. Increased applications in remote learning and special education. For attractive, interactive learning experiences, focus on integrating AR and VR into courses. Generate resources for personalized learning experiences to fulfil the needs of every learner. Examine AR/VR applications for special education to create classrooms that are accessible. Utilize lowering hardware costs to increase the flexibility and use of AR/VR technology. Increase the usage of AR and VR in real-world scenario simulations and vocational education. Examine cutting-edge deployment techniques and evaluate long-term effects on learning objectives. Motivate wide ranging research to refine AR and VR's effectiveness in the classroom. Discuss the struggle relevant with widespread deployment in many educational contexts. Analyze how AR and VR can be used in job training programs and new educational marketplaces. Use emerging technology to enhance AR/VR experiences, such as 5G/6G and AI.

7. Limitations

- Fiducial markers were used for engagement in the AR environment, which might not have suggest the best tactile interaction. This might affect the end result and not precisely serve the usability of AR in the actual world.
- The output of this prospective study provide first ideas, but they need to be verified by additional thorough and distinct research in order to support the conclusions.
- The use of AR and VR in education is being hampered by technical difficulties, such as the unease of present equipment and restricted accessibility.
- To fully utilise the potential of new technologies, educational programs must go through fundamental changes in order to integrate them successfully.
- The overprice of AR and VR software and hardware restricts many schools and organizations from executing these technologies broadly in educational contexts.
- Successful adoption of AR and VR technologies is still restricted by the complexity of integrating them in the classroom, which calls for infrastructure development and additional training for teachers.
- The analysis of bibliometric is restricted to the Web of Science database, which may not cover relevant studies indexed in other databases such as PubMed or Scopus, although being thorough. This restriction may result in unfair or an inadequate picture of the contributions and trends in educational AR/VR research.
- The report admitted the potential of AR and VR in education, but it misses out over major practical matters like the cost and training struggle for teachers or the accessibility of technology in developing countries. By handling these problems, it could lead to a more thorough and practical set of findings.

8. Conclusion

With their capacity to provide personalised and interactive learning experiences, AR and VR mark a significant progress in educational technology. But in order to fulfil their potential, difficulties with performance, cost, and accessibility must be sort out. Applications of AR and VR can alter the educational

experience for a variety of populations by matching academic objectives with learner needs. Unlatching AR/VR's transformational potential will need in progress research and investment. This study highlights how engaging and interactive learning experiences using augmented reality (AR) and virtual reality (VR) have the potential to fully change education. Their use in remote and hybrid learning has increased dramatically during the last ten years, mainly during the COVID-19 pandemic. Even if AR and VR make better variety and participation, issues with scale, reasonability, and accessibility still exist. These technologies have the potential to change education by filling the gap between theory and practice and generating a more dynamic learning environment as long as developments continue and costs fall down.

9. Results

- In terms of usage, convenience of use, and purpose to use, augmented reality (AR) interfaces were gained much higher than virtual reality (VR), with kinaesthetic and visual learners favouring AR in particular.
- Learner choice had an effect on noticed usefulness, but it had no visible effect on creativity or the design process as a whole.
- AR and VR are now much more reachable, interesting, and able to fulfil the demands of 21st-century learners by upgrading motivation, interactivity, and engagement in the classroom thanks to latest developments in hardware and software.
- In spite of these developments, getting over social and technological barriers and modifying educational curricula to make full use of AR and VR in the classroom are necessary for their successful integration.
- The potential of AR and VR technologies to improve learning through engaging, interactive, and fascinating experiences has been illustrated by their exponential arise in educational research and applications, mainly during the COVID-19 epidemic.
- The use of AR and VR in education is still in its inception, in spite of its growing fame, but it has huge potential to change teaching and learning approaches in the future.
- Research on virtual reality (VR) and augmented reality (AR) in education significantly increased between 2018 and 2022, according to bibliometric and content analysis. The analysis displayed the increasing interest and adoption of these technologies in a variety of educational contexts by determining necessary areas of application, such as STEM education, medical training, and interactive classroom environments.
- The study exhibited how engaging and interactive VR and AR experiences might refine learning outcomes. It did, however, also point out research faults, such as the lack of studies comparing the educational effects of VR and AR and the little investigation of their potential uses for students with special needs or in distance learning environments.

10. References

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