A SYSTEMATIC REVIEW ON AUGMENTED AND VIRTUAL REALITY(AR/VR) IN EDUCATION

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ABSTRACT

The entire educational process could be completely transformed by new virtual reality and augmented reality (VR/AR) technology. According to studies, teachers should thoroughly evaluate the technology's practicality and potential adoption in the classroom before introducing it to their students. The corpus of information regarding the leadership and coupling of VR and AR in education, as well as its trends and the direction of research in other fields, is not well summarized, nevertheless. According to this article's bibliometric and content study, the Web of Science database's interest in virtual and augmented reality grew between 2018 and 2022. The bibliometric analysis's Vosviewer trends have also demonstrated that virtual reality (VR) and Education, healthcare, the arts, engineering, business, and marketing are just a few of the industries that use augmented reality (AR). The authors with the most publications in the field, their linked universities, and the articles' source were displayed in other data mining findings. These findings could also assist enhance the quality of instruction and educational opportunities for all pupils in the wake of the Covid-19 pandemic. In other words, virtual reality (VR) and augmented reality (AR) use existing technology to place digital material in the real environment so that users can engage with it more meaningfully on desktop or mobile devices. According to this bibliometric study, animation, 3D graphics, and sound may eventually supplant more conventional teaching methods. Despite the promising advantages, challenges such as the cost of hardware, the need for teacher training, and the development of curriculum-specific content remain. Future research and development in AR and VR for education will focus on improving accessibility, reducing costs, and integrating these technologies seamlessly into traditional and digital classrooms.

KEYWORDS

Augmented Reality, Virtual Reality, Education, Immersive Learning, Experiential Learning, Educational Technology, Active Learning

INTRODUCTION

Technology has significantly changed many facets of our life in recent years, including education. As educators and researchers look for new and creative ways to engage students and enhance learning results, traditional educational practices are changing. Virtual reality (VR) and augmented reality (AR) are two cutting-edge technologies that have garnered a lot of interest due to their potential to revolutionize the educational landscape. Teachers are able to develop engaging and dynamic learning experiences that go beyond the standard classroom by utilizing AR and VR.

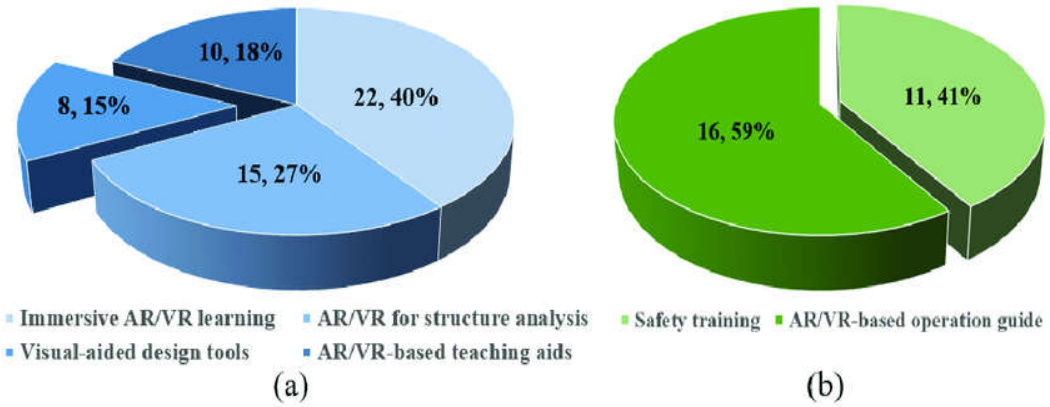
Students have a unique opportunity to interact with realistic simulations, explore virtual worlds, and manipulate digital things thanks to AR and VR. Whereas VR produces completely virtual environments that users may explore and interact with, AR superimposes computer-generated content over real-world settings. With the use of these tools, students may now handle three-dimensional models, visualize difficult ideas, and run realistic simulations that were previously unthinkable.

There is potential for incorporating AR and VR into the classroom across a range of subject areas and educational levels. Teachers are coming up with innovative methods to use these technology in their lessons in both elementary and higher education settings. AR and VR provide life-changing experiences that can increase student engagement and enhance learning results, whether it is through simulated field visits to historical locations, virtual science experiments, or the practice of practical skills .Using AR and VR in the classroom has advantages beyond raising student interest. These tools could help students become more adept at critical thinking, encourage cooperation and teamwork, and accommodate various learning preferences. Individual student needs can be met and the gap between theory and practice can be closed by offering tailored adaptive learning experiences like AR and VR.

But there are obstacles in the way of effectively incorporating AR and VR into the classroom. Widespread adoption may be hampered by technological constraints like the requirement for specialized hardware and software.Resources and experience are needed to create content for AR and VR applications, and the caliber of instructional materials that are already available can differ. To provide fair access to new technologies, ethical issues like privacy and accessibility must also be carefully taken into account.This essay looks at the uses, advantages, and difficulties of AR and VR in order to investigate their potential in education. By examining pertinent research studies and case studies Specifically, it will emphasize the pedagogical frameworks and instructional practices that can effectively harness the potential of AR and VR and offer insights into successful implementations. By tackling these important problems, this research advances the conversation about incorporating new technology into teaching methods and opens the door to a more rigorous and interesting learning environment that equips students for the challenges of the future.

Comparison between Augmented Reality (AR) and Virtual Reality (VR) in education

Augmented Reality (AR) and Virtual Reality (VR) are two technologies that have the potential to revolutionize the education sector. Here is a comparison between AR and VR in the context of education:



A. **Basic Concept**

- **Augmented Reality (AR)**:

- AR overlays digital content (images, sounds, videos, etc.) onto the real world, enhancing the user's perception of their physical environment. It blends virtual elements with the real world to enrich learning experiences without replacing the physical surroundings.

- **Virtual Reality (VR)**:
- VR creates a fully immersive digital environment, replacing the real world entirely. Users are placed in a computer-generated, three-dimensional virtual space where they can interact with objects and scenarios, often using specialized devices like VR headsets and controllers.

B. User Interaction

- **AR**:

- AR allows users to interact with both real-world and virtual objects. For example, learners can use smartphones or AR glasses to interact with 3D models of historical landmarks or scientific structures overlaid on their physical surroundings. This blend of virtual and real elements encourages active engagement with the environment.

- **VR**:
- VR provides a completely virtual environment where users can interact with objects and environments that are not bound by the physical world. VR typically requires dedicated

hardware, such as headsets and motion controllers, to allow users to interact with the simulated world. The interaction is immersive but isolated from the real world

C. **Immersion**

- **AR**:

- AR offers **partial immersion**. While the digital content is integrated into the real world, users are still aware of and interact with their physical surroundings. The experience is augmented but not entirely immersive, allowing users to maintain a sense of presence in their physical space.

- **VR**:
- VR offers **full immersion**. Users are completely immersed in a virtual environment, often experiencing sensations of presence and engagement that feel "real." VR users are typically isolated from their physical surroundings, which allows for deeper engagement with the virtual content but may limit the ability to interact with the real world.

D. **Flexibility and Accessibility**

- **AR**:

- AR is more **flexible and accessible**. Since it integrates digital content with the real world, learners can use AR applications anywhere, making it ideal for outdoor or mobile learning. Students only need a device like a smartphone or tablet, which they may already have.

VR:VR is **less flexible** due to its immersive nature. It generally requires specialized spaces and equipment, making it harder to integrate into everyday learning environments.

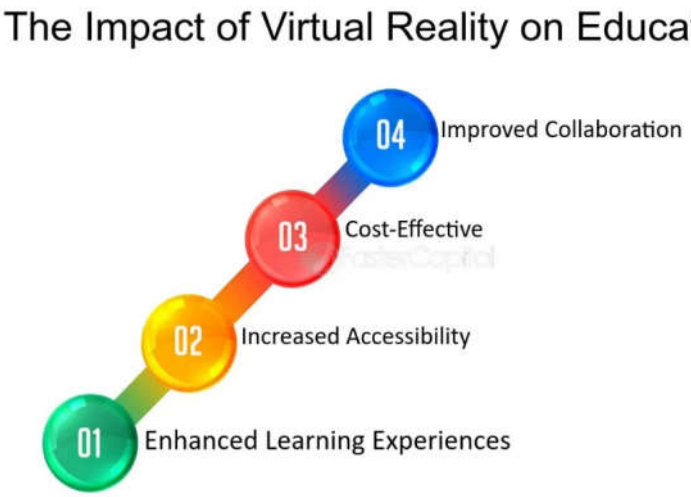
- However, VR provides a more **structured and controlled learning experience** that can be useful for highly specific educational goals.

E. Cost and Implementation

- **AR**:
- AR applications tend to be **more affordable** than VR systems. AR does not require expensive hardware and can be integrated into existing mobile devices. As such, AR can be implemented more easily in classrooms with fewer financial constraints.
- **VR**:
- The **cost of VR** is higher, as it requires specialized headsets, controllers, and often additional hardware like computers or sensors. The setup and maintenance costs may also

be higher, making VR more expensive to implement on a large scale, especially in resource-constrained environments.

Application of augmented reality and virtual reality in education



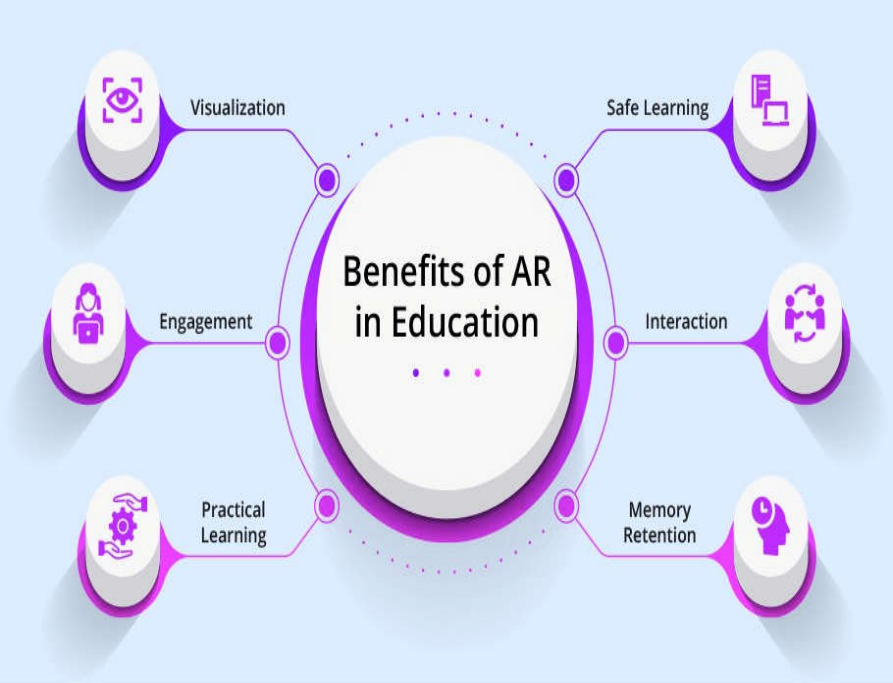
A. Virtual field trips and simulations for immersive learning: Using AR and VR technologies, students can go on virtual field trips and explore faraway places, historical landmarks, or even scientific phenomena. These immersive experiences provide a deeper understanding of the subject matter and engage students in ways that traditional textbooks cannot.

B. Interactive learning materials with digital overlays: AR can overlay digital content on top of physical learning materials, such as textbooks or worksheets. This extension brings static materials to life by incorporating 3D models, animations, or videos to make the learning process more engaging. Students can interact with content, manipulate objects, and reinforce complex concepts. Language learning in virtual environments: AR and VR can create virtual environments where students can practice and improve their language. They can converse with virtual characters, explore foreign cultures, and improve their language skills through immersive experiences. This technology promotes language acquisition and cultural understanding.

C. Improved accessibility and inclusion: AR and VR technologies provide solutions for students with diverse learning needs. For example, students with visual impairments can use AR to access visual content, while students with learning disabilities can benefit from interactive and multisensory VR. These technologies can be tailored to individual learning styles to promote inclusive education.

D. Soft skills development through virtual scenarios: AR and VR provide a safe and controlled environment in which students can practice and improve soft skills. Virtual scenarios can simulate real-life situations and allow students to develop teamwork, communication, problem-solving, and

decision-making skills. They can learn to collaborate, adapt to different situations, and receive immediate feedback for improvement. Historical and Cultural Reconstructions: AR and VR allow students to experience history and culture in a virtual way. This interactive approach to history and culture brings the past to life and allows for a deeper connection with the subject.



II. VR-BASED VOCATIONAL TRAINING: AR and VR are increasingly being used for vocational training. Industries such as healthcare, aviation, and emergency services are using VR simulations to train professionals in realistic scenarios. This allows learners to practice skills, make decisions, and receive feedback in a safe environment to prepare for real-world challenges. These educational applications of AR and VR enhance traditional teaching methods by providing immersive and interactive experiences. They address different learning styles, promote engagement, and promote deeper understanding, which ultimately improves learning outcomes and prepares students for the evolving demands of the future.

Future possibilities of AR and VR in education:

The future of augmented reality (AR) in education holds tremendous potential for transformative learning experiences. The following describes some emerging trends that can be anticipated:

A. Expanded content libraries: as AR becomes more widely used in education, the availability and variety of educational AR content will increase. Content developers and educators will collaborate to create comprehensive libraries of AR experiences covering a variety of topics and grade levels. These libraries will offer a wide range of interactive simulations, virtual experiments, historical reconstructions, and engaging narratives.

B. Seamless Integration into the Curriculum: AR will become an integral part of the curriculum, seamlessly integrating into lesson plans and learning. Educators will harness the power of AR to enhance existing instructional materials and activities by creating immersive and compelling learning experiences that AR will serve as a tool to reinforce concepts, promote inquiry-based learning, and allow students to explore and discover knowledge independently.

C. Personalized and Adaptive Learning: AR technology has the potential to personalize learning experiences by addressing individual student needs. Adaptive AR applications will assess student progress and adjust content and difficulty based on their performance. This adaptive approach provides tailored feedback, additional resources, and personalized challenges to optimize learning outcomes for each individual.

D. Collaborative learning experiences: AR will promote collaboration and social learning by allowing students to work together in shared virtual spaces. Students will engage in collaborative problem solving, group projects, and virtual discussions regardless of their physical location. AR-based collaboration platforms will facilitate communication, cooperation, and knowledge sharing among students and promote teamwork and interpersonal skill development.

E. Gamified learning experiences: AR Games and gamified learning experiences are becoming more prevalent in the education sector. By combining educational content with game mechanics, applications from AR make learning more enjoyable, and gamification elements such as points, rewards, levels, and achievements motivate students and increase their engagement with educational content. Increased Accessibility and Inclusion: AR Technology will play a critical role in making education moreaccessible and inclusive. AR Applications will offer features such as audio description, closed captioning, and customizable interfaces to accommodate learners with disabilities. AR will provide alternative modes of presentation that allow students with different learning styles and preferences to access educational content in a way that meets their needs.

F. Integration with Distance Education: AR will support distance education scenarios by bridging the physical distance between teachers and students. Educators will use AR to deliver virtual lectures, demonstrations, and interactive sessions that allow students to actively participate in the learning process from their own location. AR will create immersive virtual classrooms where students can collaborate, interact with virtual objects, and receive real-time instruction from teachers.

CONCLUSION

In conclusion, by encouraging student participation, the visualization of difficult ideas, practical learning, individualized instruction, and teamwork, augmented reality (AR) and virtual reality (VR) have the potential to completely transform the educational landscape. Successful case studies have shown the beneficial effects of AR and VR in education despite obstacles relating to cost, accessibility, technical constraints, pedagogical integration, and ethical considerations. New technologies, scalability, and their

long-term effects on learning outcomes should be the main topics of future trends and study. Teachers may construct immersive learning environments that empower students and develop critical thinking abilities by utilizing AR and VR, which will result in a learning experience that is transformative.

REFERENCES

1. **Bailenson, J. N., et al.** (2008). *"Bridging the gap: A virtual reality approach to social interaction." CyberPsychology & Behavior, 11*(6), 727-735.

2. **Dünser, A., et al.** (2012). *"Augmented reality in education—Cases, places, and potentials." Educational Media International, 49*(1), 1-15.

3. Akbulut, A.; Catal, C.; Yıldız, B. On the effectiveness of virtual reality in the education of software engineering. *Comput. Appl. Eng. Educ.* **2018**, *26*, 918–927.

4. Klopfer, E., Squire, K., & Jenkins, H. (2002). Environmental detectives: PDAs as a window into a virtual simulated world. In Proceedings of the SIGCHI conference on Human factors in computing systems (pp. 17-24). ACM

5. Pivec, M., &Dziabenko, O. (2015). Game-based learning in virtual realities: A review of the stateof-the-art. In Proceedings of the 2015 IEEE 15th International Conference on Advanced Learning Technologies (pp. 682-686). IEEE

6. Wu, H. K., Lee, S. W. Y., Chang, H. Y., & Liang, J. C. (2013). Current status, opportunities and challenges of augmented reality in education. Computers & Education, 62, 41-49. DOI: 10.1016/j.compedu.2012.10.024.

7. . Chen, C. H., & Jones, K. T. (2018). Augmented reality in special education: A systematic review of the literature. Journal of Educational Technology & Society, 21(2), 222-236.

8. Barzilai, S., &Blau, I. (2014). Sustaining innovation by transforming habits of mind: Augmented reality in formal and informal science education. Journal of Science Education and Technology, 23(5), 754-764. DOI: 10.1007/s10956-014-9496-1.

9. Dunleavy, M., &Dede, C. (2014). Augmented reality teaching and learning. Handbook of research on educational communications and technology, 735-745.

10. **Johnson, L., et al.** (2016). *"The NMC Horizon Report: 2016 Higher Education Edition."* The New Media Consortium.

11.Azuma, R. T. (1997). *"A survey of augmented reality." Presence: Teleoperators & Virtual Environments, 6*(4), 355-385.

12.Dede, C. (2009). *"Immersive interfaces for engagement and learning." Science, 323*(5910), 66-69.