Augmented Reality (AR) in education

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ABSTRACT

Research on augmented reality in learning is still in its early stages, with a notable gap in understanding the effects and implications of this method or technology. This study sought to investigate the influence of an AR applications on the learning motivation of undergraduate students.

The study utilized the Instructional Materials Motivation Survey to design the research instrument and assessed differences in student learning motivation before and after using the augmented reality mobile application. Out of 78 participants, the results demonstrated a significant increase in overall learning motivation. Specifically, attention, satisfaction, and confidence factors experienced noteworthy enhancements. Despite a decrease observed in the relevance factor, statistical analysis deemed this change insignificant. This research contributes to our understanding of augmented reality's potential in enhancing student motivation within educational settings

Keywords: Augmented reality,Learning,Mixed reality,Education,Technology ,4d mobile application

INTRODUCTION

The exploration of augmented reality (AR) within educational contexts is a crucial area of investigation. AR allows the integration of virtual elements into real-world environments, integrating real-time interaction. Despite the increasing accessibility of AR, research on its applications in education is still in its very early phase, with a noticeable scarcity of studies delving into the effects and implications of AR within the educational realm

The potential impact of AR on enhancing student learning motivation and contributing to improved academic achievement is a topic of interest. Despite this interest, there exists an insufficient body of research on the consequences of employing mobile AR in education, leaving ample room to explore AR's potential to enhance student motivation and academic performance. This research extends prior studies conducted in other countries that specifically examined the impact of AR technology on student learning motivation, presenting a case study from a South African university.

The primary objective of this research is to see how AR has helped students learn more effectively.

Augmented reality

Augmented Reality (AR) amalgamates the real and virtual realms by introducing computer-generated virtual objects into real-world environments in real-time. According to a widely accepted definition, AR is characterized by three essential components: the integration of real and virtual objects in a genuine environment, alignment of real and virtual objects, and real-time interaction. Milgram's mixed reality continuum, depicted in Figure 1, serves as a taxonomy illustrating various ways of combining real and virtual elements. This continuum spans from a completely real environment to a wholly virtual one Mixed reality, as defined by this continuum, involves the combination of real and virtual objects. Positioned

closer to the real environment end of the continuum, AR is considered a mixed reality technology with a more pronounced element of reality. This technology introduces virtual objects into the user's actual environment, facilitating interaction with virtual content

In the context of mobile AR, the technology entails the incorporation of digital elements into the real world through a smartphone camera. Examples of mobile AR applications include Pokémon GO, a location-based mobile AR game allowing users to capture various digital Pokémon creatures in their surroundings, and AR GPS drive/walk navigation, offering an AR-powered navigation system . It is essential to note the distinction between AR and Virtual Reality (VR). In VR, the real world is isolated, and users immerse themselves in a digital realm using devices like the Oculus Rift or Samsung Gear VR.
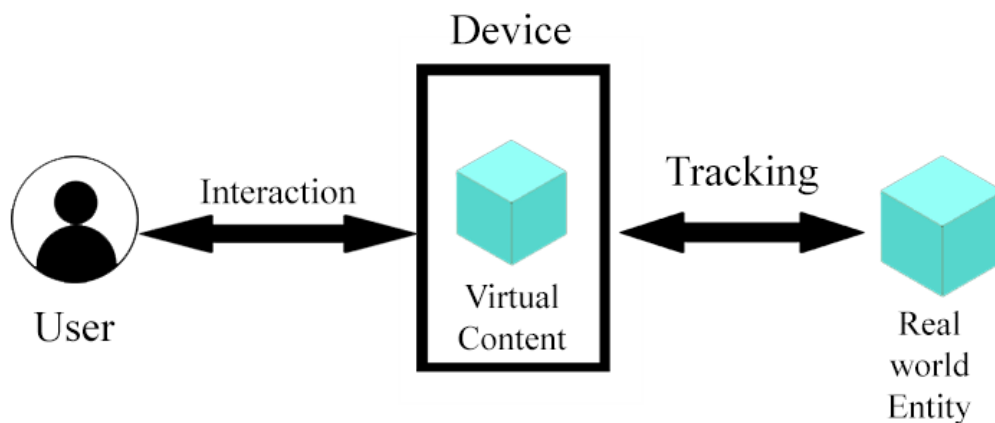
Augmented Reality Architecture

Augmented Reality in Education

The educational value of Augmented Reality (AR) is inextricably linked to its design, implementation, and incorporation into both formal and informal learning environments. Understanding how AR technology may support and enable meaningful learning experiences is an important consideration. Treating augmented reality as a conceptual framework rather than a specific technology has the potential to benefit educators by encouraging a productive mindset. Educators' active participation is critical in improving the development of effective AR applications for teaching, which expands the possibilities for incorporating AR into educational processes. Notably, AR applications have been developed for a variety of educational subjects.

A number of these augmented reality applications have been investigated in earlier research. Gopalan et al. looked at how scientific textbooks with augmented reality affected Malaysian lower secondary school pupils. Taiwanese fourth-grade students' use of an augmented reality (AR)-based mobile learning system for natural science inquiry activities was investigated by Chiang et al. This system directed students toward certain ecological regions and displayed learning assignments or pertinent resources in line with those locations. The usefulness of an AR-enhanced lab manual for first-year science students in Turkey was evaluated by Akçayır et al. Consistent with previous study, we assess the impact of the Anatomy 4D mobile application on the motivation to learn of University of Cape Town (UCT) undergraduate health science students.

## Advantages of Incorporating Augmented Reality in Education

Augmented Reality (AR) introduces innovative ways of interacting with the real world, offering experiences that are unattainable in either a purely real or virtual environment . A distinctive strength of AR lies in its ability to create immersive hybrid learning environments that seamlessly blend real and virtual objects. Through AR technologies, students gain access to scientific phenomena that are otherwise inaccessible in the real world, such as specific chemical reactions . AR facilitates the manipulation of virtual objects and observation of phenomena that may be challenging to witness in reality, promoting thinking skills and enhancing conceptual understanding . This immersive learning experience proves valuable in addressing challenges associated with visualizing unobservable phenomena and correcting misconceptions.

Moreover, the skills and knowledge acquired through technology-enhanced learning environments can be more effectively developed with the integration of AR technology . By streamlining information from multiple sources, AR reduces cognitive workload . The interactive and immersive features of AR can stimulate student engagement in learning activities, fostering increased motivation to learn . AR provides authentic learner activity, interactivity, and heightened sense of realism, making it a potent facilitator of interaction with the learning environment.

Challenges Associated with Augmented Reality in Education

Despite its advantages, the utilization of Augmented Reality in education is not without challenges. Users may encounter usability issues and technical problems, with some finding the technology complex. Usability concerns, while acknowledged as a challenge, are also recognized as an advantage, and evidence suggests that difficulties may stem from factors such as inadequate technology experience, interface design errors, technical glitches, or negative attitudes. The juxtaposition of real and virtual objects could lead to confusion as students navigate between fantasy and reality. Integrating AR in learning environments necessitates multitasking, potentially causing cognitive overload and feelings of being overwhelmed or confused among students. This confusion, while authenticating the AR system, may prove counterproductive in maintaining students' connection with the real environment.

The adoption of AR technology in schools may be constrained by institutional factors, and educators might exhibit reluctance due to the innovative teaching approaches required for effective implementation. Additionally, the inflexibility of content in AR applications limits the teacher's control and adaptability to accommodate individual student needs. Addressing this challenge could involve the availability of authoring tools, empowering users to modify and create AR applications. Furthermore, the stability of mobile AR technology is not guaranteed, and poorly designed interfaces and lack of guidance may render the technology overly complicated. Users may also require time to familiarize themselves with and become comfortable with AR technology.
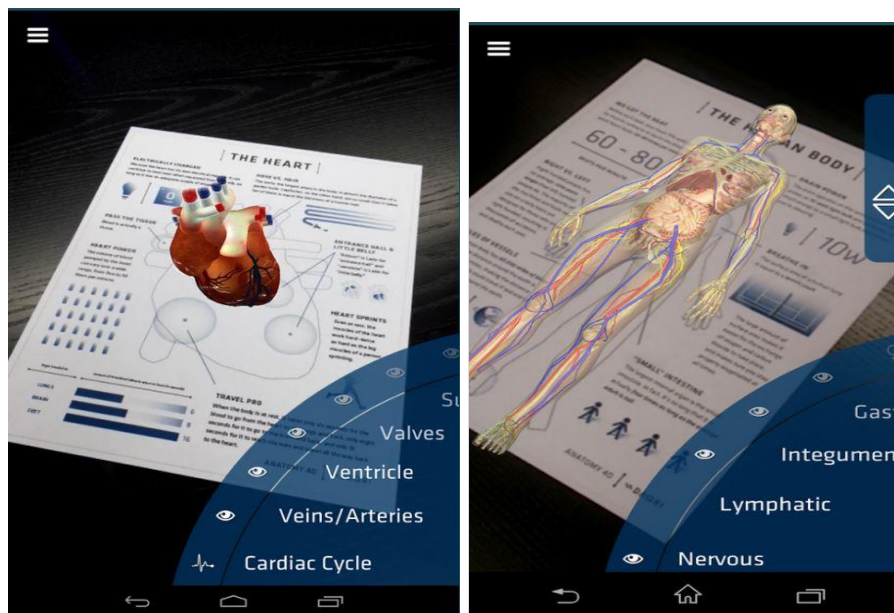
Conclusion

The primary objective of this research was to investigate the influence of an Augmented Reality (AR) mobile application on the learning motivation of undergraduate students. The existing literature underscored the scarcity of research on the impact of mobile AR in education, creating a valuable space to explore its potential in enhancing student learning motivation and contributing to improved academic achievement.

While this study, like its predecessors, demonstrated the positive contribution of AR technology in education, it acknowledged that research in this domain is still in its early stages . Recommendations for future research include conducting studies over extended periods to mitigate the potential novelty effect, assessing which learning activities benefit the most from AR technology, and exploring the impact of AR on academic performance. Lecturer X suggested further research to evaluate whether AR improves understanding of content and assessment performance. The collective insights from this research and related studies underscore the evolving role of AR in shaping educational experiences and motivating students to engage with course material.

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