

Beneficial Impact within Education & Learning Due to the Rise of Augmented/Virtual Reality

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ABSTRACT

The utilization of technological advances in educational set up offers learners, as well as instructors with better tools. Augmented Reality (AR) and Virtual Reality (VR) have been used in ensuring effective learning processes. They have become beneficial in various fields such as medicine, construction, and aviation. The beneficial impacts of augmented and virtual reality can be classified and divided into various different sections, including discovery-based learning, object modeling, skills training, and gaming. For successful transfer of knowledge and a positive educational experience, it is crucial to ensure effective delivery and comprehension of content. Students approve the utilization of augmented reality due to its attractiveness. The engaging technology makes learning and teaching interesting. These findings can be used to ensure proper learning activities in various institutions. The introduction of AR gaming makes it possible for utilization of the application at any educational level. Therefore, it is important to warrant the adoption of augmented technologies in learning environments. Although AR and VR are powerful educational tools, it is critical that instructors should make sure students do not over rely on these technologies. Over dependence on technology can potentially destroy an individual's innovative capacity.

Keywords: Augmented Reality; Technology; Comprehension; Technology

Keywords: Augmented Reality; Technology; Instructor

ACM Classification Keywords

H.5.1 (Information presentation and Interfaces): Multimedia Information Systems- Augmented, Virtual realities, and artificial

1. INTRODUCTION

In today's current global environment, technology is evolving at an increasingly rapid pace. The technological advances that humans have experienced in the past decade have had an influence upon several sectors within our society. More specifically, it has impacted the perception of people within our education sectors. Traditional educational methods involved a face to face interaction, as class activities were arranged and conveyed by the tutor or teacher. Furthermore, teaching and learning material were based on static articles such as papers, journals, and textbooks. These different mediums are dated in today's modern society, and effectively slow down the process of knowledge acquisition.

The mentioned traditional methods can be seen as ineffective in ensuring a dynamic classroom environment. Therefore, it is crucial for researchers and educators to improve learning and teaching experiences. Transformation caused by technological advancements has offered exciting opportunities for the creation of proper learning environments. These are often funny, engaging, authentic, as well as realistic. Research shows that technology provides a platform for improved student

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engagement and content comprehension, which leads to improved academic results [1]. Several new engaging technologies have been integrated into the educational field. These include social web, the internet, multimedia, computers, and mobile devices. The latest addition is virtual and augmented reality.

AR and VR as a rising technology have beneficial impacts on education and learning. Additionally, the emergence and increased ownership of mobile phones have led to rising interest in the integration of various aspects. For instance, integrating AR applications and mobile learning. The utilization of augmented reality in hand-held computer devices is increasing. Since this is a growing technology, people need to understand how it works and its potential benefits. This paper examines the advantages of virtual and augmented reality to education and learning.

2. THE AUGMENTED/VIRTUAL REALITY CONCEPT

Following the emergence, proliferation, and widespread utilization of new technologies, researchers have been looking for effective teaching methods. Augmented Reality (AR) technology has the potential for a variety of practical academic applications. AR has successfully gathered attention in the educational arena, and therefore makes it a crucial component of exciting learning experiences. However, the average person does not understand its exact meaning and application [2]. Therefore, it is imperative to define AR's core concepts. Scholars, as well as researchers, define the concept differently, but this does not affect its importance and application within the educational sector.

Tom Caudell officially formulated augmented reality in the nineteen nineties, but virtual data systems were utilized in between the 1960s and 1970s. Since 1990, AR has been utilized by large companies for training and visualization

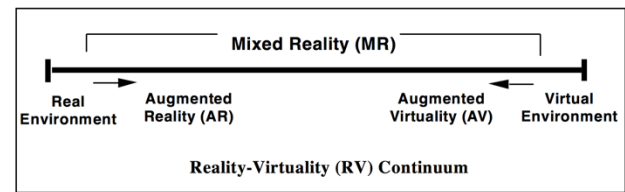


Figure 1: Reality-Virtuality Continuum

purposes. The increasing ownership of mobile devices, as well as personal computers, has been crucial in the adoption of Augmented Reality [2]. Mobile devices give an opportunity for AR to be used in different levels of academic environments, ranging from elementary school to universities.

In recent discussions and research, the concept of AR has been given different meanings. Most people define it on the basis of a 'Reality-Virtuality Continuum' (Figure 1). This allows for offering a distinction between the concepts of virtual environments and AR. The virtual environment can also be regarded as Virtual Reality (VR). Virtual Reality deals with various settings where an individual is completely immersed in a synthetic environment. The primary world experienced is predominantly virtual. The virtual environment is then often augmented with real world information. It is defined as a situation that allows for dynamic overlaying of real world context into a sensitive virtual information (SVI).

In the educational sector, augmented reality takes five essential directions. These 5 directions are composed of discovery-based learning, AR books, skills training, objects modeling, as well as gaming. These can be exploited through online or distance learning. Moreover, the application of this new technology can offer lectures for students unable to attend classes, and also allows for a later time review of course materials [3]. Therefore, augmented reality provides an opportunity for improvement of teaching and learning experience.

3. BENEFITS OF AUGMENTED AND VIRTUAL REALITY IN EDUCATION AND LEARNING

AR can be implemented in a learning environment in a variety of ways. These different methods of implementation are often referred to as ‘the five directions’ of augmented reality in a learning and teaching set up, and they assist in the improvement of learning outcomes. Additionally, these approaches are essential in achieving consistency in knowledge transfer and acquisition among learners. Significant differences often exist between learning and teaching methods. Developing a teaching strategy that positively impacts the majority of student learning is crucial. Augmented Reality can be an invaluable tool for improving learning effectiveness. Additionally, teaching and learning with AR can help bridge the grade gap between students that have difficulty with grasping course material and students who perform well without additional support.

3.1 Discovery-Based Learning

AR can assist in connecting knowledge with actions, as well as choices. Having this connection is an essential principle of achieving success in learning. Creating linkage between practice and education is important in fields such as construction and health. It is important to note that most engineering learning activities still depend on traditional methods. Generating a curriculum that is responsive to the needs of the current modern population enables easier and better learning. Social and technical skills, such as decision-making, critical skills, and leadership, are essential in today’s learning environment. Furthermore, competency in digital applications often leads to effective learning outcomes.

In the construction sector, students often lack hands-on experience. Most of their learning is concentrated in classrooms. This experience is often deductive and passive, leading to reduced participation and knowledge retention. In classrooms, teachers regularly focus on the communication of important concepts of engineering.

Additionally, educators may also offer assignments, as well as practical applications by using in-class examples. Students do not often experience valuable field-time due to weather conditions, access difficulties, schedule conflicts, as well as an overriding need for safety.

Embracing new modern technologies makes learning and teaching easy and flexible. It is common that students with a high potential of performing well in STEM fields often switch to non-scientific career paths. This switch can be attributed to the teaching techniques used in the STEM fields, thus highlighting the need for the adoption of new learning methods. Educators should take advantage and utilize new advanced information and computing technologies, such as simulations and virtual learning environments, to overcome the barriers of not being able to introduce students to in-field experiences. The utilization of advanced technological methods in academic situations has recently received more attention and has been gaining momentum. AR and VR can potentially assist in the introduction of electronic field trips in various courses. Field work is a critical component of learning in all areas, and VR can effectively introduce learners to dynamic real world scenarios that will effectively prepare them for real-world situations [4]. Augmented and Virtual reality offer an opportunity for experimentation with different teaching methods. It breaks the class monotony in effective ways, and due to the increased role of computer assisted programs, virtual field trips have become essential for student engagement.

Following the introduction of technologies such as building information modeling (BIM) and computer aided design (CAD), learning quality has improved. A study done in Hong Kong revealed that computer-based programs have the potential of improved construction education [5]. They utilize building information modeling to ensure effective teaching and learning. Discovery based learning has been boosted by the introduction of computer

applications such as virtual reality. Additionally, it has improved cooperation among students. Through virtual reality, students can see the development of ideas in a three-dimensional environment, which encourages teamwork and proper knowledge dissemination in various fields.

3.2 Objects Modeling

AR can be utilized in object modeling applications. These applications allow students to receive quick visual feedbacks on how a given item looks and behaves in a variety of settings. Virtual objects can be investigated for their interactions with other elements, and furthermore, their physical characteristics can also be studied. Integrating augmented reality in every activity for better results is essential. The utilization of AR has been key in the study of health sciences. The study of biological concepts requires an understanding of three-dimensional models. Therefore, the integration of computer informatics and biological domains is essential in helping learners understand complex health systems and concepts.

In the past, proteins were modeled through fixed positions of atoms on a given backbone template. These involved substantial computational resources, as well as complex calculations. Incorrect calculations may lead to adverse reactions. The rising utilization of computer programs has improved creation and comprehension of biological structures. In the learning of models, AR adds contextual information, which has the potential to improve molecular biology. It makes it possible for learners to understand subjects such as inorganic chemistry. AR assists in the viewing of various structures through a collaborative system.

Augmented Reality supported learning offers an opportunity for users to view their bodies and effects when using the application. For example, hand motion in the orientation of marker cubes. Additionally, the modeling of objects makes education interesting due to the combination

of experimental and experiential properties. Students often approve the utilization of AR for its attractiveness [6]. Using actuated interfaces that are tangible can improve protein study. Furthermore, the application of AR technology can assist in overcoming limitations faced by learners in understanding protein mechanisms. Many students have become interested in bioinformatics due to the introduction of AR that makes learning and teaching interesting.

3.3 AR Books

AR books provide students with three-dimensional (3D) presentations, as well as interactive learning experiences. These books are augmented through technological devices and platforms, including special glasses or headsets. The new technology appeals to students, making it an essential educational medium. AR provides a realistic experience because of its multi-sensory three-dimensional transitional interfaces and models. These allow users to interact with virtual and real worlds seamlessly. Also, AR interacts with various objects providing real-time information. This is done through the detection of situation and location in a given context via the use of multi-sensors and cameras. The growth of AR books has been rising due to the global spread of camera phones, PDAs and other emerging AR devices.

AR creates an interactive environment incorporating simulation, 3D, and animation. Their physical paper books have multimedia and voice elements. These books improve overall realism and familiarity to learners. The realism assists students by allowing them to interact with a platform that integrates the real-world environment. Augmented Reality books are often attractive, resulting in immersion and motivation. Moreover, the books facilitate a constructive, active, intentional, practical, as well as collaborating learning. This reduces the acquisition of wrong concepts regarding a particular unit [7]. AR also improves the understanding of complex calculations and

concepts. Additionally, the relatively new technology raises the curiosity of users enabling them to manipulate and observe learning concepts. This engaging and dynamic interaction between student and learning platform, improves the attitude of students towards learning, which often leads to a positive impact in achieving high grades.

3.4 Skills Training

AR applications can support and have a positive impact on the training of skills in a variety of different industries. In today's environment, AR applications that target skill development are often utilized in the aviation industry for airplane maintenance. This training activity involves the display of steps, tools identification, and inclusion of textual instructions. The training is commonly done through head mounted displays.

AR is also essential in industrial training, involving maintenance and assembly of large machinery. These industrial training applications integrate rendering and capturing technologies. Cameras are utilized in the capture of activities in a large-scale environment. Videos document complex maintenance and assembly workflows. Learners use mobile AR tools in machine inspection [8]. Any problem that occurs during inspection and maintenance can be easily detected and corrected. The advantage of utilizing this type of training is that it allows learners to interact with real-time objects. Therefore, trainees can connect real task and training, which further reinforces the retention of knowledge.

The AR skill training approach also provides a trainer with real-time feedback during task performance as the learner interacts with real and virtual environments. Virtual objects offer supplementary information about a given task, as well as its performance. Additionally, a learner can access real environment and training materials without utilizing user manuals, thus improving productivity. The monitoring and evaluation of students' performance assists tutors in responding to performances of various students. The

learning approach also enables communication and presentation of correction within a learning environment, allowing users to detect, correct, and learn from any potential mistakes. Despite the advantages of AR in skills training, it makes people dependent on technology [9]. This dependency makes users unable to perform various tasks without the assistance of AR applications. It is essential for trainers to create approaches that ensure people can conduct tasks without the constant usage of AR features. Therefore, reducing these elements during specific training periods is crucial.

3.5 Augmented Reality Gaming

The benefits of video games have been ignored for several decades. In the contemporary education sector, trainers have realized their power in ensuring effective delivery and comprehension of contents. AR technologies allow for the development of games that can occur in the real world. These games are often executed in a physical environment that is augmented with virtual data, and they offer powerful ways of ensuring proper teaching and learning. AR and VR games offer highly visual, as well as interactive learning tactics, that have been utilized in simulation training. The approach integrates virtual and real environments in education. Its role in learning is to ensure the acceleration of knowledge acquisition. It engages learners in active, intentional, and authentic components of games. These assist in the maximization of learning and knowledge transfer.

In most cases, games for educational purposes are designed to be tackled by groups. This leads to social benefits for learners. Additionally, these games often deliver important global messages. Therefore, they are valuable in the sensitization of students [10]. For instance, 'The World Without Oil' is a game presented by Independent Television Service (ITS). It sensitizes users on the importance of conserving non-renewable energy sources. These games also offer cognitive challenges to learners. A

novel, as well as realistic problem, is often posted for a user to solve. When addressing these issues, students are required to apply their academic knowledge. This is essential in the development of new ideas. Therefore, augmented gaming is important to all educational levels, as it provides learners with an adequate time for likable interactions and knowledge acquisition.

4. CONCLUSION

Augmented reality is an essential tool for the educational environment. Its application can be utilized in improving skills training, language education, as well as spatial abilities. It also improves learners' concentration and comprehension of unit content. Each AR application is unique with a potential of ensuring adequate learning. The benefits of Augmented Reality can be outlined in five broad areas including discovery-based learning, objects modeling, skills training, and gaming. However, it is important for trainers to adopt approaches that stave off and reduce overdependence on AR features and technology.

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