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Meaningful Learning through Virtual Reality and Augmented Reality Technological Environments

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Abstract: ***Augmented reality (AR) overlies manually made materials directly over the real-world materials. Virtual and augmented reality industry committed innovative technologies that can be explored in the field of entertainment, education, training, medical and industrial innovation, and the development are explored. Augmented reality (AR) allows the physical world to be enhanced by incorporating digital knowledge in real time created by virtual machine. Few applications that have used augmented and virtual reality in real-world applications are discussed. VR will make it conceivable to educate in virtual situations that are difficult to picture in physical study halls, such as getting into virtual research facilities, imagining machines, mechanical plants, or even clinical cases. The gigantic prospects of open virtual advancements will make it conceivable to break the limits of formal instruction.***
Keywords: Virtual Reality, Virtual Learning Environment, Computer Games, Educational Technology, Mechanical plants.

I. INTRODUCTION

A. Virtual Reality

Technology that includes virtual reality is becoming prevalent. The software of virtual reality is making many industries prepared for various scenarios before entering them**.** The medical profession is projected to use virtual reality for some treatments and interactions with patients in the coming years. Virtual training sessions for companies can cut costs, fill in the need for personnel, and increase education.

According to Gartner, by 2023, virtual simulations for selected patients with specific illnesses will reduce emergency room visits in America by 20 million. These simulations will have intelligence capabilities, so virtual-reality care can still provide patients with proper attention.

B. Augmented Reality

Augmented reality is a more versatile and practical version of virtual reality, as it does not fully immerse individuals in an experience.

Augmented reality features interactive scenarios that enhance the real world with images and sounds that create an altered experience. The most common current applications of this overlay of digital images on the surrounding environment include the recent Pokémon Go fad or the additions on televised football in the U.S.

The benefits of virtual reality in education are embraced by many educators, but some are still reluctant to use it in their classrooms. Reasons range from high costs to pushback from school administrators. Others see the value of both VR and AR as entertainment, but not as effective teaching tools in the classroom. Additional educator concerns, as reported in a recent *EdTech* report, include the bulkiness of the equipment, glitches, and the quality and availability of content. Despite these challenges, demand for AR and VR in education is expected to grow in the coming years. This means that current and aspiring teachers should take steps to learn about the benefits of virtual reality in the classroom.

In addition to providing students with immersive learning experiences, other benefits of virtual reality in education include the ability to inspire students' creativity and spark their imaginations. And this can motivate them to explore new academic interests. AR and VR in education also helps students struggling to understand difficult academic concepts. For example, through AR, geometry students can check out 3D geometric forms from multiple perspectives; they can rotate a shape to see it from different angles and even view it from the inside.

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The benefits of virtual reality in education go beyond academics as well to include cultural competence, the ability to understand another person's culture and values, an important skill in today's interconnected global society. For example, a virtual reality field trip to other parts of the world, whether it is Peru or China, exposes students to cultures other than their own.

II. VR APPLICATIONS

1) Automotive Industry

Car manufacturers are continuously trying to put the current technologies to use in order to deliver the best vehicles. Virtual Reality (VR) and Augmented Reality (AR) technology is advancing rapidly as computers are becoming more powerful. VR in manufacturing industry enables the designers to simulate their design prototype or model on advanced VR software. This helps them to rectify errors at the primary stage and reduce production time and cost.



Fig: 1 AR and VR in the Automotive Industry

From concept to detail design, VR enables an open environment where actual product quality can match the rendered models. This is especially crucial in industries where there is no room for error. VR can be used in the design process to give a more accurate depiction and immersive creation of 3D models.

2) Healthcare

VR is being used as a powerful diagnostic tool, which helps doctors and physicians to carry out accurate diagnosis. This is done in combination with other methods, such as MRI/CT scans, and eliminates the need for any kind of invasive techniques, making it a pain-free experience for the patient. VR is making a significant impact in healthcare. In November 2021, the FDA approved prescription-use EaseVRx for the treatment of pain reduction in adults. The system uses cognitive behavioral therapy and other behavioral principles such as deep relaxation, attention-shifting, interoceptive awareness, and others, to aid in the reduction of chronic pain. VR has even been used as pain relief for burn injuries.

VR can also be used as a treatment for mental health issues, with Virtual Reality Exposure Therapy thought to be particularly effective in the treatment of PTSD and anxiety.



Fig: 2 VR the Medical Futurist

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3) Education

Virtual reality can improve education by providing students with memorable and immersive experiences that would otherwise not be possible. What's more, it can all take place within the classroom. VR is accessible to every student and can be easily monitored by teachers.



Fig: 3 VR Improves Student's Learning Experience

With VR, we can make almost anything possible – especially in education. From virtual classrooms to hands-on training, VR allows the user to experience situations they are usually unable to in the traditional classroom. VR immerses learners in the virtual world, allowing them to learn effectively and with confidence. Besides this, there are so many ways to use virtual reality in eLearning, and these activities are more like fun games than schoolwork, making learning fun. This increases the students' motivation to keep on learning.

4) Tourism

VR can be used in many different ways in the tourism industry. The technology is evolving at a rapid rate and the uses of VR within tourism are expanding along with the technology. The main VR technologies that are used in the travel industry are VR video and VR photography.



Fig: 4 VR Tourism model

VR created for headsets is more expensive to produce as it requires the production of Stereoscopic content and spatial audio. However, for those travel companies looking to be at the forefront of the technology, the cost can be worth it to allow them to stand out from the crowd and provide an unrivalled experience to their clients.

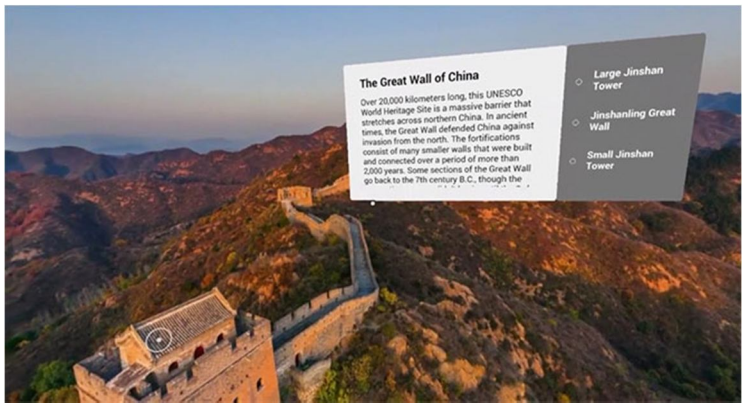


Fig: 5 VR Tourism – The Great Wall of China

5) Architecture

VR technology has so much potential for architects and designers. From initial design mock-ups, to project collaboration, through to the finishing touches that make a building design go from good to great, virtual reality possesses the capability t really sell an idea better than any other medium.


Fig: 6 VR in scanning of building

Floor plans, 3D renderings, and models are often used to convey an idea for a particular space within a design, but even these approaches, a staple of architectural design can fail to effectively communicate ideas with clients.


Fig: 7 VR Explores the Virtual representation of room

VR as an immersive technology, it will transport users into a fully interactive 3D environment, giving them the opportunity to explore a virtual representation of a particular room, floor, or building design as a whole.

A. Augmented Reality in Education and Training

Augmented reality in education can serve a number of purposes. It helps the students easily acquire, process, and remember the information. Additionally, AR makes learning itself more engaging and fun. It is also not limited to a single age group or level of education, and can be used equally well in all levels of schooling; from pre-school education up to college, or even at work.

*B. Augmented **Reality** in the classroom*

Probably, the most popular application for augmented reality in education is the use of AR apps directly in the classroom. In this case, they can help the teacher explain a subject, provide a visual representation of the material, and help students test out their knowledge in practice. Namely, you can find an AR app for almost any subject, including chemistry, geometry, zoology, grammar, and even programming.

C. Examples of AR Education APPs in Classroom

1) *Assemblr EDU* leaves traditional learning systems in the past, where students counted solely on textbooks, illustrations, and diagrams. Now, teachers can turn their classes into an immersive 3D and AR experience, helping students engage with the material with more curiosity and understanding.
2) *Arloon Geometry* is a go-to AR learning app for geometry classes. This subject relies heavily on visualization, and this app assists students in exploring 2D and 3D geometric shapes interactively.

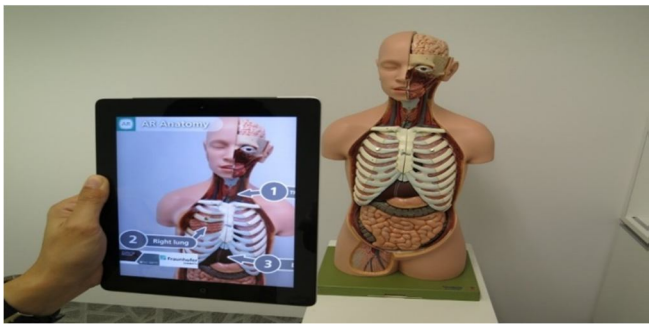


Fig: 8 Arloon Geometry App

3) *Merge Cube* transforms visual objects into 3D tactile items that students can study literally inside and out. Using this touchable AR in the classroom will help learners master STEM and science much faster and more efficiently.
4) *Wonderscope* exemplifies how augmented reality can be used in education for children and is an effective tool for when students can't physically attend the class. The app brings the stories into real life through the device's screen, sparking kids' curiosity and excitement from reading new books.
5) *Mondly*, a language-learning app, has recently integrated an AR-based virtual teacher to help users practice their skills as if they were in a real-life setting.

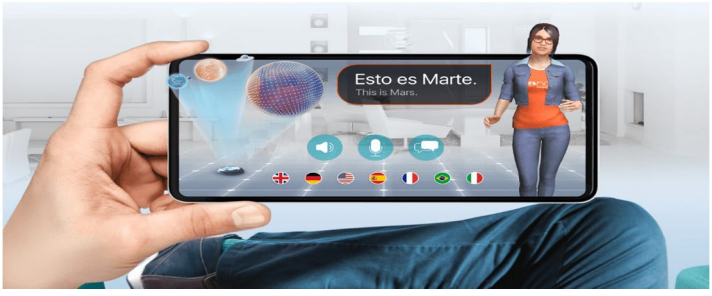


Fig: 9 Mondly AR-based App

6) The *3DBear app* combines all the benefits of AR learning and at the same time is perfect for remote classes. The platform's developers designed a convenient space that helps teachers control the distance learning process.

D. Benefits Of Augmented Reality In Education

1) *Accessible Learning Materials:* Anytime, anywhere. Augmented reality has the potential to replace paper textbooks, physical models, posters, printed manuals. It offers portable and less expensive learning materials. As a result, education becomes more accessible and mobile.
2) *No Special Equipment is Required:* Unlike VR, augmented reality doesn't require any expensive hardware. Because 73% of all teens currently own a smartphone, AR technologies are immediately available for use for the majority of the target audience.
3) *Higher Student Engagement and Interest:* Interactive, gamified AR learning can have a significant positive impact on students. It keeps them engaged throughout the lesson and makes learning fun and effortless.
4) *Improved Collaboration Capabilities:* Augmented reality apps offer vast opportunities to diversify and shake up boring classes. Interactive lessons, where all students are involved in the learning process at the same time, help improve teamwork skills.
5) *A faster and More Effective Learning Process:* AR in education helps students achieve better results through visualization and full immersion in the subject matter. A picture is worth a thousand words, right? So, instead of reading theory about something, students can see it with their own eyes, in action.
6) *Practical Learning:* Apart from schooling, professional training can also benefit greatly from the use of AR. For example, accurate reproduction of in-field conditions can help master the practical skills required for a certain job.
7) *Safe and Efficient Workplace Training:* Imagine being able to practice in heart surgery or operating a space shuttle without putting other people in danger or risking millions of dollars in damage if something goes wrong. It is possible with AR.
8) *Universally Applicable to any Level of Education and Training:* Be it learning games for kindergarten or on-the-job training, AR isn't limited to only one use case or field of application.

E. Challenges Of Augmented Reality In Education

1) *A lack of Necessary Training:* Some teachers might struggle putting these new technologies into practice as their background training doesn't provide the necessary skills. Only the most open-minded teachers and innovative educational institutions are ready to apply augmented reality apps in education.
2) *Dependence on Hardware:* Using augmented reality in the classroom requires a certain resource base. For example, not all students have smartphones capable of supporting AR applications.
3) *Content Portability Issues:* The AR app you build needs to work equally well on all platforms and devices. However, it is practically impossible to provide the same quality of AR content on any device.

III. CONCLUSION

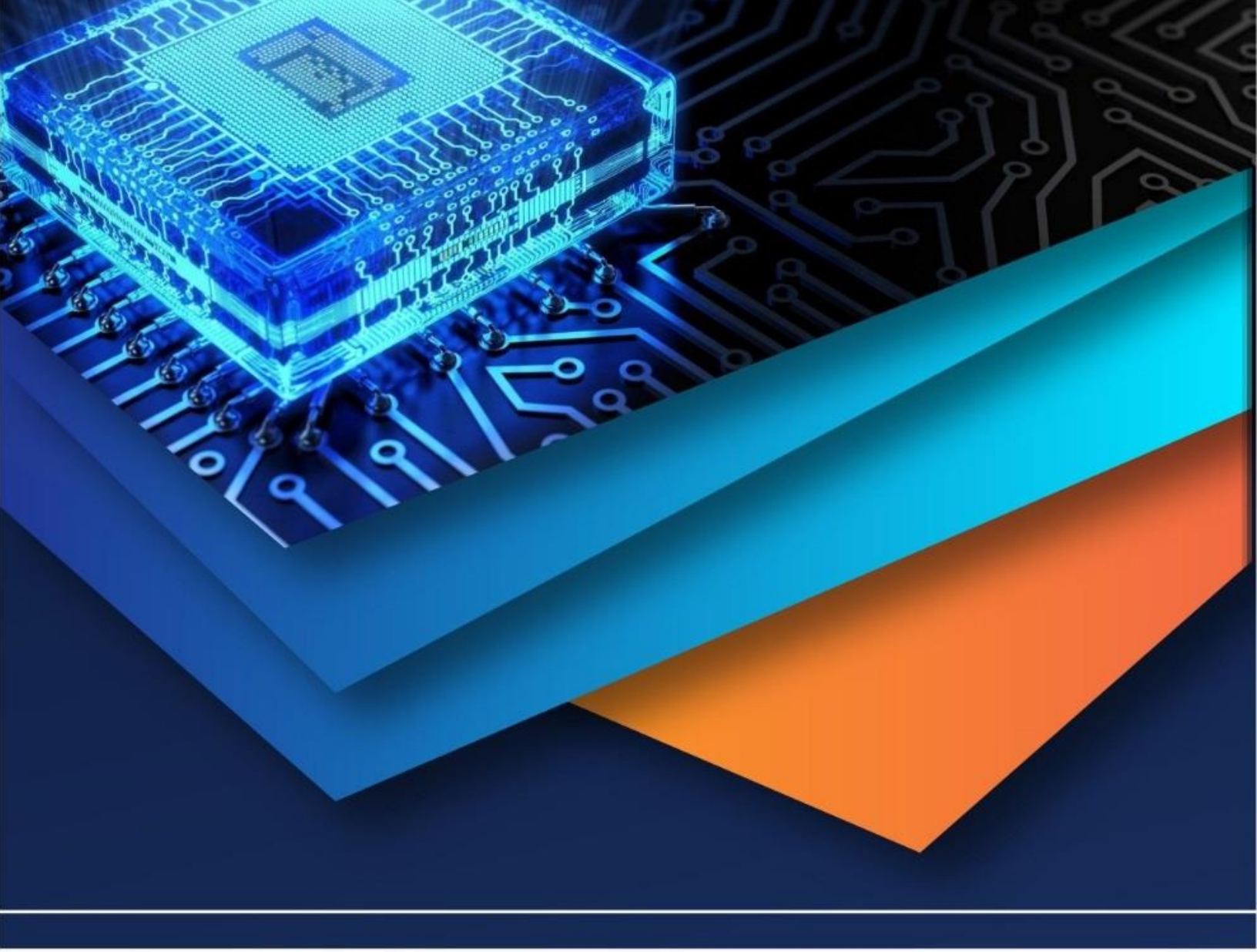
The education system has been evolving for centuries. It has always adapted to the available technology and needs of the students. We are now on the threshold of another development and itis a duty of scholars, educators and teachers to embrace it and prepare for it. The generation that is starting education right now has been online for whole their lives. Digital world is as important and immersive as the real one. They are digital natives, born onto the world of mobile phones, omnipresent Internet and immediate access to most of desired information or data, is it music, video or content. Although using modern technology in education environment is clearly beneficial, it is not without risks or dangers. One of the main issue is the lack of flexibility. During traditional classes students may ask questions, receive answers, take part in this discussion. Using a virtual reality headset with specific software, the students have to follow the rules and are not able to do anything else except what they are supposed to do. Some educators are naturally resistant to change and their involvement and active participation is crucial for successful introduction of technology into the classroom. Although we might be tempted to replace all old-fashioned solutions with modern digital ones, there must be equilibrium between state-of-the-art solutions and human interaction, mentoring and teacher–student relationship.

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