

A WHITE PAPER ON USING (XR) EXTENDED REALITY IN THE CLASSROOM



XR GURU[®]

Immersive Learning Hub

Advancing education and training in the metaverse



A White Paper on Using (XR) Extended Reality in the Classroom



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Executive Summary

Only a decade ago, Extended Reality (XR) technologies such as Augmented Reality (AR) and Virtual Reality (VR) were thought of as futuristic, sci-fi concepts we could see only in movies. However, today, extended reality is transforming several industries, and education is undoubtedly one of them. Extended reality has the potential to revolutionize the way we teach and learn. Utilizing cutting-edge technologies such as Extended Reality (XR) can make education fun, interactive, and engaging. For example, AR/VR can dramatically improve the educational experience by providing a computer-generated 3D environment that can be explored and interacted with by students. Many educational institutions have already realized the potential of XR and have adopted augmented and virtual reality into their curriculums. Continue reading to learn how to use virtual and augmented reality in learning and their benefits.

Active learner engagement and situated learning offer significant benefits over passive observation and interpretation, forming new experience-based knowledge that can motivate the development of new methods of teaching. The application of technology in education has mostly focused on making information more accessible and interactive, but augmented and virtual reality (in particular) takes this much further, enhancing learning experiences through more naturalistic presentation of the information, interaction with simulated environments, and substantial reductions in a learner's cognitive load. Teaching, therefore, must adapt to this changing medium and move from abstract, passive, and 2D learning formats to practical, situated, and natively 3D curricula.



Evolution of Education

With the invention of paper and the printing press, it became easy to communicate ideas, and the shelf-life of those ideas was extended from a few months to years. When the digital medium of transmission came of age, communication and, more importantly, education evolved and made the leap from print to digital and from 2D to 3D in the form of animations and online videos.



The past few decades saw great strides happening in the field of online education in the form of interactive whiteboards and simulations, educational games, online blackboards and classrooms becoming an integral part of the educational process. Students transitioned from using traditional pen and paper to using online desktops and laptops with their keyboards, mice, and of late, mobile phones and tablets. These technological breakthroughs have helped students and teachers to digitally communicate their ideas, resulting in improved collaboration.

However, as the Learning Management Systems used to develop and deliver online education continue to gain in popularity, there is still considerable room for improvement when it comes to student engagement.



Embracing a Digital Future

Due to the COVID-19 pandemic, schools and educational institutions have been forced to operate virtually. Prior to the pandemic, most institutions employed a traditional “blackboard and in-person learning” strategy, but due to the pandemic, they have been forced to adopt a “whiteboard and virtual learning” strategy to continue operations. However, not all schools and educational institutions are properly equipped with engaging content and technology to continue empowering their students in their successful learning journeys.

How should education evolve post COVID-19?

- ✓ Be accessible across distance
- ✓ Be useable with current technology
- ✓ Be scalable as per growing content needs
- ✓ Offer scope for interactivity
- ✓ Enable interactive learning
- ✓ Provide enhanced student engagement levels
- ✓ Be safe to deploy in large scale
- ✓ Be universally acceptable across all education levels
- ✓ Be affordable



What is XR?

Extended Reality (XR) is the combination of human & computer-generated graphics interaction, which is in reality as well as the virtual environment. In basic terms, Extended Reality is a superset of immersive computer technologies such as Augmented Reality (AR), Virtual Reality (VR) & Mixed Reality (MR).

Virtual Reality

Virtual Reality (VR) is the term used to describe a three-dimensional, computer generated environment which can be explored and interacted with by a person. That person becomes part of this virtual world or is immersed within this environment and whilst there, is able to manipulate objects or perform a series of actions. Morton Heilig invented the first VR device named the Sensorama in 1962.

A few years later, the concept of Virtual Reality was made popular by VR pioneer Jaron Lanier. Virtual Reality creates a completely computer-generated world which can be interacted with and related to by the user. There is no connection with the physical world in Virtual Reality. While users cannot physically touch any objects in the virtual world, they can interact with virtual objects rendered within the virtual world.

In the past, VR has been primarily associated with the gaming industry. However, advancements in technology, the high level of internet connectivity, and cheap bandwidth have paved a way for its application and acceptably across multiple industries. Virtual Reality's unique value proposition is to educate and entertain users via an interactive and immersive, digital content experience. Though it started with gaming, Virtual Reality has now become a highly acceptable and valuable tool in many industries ranging from Education, Sales & Marketing, Sports, Construction & Engineering, Healthcare, and Teleconferencing, just to name a few.





Augmented Reality

Augmented reality (AR) is an interactive experience of a real-world environment where the objects that reside in the real world are enhanced by computer-generated perceptual information. AR can be defined as a system that incorporates three basic features: a combination of real and virtual worlds, real-time interaction, and accurate 3D registration of virtual and real objects. The overlaid sensory information can be constructive (i.e. additive to the natural environment), or destructive (i.e. masking of the natural environment). This experience is seamlessly interwoven with the physical world such that it is perceived as an immersive aspect of the real environment. In this way, augmented reality alters one's ongoing perception of a real-world environment, whereas virtual reality completely replaces the user's real-world environment with a simulated one.

The uses of Augmented Reality are numerous. With the Covid-19 pandemic and the need to practice social distancing, any means of interaction with objects and humans has been limited. This is where AR shined with its ability to superimpose information on objects in the real world. Some areas where AR can add value while still maintaining social distancing are shopping and retail, travel, education, marketing, manufacturing, infrastructure, print media, and publishing.



Mixed Reality

Mixed or Merged reality (MR) is the merging of real and virtual worlds to produce new environments and visualizations, where physical and digital objects co-exist and interact in real time. Mixed reality does not exclusively take place in either the physical world or virtual world, but is a hybrid of augmented reality and virtual reality. To mark the difference: Augmented reality takes place in the physical world, with information or objects added virtually like an overlay; Virtual Reality immerses a user in a fully virtual world without the intervention of the physical world. Mixed reality extends virtual reality to the real world. A person experiencing mixed reality can visualize 3D objects superimposed on the real world.

Wherever there is a need to simplify a complex concept or theory, there exists a use case for mixed reality. Mixed reality has a lot to offer in industries such as construction and engineering as well as other industries like interior design, where users can interact with their environment in real time.



Why Use XR?

As educators, we know students learn in different ways. Whether visual, audio, or kinesthetic, XR technology gives students the option to choose their preferred learning style or combine all styles simultaneously. XR learning provides an interactive way for students to learn using a mobile device or VR headset. When we think about the brain and how we learn, we tend to think of it as information being downloaded. Instead, it's more a process of building associations and stimuli. You're not just memorizing; you're allowing your brain to create neural associations.



Retention rates improve when learners use virtual reality and augmented reality. Learners achieved recall accuracy rates of 90% using VR headsets compared to 78% for learning with desktop computers (University of Maryland). Learners who used VR education for two hours improved their time on task by 83% (University of Michigan). Using AR modules increased the learning motivation by 16%. It also increased student attention, confidence, and satisfaction (University of Cape Town).”

RESEARCH FINDINGS



Generally, teachers and educators use PowerPoint, videos, and textbooks to share knowledge and concepts. In other words, in traditional classrooms, teachers are typically using only images and auditory materials to teach their students. Unfortunately, the average student only remembers 30% of what they hear and 20% of what they see. XR can bring static concepts to life. XR-based learning taps into the power of interactive, visual 3D models to augment the learning experience. According to a study by Thermopylae, we respond and process visual information at a high rate. The study shows 90% of information transmitted to the brain is visual, and humans process images 60,000 times faster than text.

By utilizing immersive technologies such as AR/VR, you can keep students engaged throughout the lesson. Students can better learn with interactive media elements and immersive simulations. XR spurs students' creativity and keeps them focused on the lesson by delivering engaging graphics, 360° videos, simulations, and much more.



Use Cases

In conventional education, students focus on understanding concepts by reading rather than experiencing. Virtual reality enables students to "learn by doing" rather than "learn by reading." In other words, with XR the focus shifts to learning through practice rather than theory. By "doing" students gain a greater understanding and retain information for a longer period. XR teaching supports a practical learning method and presents a safe platform for students to practice. XR greatly reduces the risks involved in traditional training methods and gives learners a safe environment to practice and learn from their mistakes without worrying about the consequences. A few use cases follow.

Experiential Learning with AR and VR

AR/VR enables students to interact and connect with the subject matter on a deeper level. It also presents a safe environment for learners to train and hone their skills. With immersive simulations, students can practice high-risk activities such as heavy machine training, fire drills, and medical surgeries without worrying about the risks involved.

Create Immersive Lessons

Thanks to the highly immersive nature of AR & VR, students can become completely immerse in lessons. Extended reality presents 3D visuals and interactive digital elements that make teaching complex concepts considerably easier. Also, these simulations and visual 3D models help learners better comprehend the subject. Imagine traveling back in time to study history. Immersive technology makes this possible. With AR/VR learning, you can recreate historic events and bring history to life, making it more interesting and engaging.

Facilitate Exhilarating Field Trips

We know field trips require lots of planning and organizing; in addition, they can be expensive. However, with AR/VR, field trips become more affordable, accessible, and engaging. Immersive technologies make traveling to distant or hard to reach locations a reality. For example, if you want to take your students on a trip to the moon or see a white rhino on an African game safari, you can do so from the comfort of your classroom.





Benefits to Educators

The objective of education is to help people learn, understand, and remember things. In this digital era, modern gadgets can be a major source of distractions. Hence, innovating new ways to make lessons interactive and improving student engagement has become increasingly difficult. However, utilizing cutting-edge technologies such as Extended Reality (XR) can make education fun, interactive, and engaging. Extended reality has the potential to revolutionize the way we teach and learn. Read on to learn about some of the uses and benefits offered to educators by augmented and virtual reality learning.

Heightens Student Engagement

Immersive education not only helps mitigate distraction, but by making learning fun and effortless, has been found to boost student engagement with and retention of the material. By allowing students to perform practical tasks to deepen their learning, the educational material moves past the abstract and into the physical. Students aren't confined to classroom lectures anymore – they can actually practice surgery, build bridges, and travel to different parts of the globe or universe.

Increased Collaboration

Extended realities also provide a platform for remote proctoring and collaboration by allowing students to communicate with each other, using avatars and mapped facial expressions. Students can attend “class” with peers from other cities or countries, diversifying the student pool and granting students the opportunities to learn from others and practice their teamwork skills amongst a highly diverse group.

Transform Teaching

It can be challenging for teachers to teach complex science topics using only images and auditory materials. Adopting AR/VR learning can help instructors teach complex concepts easier through interactive visuals.

Anytime, Anywhere' Teaching

Accessibility is an ongoing concern for schools and universities, and the ability to teach remotely significantly reduces some of the physical barriers that some students may face when it comes to attending classes or lectures in person. Covid-19 has only served to intensify this challenge. Using XR reality technologies could allow some students to complete their studies from anywhere, whilst still receiving a high-quality teaching experience.





Benefits to Students

Extended reality is providing incredible experiences to extend the learning environment, from K-12 education all the way up to higher learning. Augmented and virtual reality allows students to learn in ways they have never been able to before. It could be teaching preschoolers about the solar system, or showing high school students human anatomy, all the way up to preparing medical students to perform life-saving surgical operations. XR encourages engagement. It breathes fresh life into education. Read on to learn about some of the benefits offered to students by augmented and virtual reality.

Better Retention Rates

Augmented and virtual reality can help students better understand concepts and retain information for a prolonged time to achieve better grades.

Gamified Learning

Gamified learning with AR/VR motivates learners and makes the learning experience fun, interactive, and appealing.

Distraction-free Education

Since AR/VR learning makes education immersive, it can greatly eliminate distractions which help students better conceptualize and understand.

Anytime, Anywhere' Learning

XR allows you to choose the appropriate lessons and learn anytime from anywhere at your pace.

Learn Through Experience

By “doing” you gain a greater understanding and retain the information learned for a longer period.





What You Need to Know

XR has immense potential as it offers new and exciting ways for learners to interact and engage with subject material. However, there are a few concerns to consider and evaluate prior to adopting XR.

Privacy Issues

To provide an immersive experience, XR collects extensive biometric data of the users. While this is essential to provide a better experience, it does present a privacy issue.

Health Concerns

VR offers an engaging, fun, and interactive way of learning, but some learners can experience headaches, eyestrain, fatigue, and nausea when using VR for a prolonged period. Spending too much time in the virtual world can cause problems for your eyes, plus you may experience VR motion sickness. Furthermore, there is also the risk of addiction and social isolation. If a student finds the virtual more interesting than the real world, they may end up getting addicted to the world of simulation. Therefore, it is paramount teachers and parents moderate and supervise the usage of VR.

Adaptability of Teachers

Before introducing a new technology, institutions must ensure their teachers possess the prerequisite level of technical knowledge. Some teachers may find it hard to transition from traditional methods to newer, tech-heavy methods of teaching. Not being comfortable operating the tech or troubleshooting a problem can be a real concern, for students maybe highly likely to lose focus if there are technical glitches during the class.

Cost

VR offers an engaging, fun, and interactive way of learning, but it does require special equipment (i.e., VR headset) and VR is not always inexpensive. Setting up a VR classroom can be quite expensive, so institutions with a modest budget may struggle to afford VR equipment. However, with technological advancements and prices on the decline, VR equipment is becoming more available to everyone. Unlike Virtual Reality (VR), Augmented Reality (AR) does not require any special skills or specialized hardware equipment. AR is mobile-friendly, and most smartphones and tablets meet the requirements to effectively run AR applications. As is the case with any financial decision, you should perform a "cost-benefit" analysis.





XR Guru[®]

XR content can show students a variety of careers available in the labor trades market. Students can gain first-hand experience in a career using fully interactive XR.

Advancing education and training in the metaverse

XR Guru is an integrated, immersive learning platform providing educational modules for STEM topics via smart devices and VR HMDs (Virtual Reality Head Mounted Devices). To know more, **visit www.xrguru.com.**

XR Guru is one of the world's first extended reality platforms tailored towards the needs of students and teachers from middle school through college. XR Guru provides supplemental content in Augmented Reality (AR) and Virtual Reality (VR) created to augment a school's curriculum. Schools and teachers can use the content in AR/VR to supplement their classroom teachings to make the learning process fun, interactive, and engaging.

Currently, more than 300 modules are available in Biology, Physics, and Chemistry, meeting STEM guidelines and AP curriculum standards. With this innovative new platform, you can share engaging and interactive educational content to students with tablets and virtual reality headsets. More modules are being developed and will be available shortly.



Deepens Student Understanding

The interactive 3-D content library has engaging and easy to understand, lectures with quizzes. Optimized lesson plans and micro-learning-based quizzes to help students test their knowledge & deepen their understanding.

Learning Assisted Environment

Sort, search, & filter your topics. Bookmark your lectures. Read video transcripts. Select your custom theme and learn at your own pace.



Cutting-edge Technology

Immersive learning using Augmented Reality and Virtual Reality engages both sides of your brain. It helps you understand faster and retain better. Choosing your own lessons in a non-linear way helps build natural curiosity to learn new concepts.

Device Agnostic Platform

Use across Android, iOS, and Oculus Devices with a single XR Guru account. Create an account in one platform and seamlessly sync across platforms.

