



Immersive Technologies AR & VR in Education

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What are AR & VR?

Virtual Reality (VR) is a fully immersive virtual world while Augmented Reality (AR) adds virtual components to reality (ex: visualizing an atom from the center of the classroom). Today, VR experiences are available through VR headsets distributed by many well-known companies. While AR may require only a smartphone (think Pokemon Go), it also works with headsets.

Virtual Reality (VR)

Virtual Reality is the name coined for any system that allows users to feel as if they're experiencing a particular experience through the use of special perception-changing tools. In other words, VR is an illusion of reality, one that exists inside a virtual, software-based world.

When connected to a VR system, users might be able to move their heads around in a full 360-degree motion to see all around them. Some VR environments use handheld tools and special floors that can make users feel as if they can walk around and interact with virtual objects.

Augmented Reality (AR)

Augmented Reality is a form of virtual reality with one major difference: instead of virtualizing the whole experience like VR, virtual elements are overlaid on top of real ones so that users see both simultaneously, blended into one experience.

Augmented reality also can be termed as an integration of digital information with the user's environment in real-time. Unlike virtual reality, which creates a totally artificial environment, augmented reality uses the existing environment and overlays new information on top of it.

Differences Between VR and AR

Virtual Reality (VR)	Augmented reality (AR)
<p>Virtual reality (VR) is a simulated system or digital representation that can be similar or completely different from the real world.</p>	<p>Augmented reality (AR) is a system that fulfills three basic features:</p> <ul style="list-style-type: none"> • a combination of real and virtual worlds • real-time interaction • accurate 3D registration of virtual and real objects.
<p>Virtual reality (VR) provides a complete immersion experience that shuts out the physical world. VR devices such as HTC Vive, Oculus Rift or Google Cardboard, transport users into real-world and imagined environments such as the middle of a squawking penguin colony or even the back of a dragon.</p>	<p>Augmented reality (AR) adds digital elements to a live view by using the camera on a smartphone.</p>
<p>Virtual reality (VR) requires complete immersion. VR devices shut out the physical world completely.</p>	<p>On the other hand, the lens on the smart glasses that deliver Augmented reality (AR) capabilities are transparent and the user can still see their surroundings.</p>
<p>Virtual reality (VR) applications are best suited for simulation or complete immersion: Think remote collaboration with 3D elements, point-of-view training, and virtual tours.</p> <p>The Johnson & Johnson Institute, for example, developed virtual reality software to improve training for orthopedic surgeons and nurses.</p>	<p>Augmented reality (AR) applications are best suited for use when users need to be connected to and present in the real world.</p> <p>Pokemon Go is an example of an augmented reality experience.</p>

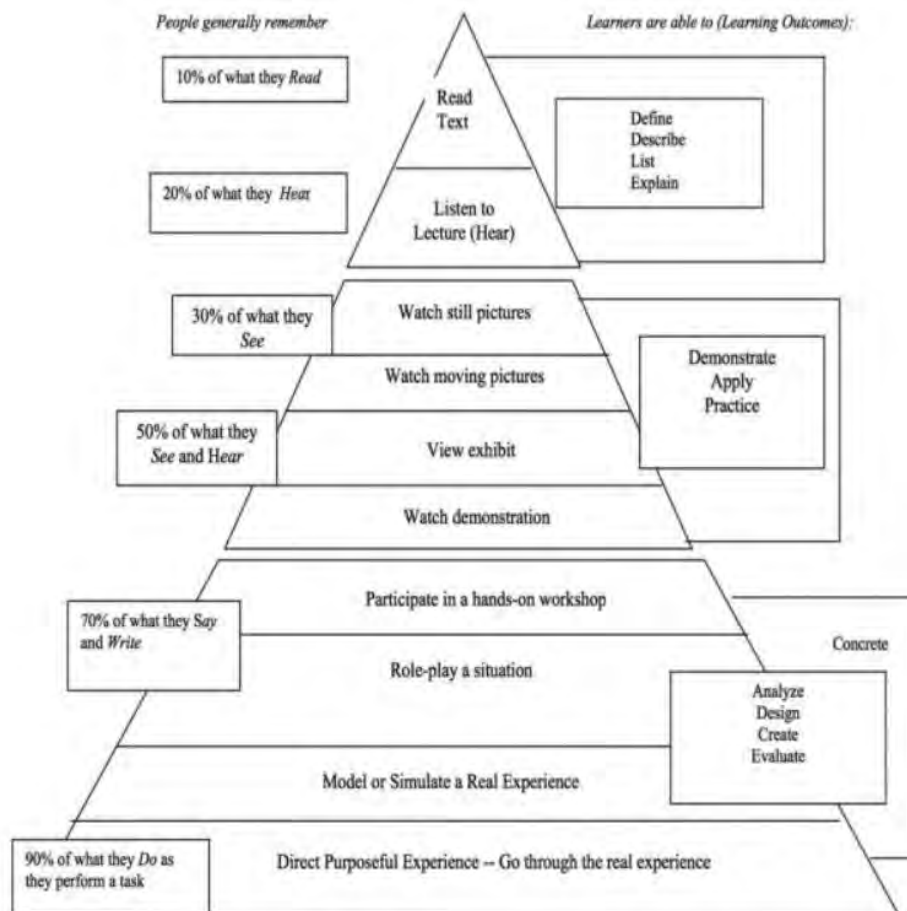
Why We Need AR/VR in Education

Today's digital world is filled with gizmos, gadgets, and distractions. It has become more difficult to find new ways to make learning more interactive to increase student engagement and to improve knowledge retention. The purpose of education is to help people learn, understand, and remember things; if any of these is missed, the purpose remains unfulfilled.

By reading, seeing, or hearing alone, we only retain 10-30% of the information in our memories. However, interactivity helps us retain up to 90%.

Making education worthwhile means providing new experiences to students. AR and VR enable you to do this within the walls of the classroom.

Edgar Dale, an American educator, developed the Cone of Experience (or Learning Pyramid)¹ during the 1960s. According to the Cone of Experience, learners retain more knowledge and information by what they "do," rather than what they "read," "hear," or "observe."



1. Anderson, H.M. Dale's Cone of Experience, *Queen's University*.

How is Immersive Technology Useful in Education and Training?

Engagement

Student engagement has always been one of the major challenges for schools and teachers. Hence, learning management systems powered with AR and VR help teachers by increasing student engagement through immersive content.

VR and AR provide yet another means for the teacher/trainer to capture attention by creating an experience (sometimes gamified) rather than delivering content.

Perspective

Using VR and AR, students can experience another perspective and learn about different career options, for example.

Making the impossible possible

It has always been difficult to teach abstract topics within the boundaries of a classroom. With the help of AR and VR, students can travel virtually to physically inaccessible places. AR/VR allows students to travel distances, including space, while remaining present in the classroom.

They can even explore the human body or hazardous environments. The possibilities are limitless.

Lower costs and increased accessibility

With the use of VR & AR, expensive machinery or lab equipment can be experienced virtually (without the investment in such equipment and labs). The education system can train students and give them live experiences in labs and on specific machinery.

Online classes

Social and collaborative learning is important. The potential for online distance learning is enhanced through VR, bridging the gap between the educator and student. Experiential VR enables online students and lecturers to transport themselves as virtual characters into the same virtual world. As the teacher guides the student through experiences, they all get a sense of being in the same room.

AR/VR Market Research

There has been increasing interest from many companies related to AR/VR to reach the education market with immersive technologies.

Future Prediction and Investments

According to Goldman Sachs, **\$700m will be invested in VR & AR products in education by 2025.**²

As investments continue to rise the quality of content improves and the cost of hardware decreases, making the technology more accessible to educational institutes worldwide. AR/VR technology has the potential to be the biggest breakthrough in the education system in the 21st century, helping students move away from memorization and exams towards learning through active participation and experience.

Market Study

According to a study, **more than half of all education institutions in the U.S. will be using AR/VR technology in the classroom by 2021.**³

Today, technology can enable students to see what World War I was like for those on the ground. AR/VR companies are giving students new perspectives by letting them see and interact with 3D objects (human body parts, engines, space stations, etc.). We can visit space with VR glasses that cost just a few dollars. This is not just another technology for the classroom; it allows students to visualize, understand, design and build at a whole new level.

Examples:

- A Danish company named Labster is partnering with Google to build 30 virtual labs on the Daydream platform for colleges. Many universities in Europe and the U.S., such as MIT or Arizona State, are using this technology to examine microorganisms or sequence DNA.
- Another company, Fundamental VR, allows surgeons and students to practice operating with a VR headset and other devices in a realistic environment. This has lowered the cost of expensive simulators or cadaveric training. It has also increased training and retraining time with much better results.
- Many hospitals have entered into a new venture to bring 3D content into the real world for healthcare education via AR using Microsoft HoloLens. Touch Surgery (U.S.) provides an opportunity for doctors to use AR in the operating room. It could be used to enhance the workflow of the surgeons in the operating room.

2. Dolfin. Reality check, <https://dolfin.com/diary/reality-check/>, accessed January 18, 2021.

3. Resnick, M. Virtual Reality (VR) in Higher Ed, *Gartner*.

Many more ventures have been initiated using AR/VR immersive technology, and many more are in the queue. AR/VR is the future of the education system.

AR/VR Scope in Different Education Areas

Time Travel and Space

Students can be guided to historical events by traveling in time and space using VR applications. They can uncover the secrets of space and our future. In this way, users can explore ships on the bottom of ocean depths, for example. Students with special needs can travel and explore any possible place.

Medical Education System

Students can use this technology to observe the intricate internal systems of the human body. With the help of AR, students can study human anatomy, 3D structures of organs, etc.

Vocational Education and Training

Vocational training is all about the balance between gaining knowledge and building experience through practice. The ability to go back through scenarios repeatedly, without additional expense or inconvenience is a great advantage. Augmented reality is particularly powerful in this context by enabling students to see how a technique is performed or a machine functions in the real world, all within a safe virtual environment.

Architectural Training

Students can visit virtually any building in the world using AR/VR, enabling them to gain experience in designing the architecture for buildings.

Labs

Virtual labs are interactive environments for creating and conducting simulated experiments based on real-world phenomena. This allows students to interact with an experimental apparatus or other activity using AR/VR technology.

AR/VR Limitations

Technology always comes with limitations, and VR/AR are no exception.

Virtual Reality (VR) Limitations

- VR is often an isolating, individual experience taking you to somewhere removed from your existing environment. This may run counter to event strategy where one of the main goals is to bring people together and live in a group.
- Although cheaper VR headsets like Google Cardboard provide a VR experience using your smartphone, for a better VR experience users must shell out much higher prices. Capabilities vary widely depending on the pricing.
- VR standards are early in the adoption stage, and content created for one platform usually will not work with another.

Market Study

- Augmented reality operates in the real world by adding a bit of digital into it. These virtual elements take attention away from the users' reality, which may cause a potentially dangerous situation.
- The AR software and app development process can be costlier, potentially restricting or limiting use cases for AR.
- AR app design and development are lacking in industry-wide standards, making compatibility challenging.

Conclusion

While limitations such as usage limitations, dizziness, costs, etc. are in need of improvement, much progress is being made on an ongoing basis. Immersive technologies in VR and AR open opportunities in areas from education to corporate training, fostering engagement and giving access to the unreachable.

Both VR and AR technologies offer exciting opportunities for an education system. As these solutions develop and make their way into the mainstream, they will become instrumental in solving key challenges in our education systems. With investment in these technologies expanding the availability of AR and VR, it is more a question of when than if they will be available in every classroom.

About the Author

Aman Verma, Engineering Consultant (Pearson Revel) has nine years of experience in the IT industry include both development and technical lead responsibilities, and delivering critical features for client Pearson Revel. Aman is proficient in technologies including JAVA, Spring-MVC, Spring-Boot, Microservice, WebServices, and Reactive programming.

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