

2 Why Use AR, VR, and MR in Education?

When sharing immersive technology with educators, I rarely find a bored audience. Educators are eager to dive into the technology and are awestruck with the incredible power of these resources. We giggle, squeal, and even gasp as these tools are unveiled with examples of amazing new experiences to be had. I assumed teachers would use AR, VR, and MR immediately; I was surprised when I found they weren't.

I discovered that although many educators were won over by the wow factor, they couldn't see a direct connection between immersive technology tools and content areas and student objectives. I had to face the reason why teachers were struggling to adapt these tools to the classroom. Although the experience was fun and engaging, the application needed to be clearly laid out with a direct connection to student standards and lesson plans.

To establish the legitimacy of immersive technology, this chapter addresses the reason these tools should be welcomed into the classroom. We'll begin with the most important reason, student benefit, then address changes happening in the classroom and finally, look at standards.

Student Benefit

One of the most obvious benefits of immersive technology is piquing the students' interest. Most students want to explore learning through a technology lens and these tools are still building momentum, making this the prime time to capture their attention. Students are eager to see the new technology because it's part of their culture. Technology is embedded into our everyday lives, and it's even more

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important for our students and their future work and social lives. There is quite a lot of attention to and discussion of immersive technologies in the media and your students are undoubtedly curious. They have probably encountered immersive technology in some shape or form already, through games or other entertainment. Seeing it figure into a lesson or curricular activity will likely cause them to be intrigued and engaged in the content.

In addition to increased student engagement, there are a number of ways immersive technology can benefit student learning, including:

- Providing authentic learning experiences.
- Transporting students to places outside of the classroom.
- Offering support and a means of communication for ELL students.
- Creating innovative spaces to collaborate and share information.

Authentic Learning

Research is showing that immersive technologies provide improvement in knowledge retention. In a study done by Juan, Mendez-Lopez, Perez-Hernandez, and Albiol-Perez, learners showed an increase in memory improvement in pre- and post-test results when using augmented reality in the lesson (2014). When the learning is authentic, we have an opportunity to engage students with purposeful, deepened learning.

Going Beyond the Walls of the Classroom

We are finding more of schools limiting field trips and outings due to many factors, yet at the same time we face an increased demand for improved student performance. For example, our students are expected to know about the ocean. They need to read and write about the ocean. They're expected to identify marine species and describe the relationship of ocean tides to marine life. Yet, how many of our students have never been to the ocean? Using immersive technology tools, you can eliminate the limitations of location or funding and take your students on virtual field trips to places like the Great Barrier Reef.

The limits we have in our real world are no longer limitations in our classrooms. A student can explore places that have never been an option in the past, and it's because of this incredible technology that the learning can be realistic. According to researchers Mehmet & Yasin,

“This new approach enhances the effectiveness and attractiveness of teaching and learning. The ability to overlay computer generated virtual things onto the real world changes the way we interact, and trainings become real that can be seen in real time rather than a static experience.”

(Mehmet & Yasin, 2012)

Communication

As we face budgetary and logistical issues in our classrooms, our students also face challenges that hinder learning. One obstacle that some students face is a language barrier. When English language learners have access to immersive technology, they're no longer hindered by understanding, because the experience speaks for itself. Companies are beginning to create tools that use the benefits of immersive technology to support communication. Our students can experience learning no matter their level of language proficiency, and we can build on the needed vocabulary without losing the opportunity for knowledge acquisition in the process.

Collaboration

Students can use immersive technology to access resources. Although we may not always have face-to-face access to an expert or tutor, we now have access to virtual support that can describe, share, and demonstrate the knowledge our students need for deeper understanding and real-world application. Moving beyond online videos, our students can access more realistic and effective support in AR, VR, and MR.

One example of this is a mobile app called Vuforia Chalk, which uses video chats layered with augmented reality to collaborate in real-time. Users share a live view of what they are looking at and, through the chat window, they are able to add and see each other's annotations. The website for the app (chalk.vuforia.com) uses the example of a mother explaining to her son how to use the washing machine. During their chat, both draw circles and arrows to identify different controls on

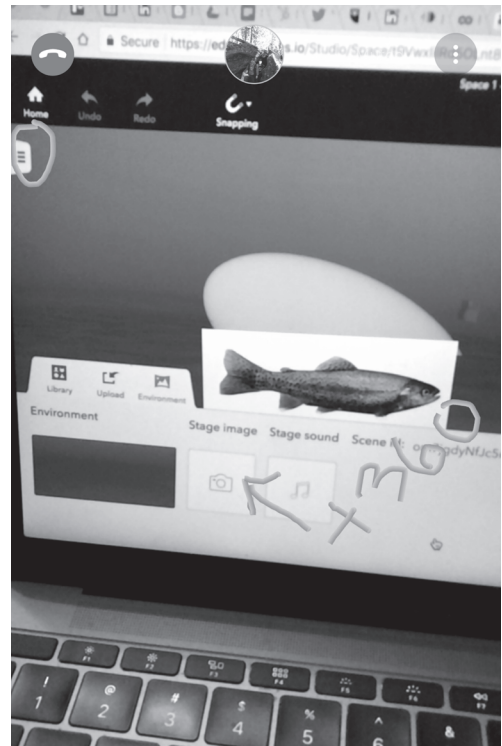


Figure 2.1

Vuforia Chalk augmented reality chat app.

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the washing machine. Gone is the frustration of trying to explain something without being able to see what the other person is looking at.

An example of using Vuforia Chalk in the classroom could be a global collaboration with another class that describes how to play a musical instrument, or a student project where a new program is being used. Figure 2.1 shows how to support someone using the CoSpaces app on their computer by showing them where to add a 360 image to change the environment. The Vuforia Chalk app is currently available in the iOS App Store at tiny.cc/chalkapp. Try it the next time you need to demonstrate a new tool or walk someone through a procedure.

Viewed through the lens of education, these tools can help illustrate real-world problems and allow students to collaborate on creative ways to solve them. Immersive technology is an open door for our students young and old to develop the skills to create the future of entertainment, education, and productivity.

Transformed Classrooms

Although some of our classrooms are still set up the same way they looked decades ago, others have evolved into interactive spaces. Likewise, teaching methods are also evolving. Our classrooms look different but, more importantly, our students engage in learning differently. Memorizing is no longer the emphasis and the “sit and get” motto is long overdue for retirement.

Our classrooms and teaching methods are evolving because we are constantly adapting to the needs of our students. We’re searching for tools that adapt to individual preferences and customizing the experience based on the needs of the individual student. Immersive technology offers powerful tools that we can harness to provide these personalized and custom learning experiences.

Although it’s sadly true that the pace of change can be slow, especially in the education environment, the good news is that solutions are coming from two directions. As noted earlier, software and applications are rapidly being adopted from the high-end systems into the technology levels common in schools and, at the same time, the power of those affordable classroom technologies is increasing to be able to deliver better experiences.

Already, many schools provide students with technology well-suited for immersive reality. Additionally, school networks are becoming more robust and powerful. This evolution will continue and, soon, every student in every classroom will have the resources to participate in VR. A good educator identifies the interests of their

students and meshes them with learning activities in the classroom. Recently, we witnessed the incredible popularity of Pokémon Go, which attracted users through augmented reality, gamification, and competition. Combining the excitement of playing an AR game (identifying your students' interests) with your lesson objectives is the start to having the most success with immersive technology.

Knowing our students is the first step in developing the best plan in using immersive technology. In a recent interview with Dr. Richard Webb, head of the Innovative Design Studio at the University of Alaska, Anchorage, he indicated our students use a part of their brain when playing that goes beyond their subconscious and into a deeper level of learning. This knowledge allows students to learn faster and retain that knowledge longer and it's something that we're only beginning to understand. Watch my full interview with Dr. Webb at tiny.cc/webbinterview.

Some of the fears that seem to haunt educators when learning to adapt immersive technology to classroom needs is that students will always expect fun instead of practical learning. In most cases, if we had a problem with students having too much fun at school, wouldn't we also not face the challenge of student dropout, behavioral problems, and lack of attention? Our issue with fun in the classroom is a result of our own issue to adapt to our students' needs for their greatest opportunity for success.

Some of the visual changes we'll begin to see more of in our classrooms surround access to power. The quantity of devices is growing and becoming more individualized. The standard computer lab is becoming more flexible and mobile to transition from class to class. In addition to power, we also see an adjustment to access points. Having a strong signal in all parts of the school where learning happens, including libraries and open spaces, is critical for the best possible experiences.

How our students interact with content is also transforming. Our students no longer look at textbooks the same way. They expect that lessons will and should include interactive activities. Textbook publishers are already jumping on board and delivering dynamic lesson activities that include augmented, virtual, and mixed reality experiences.

Imagine opening a textbook to the topic of storms and seeing a picture of a tornado. Now compare that to the experience of hearing the tornado winds whipping around you, from the left and right, and turning around to see a truck trailer being thrown onto the road. These experiences provide completely different interactions with a subject and open the door for different activities and discussions. It's important to find the right interactions to meet our student's needs.

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Standards continue to demand the same type of knowledge such as reading and writing, but we now see an evolution toward experience and engagement. While reading a book, a student can scan the pages to see the imaginary characters come to life. Students can now write a story and layer characters on top of a drawing with augmented reality props. Imagine the stories our students will want to write when they know they can enhance the content using AR.

When we begin to see the possibilities immersive technology can offer, we start to see opportunities to bring experiences to our students that we can't always offer them in real life. You would never bring your students outside to experience a real tornado, but you might use a virtual reality tool to show how powerful the winds of an F5 tornado can be. Using immersive technology, you can bring your students to the eye of the tornado without putting them in any danger.

Discovery, Education, and Retention

The difference in going from 2D to 3D interactions is similar to seeing your favorite actress on television, then meeting her in person. The two are as different as night and day; one is the interaction we experience while the other is the impression we have from TV. Although we may think we know what something looks like, the truth is we only make an assumption until we see it in real life.

Studies are trying to keep up with immersive technology as it continues to take the spotlight. In the article “Immersive Tech in Education” on edtechtimes.com, author Charlie Scanlan recognizes that the future of immersive [technology] is uncertain, but the trend of mobile learning is growing and it may change education “as we know it” (Scanlan, 2017). We can easily see the difference in learning when students can bridge the connection between content in a book and real-life relevance. Bring that learning to the next phase by viewing 3D objects in the classroom and dissecting those objects to explore what is inside.

When given the opportunity, students want to discover learning themselves rather than being told the answer. Asking for someone to explain their experience when skydiving isn't a substitute for the experience you would have when skydiving yourself. When we steal the opportunity for our students to discover these experiences on their own, we prevent them from fully understanding the content and leave them repeating facts rather than knowing them. Reproducing information is not knowledge, but merely memorization.

If I asked what was the most powerful learning opportunity you remember in school, what lessons come to mind? It's likely those experiences included problem solving, engagement, and interaction. Those events were meaningful because they deepened your knowledge by allowing you to embrace the learning as your own. Personalized learning is a major benefit in immersive technology because the adventure changes in every session based on the individual's interest at that time. A student can watch 360° videos multiple times and have different encounters each time. These discoveries make the learning more meaningful and long lasting.

Opportunity and Empathy

Making individual connections to content and learning is a major focus of immersive technology, however, there are other benefits that support our society as a whole. We are finding that AR, VR, and MR allow students to shape how they view others around the world through interactions and collaboration. As students build social interactions with individuals through collaboration tools, they're learning about diversity and conditions outside of their location.

One of the problems our students face is being limited to their own geographic area, which can result in a limited worldview when it comes to different cultures, beliefs, and societies. As incredible as it would be to bring our students on a trip across the world, very rarely do we have that opportunity. Our worldview is shaped by our experiences, and because most of our students don't have the opportunity to travel outside of the country, we need to continue to find ways to help them experience and understand other lifestyles around the world.

A clear example of building global connections and developing empathy for others is the 360° video projects that show refugee camps and travel to third world countries that lack the basic resources that humans need to survive. This type of experience can be found on the YouVisit app under the topic, "Inside Syrian Lives" or by visiting [**youvisit.com/rescue**](http://youvisit.com/rescue) from a computer. When our students are exposed to these situations, they must address how they feel about other people who face trials around the world. These experiences might never be possible without this technology.



Figure 2.2

Syrian Lives shares information in 360°.

Alignment with Standards

The ISTE Standards for Students address important skills that our students must possess to prepare them for opportunities and success in the future. The student standards capture different aspects of immersive technology that makes these resources so meaningful. Going through the standards and the connected indicators will show how to purposefully address student expectations and provide worthwhile learning. The full ISTE Standards for Students can be found in Appendix B. To learn more about the ISTE Standards and view the standards for educators, visit iste.org/standards.

Student Empowerment

The first standard focuses on student empowerment. In the process of using other technology in the classroom, students are building the skills needed to understand emerging technologies. For instance, when a student learns how to take photos, they are building foundational skills that will help them take 360° photos in the future. They will apply their troubleshooting knowledge from their past photography experiences toward the expectations of tomorrow. When we have the basic skills covered using our day-to-day activities, we are essentially giving our students the proficiency to be successful in future skills and potential careers.

Digital Citizenship

The next standard centers on our students as digital citizens. Managing your digital identity is a key skill in a world where global, virtual collaboration is becoming more and more common. Our students need to practice safe, legal, and ethical behavior in a 3D space just as they do in a 2D space. Issues such as intellectual property and copyright are the same within a virtual scene as they are in the real world. In addition, protecting their personal data is equally important when in a virtual environment as it is in a 2D environment. Students gain experience dealing with these concepts in the real world and in 2D environments. The deeper learning that immersive technologies can provide reinforces the importance of being a good digital citizen.

Student Creation

The third standard addresses students as knowledge constructors. Our students should be moving beyond passive experiences to designing and creating products that demonstrate their knowledge. The potential is endless when giving our students the baton to build classroom learning environments. Imagine a classroom where research is no longer restricted to a computer screen or textbook. Our students can collaborate with other students around the world to solve problems that they experience through the lens of a peer thousands of miles away. We don't need students to just be creators of content, but also to find ways to adapt their learning methods to find their greatest success in life.

Design and Innovation

The fourth standard is concentrated on innovative design using technology. Students develop creative solutions that provoke problem solving, experimentation, and idea discovery. We have the option for students to meet virtually in breakout areas outside of the classroom to work on projects, brainstorm, or even develop prototypes. We're no longer restricted by physical proximity and space constraints to allow collaboration or opportunities to connect to solve a problem—we can provide more options in a digital 3D environment.

Computational Thinking

The fifth standard looks to develop a classroom where students demonstrate their computational skills through a variety of technologies. Students use methods to identify, collect, and analyze data using algorithms. One valuable tool to support student connections with data is using virtual mind maps. Using tools such as

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Bubbl.us and Canva, students can create a virtual mind map and visually display information in a 360° view.

Creative Communication

The sixth standard is focused on the student as a creative communicator. Students should use a variety of platforms to creatively and clearly communicate. Our classrooms are full of potential with immersive technology that can be used in visualizing information. In the use of virtual reality simulations, 3D models, and digital content, our students have the resources available to fully express and show their thoughts and ideas.

Global Collaboration

The last student standard is identifying the characteristics of the global collaborator. Students are expected to work with group and individual peers inside and outside of the classroom. Through virtual connections, students can experience life-like situations in other parts of the world to broaden their perspectives. Students can “travel” to other parts of the world to engage in discussions that expand their perspectives.

Learning Transported Challenge

What do you think the benefits are for students using immersive technology? Are you able to find any research supporting your claims? Share your findings in a blog post or post them to the community using the #ARVRinEDU hashtag.

Choose one of the ISTE Standards for Students (found in Appendix B) and explore ways that students might embody the standard through their use of augmented, virtual, or mixed reality.