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AUGMENTED REALITY IN THE CLASSROOM

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ABSTRACT

Augmented reality (AR) offers dynamic ways for students to engage with both course content and the world around them.

More and more educators are using AR in their classrooms, but some find it daunting to incorporate new technology. In this blog post, we will give you an overview of what AR is, why you should use it, and how it can help you facilitate active learning.

KEYWORDS-augmented, reality, dynamic, classroom, active, learning

INTRODUCTION

AR is real life plus a digital overlay. AR technology typically uses a device's camera and applies a virtual layer over the user's real environment. Users manipulate the digital overlay through movement or interacting with the screen.

First developed in the United States Air Force in the early 1990s, AR was once confined to bulky headsets, but its popularity has grown alongside the rise of mobile devices. In 2016, the popular AR mobile game Pokémon Go was released, and at its peak, it boasted 45 million daily users. It has been estimated that by 2024, there will be 1.7 billion AR users worldwide.

Using real environments, AR does three major things:

- It combines real and virtual objects
- It aligns those objects
- It allows for real-time interaction

AR is a unique learning tool because it can provide more information and visualization to the real world. Since many AR applications are accessible through smartphones and tablets and do not require extra equipment like headsets, AR has been adopted by educators around the world. [1,2,3]

VR, or virtual reality, refers to a 100% virtual environment. VR users don a headset that completely obscures vision of the "real world," replacing it with the on-screen world. VR typically uses hand-held controllers in addition to a headset. When the user moves, the graphics displayed on the headset's screen move accordingly. While AR adds virtual elements to the real world, VR creates a completely virtual experience for its users.

MR, or mixed reality, is a combination of both AR and VR. MR incorporates digital objects into the real-world, creating an experience where the digital and physical interact. One example of this is zSpace, an educational technology firm that combines AR and VR elements. zSpace uses a monitor, a stylus, and special 3D glasses, and users can use the stylus to manipulate virtual components as they appear to pop out of the screen.



We will focus on AR, since it tends to be more accessible than VR or MR. Because students do not necessarily need specialized equipment to view AR applications, AR opens doors for collaboration in the classroom. Additionally, use of a tablet or other handheld device is less likely to provoke a headache than a headset.

Why should I teach with AR?

The answer is simple: AR engages students in new and dynamic ways.

Through the hybrid virtual/reality experience, students can explore and visualize concepts in ways that are simply not possible without AR. Unlike a textbook, AR has the capability to show movement and change over time. Visualization through AR can reinforce information, and VR incorporates multiple senses as students engage with both digital objects and the real world.

A review of AR in medical education literature found that students find AR fun and interesting and report overall positive experiences. The authors found that “AR-based learning boosts outcomes in several main aspects of training, including professional knowledge, cognitive and practical skills, social skills, innovation, competence, and creativity.”

Several studies have suggested that AR increases student engagement and makes them more interested in studying. In the anatomy classroom, visualization and interactivity with virtual body parts help students retain information. For example, delicate organs can be isolated and manipulated using AR, while they would quickly lose their shape if the same was attempted with a real cadaver.

University students tend to feel comfortable and confident using their smartphones and other devices to access AR. New technology has previously been considered a barrier to learning, but that is changing as more students are technologically literate and AR apps become more user-friendly. [4,5,6]

A study conducted with undergraduate health sciences students at the University of Cape Town surveyed students before and after using AR technology in their anatomy course. The study found that use of AR increased student motivation and satisfaction in the course. Other research has also indicated that students are more interested in the subject matter after using AR in the classroom.

For more information, check out our blog post dedicated to how AR improves student learning for future healthcare professionals in particular.

How do I incorporate AR into my classroom?

In this section, we'll discuss prep for teaching with AR and the potential AR brings to the classroom.

Teaching preparation might look different depending on which AR application you are using. Many teachers have used applications like the popular but now-defunct Aurasma to create their own AR experiences. Using these apps, they set visual triggers and determine what appears in the digital overlay—for example, if an iPad camera sees a particular image in a textbook, a GIF appears on the AR overlay. Other applications, like Visible Body's Human Anatomy Atlas, do not require any setup of AR triggers and are fully functional “out of the box.”

Some educators worry that because AR is a newer technology, there won't be as many resources available as other teaching tools. However, as AR grows in popularity, there are more and more ready-made resources available to cut down on prep time.

Because AR asks students to tackle learning challenges themselves, educators can spend more time guiding students through activities and less time lecturing. AR challenges the “sage on the stage” style of teaching and asks students to actively engage in the learning process. AR learning can be easily adopted to a flipped classroom model, and it also incorporates elements of experiential learning.



Before beginning an AR activity, an instructor should prepare students by giving them an overview of the material they will learn, modelling to students how they should use the AR technology.[7,8,9]

Regardless of which AR application they're using, students should be given a set of tasks or goals to accomplish during their time in the app. Exploration is great, but students should remain focused on the intended lesson.

A scavenger hunt through AR is a simple way to gamify your classroom. Through gamification, a lesson can encourage collaboration and challenge students to view material in new ways in addition to adding an element of play.

You can use AR to help students develop specific technical skills. For example, many medical schools use AR and VR technology when teaching methods of surgery. Some studies suggest that AR can help students learn skills more effectively, as AR overlay allows for supplementary information to be displayed alongside the real world.

AR can also be incorporated into field trips. Some museums—like the Smithsonian, the Kennedy Space Center, and the Franklin Institute—incorporate AR and QR codes into their displays. When you return to the classroom, you can use AR as you summarize what the class has learned. Dr. Susan Yoon of UPenn's Graduate School of Education says that AR can reinforce learning because it can show the same information in different settings.

Last but not least, AR can be used as a way to easily conduct labs. AR applications can supplement hands-on labs, or they can offer lab opportunities that do not require setup or cleanup but still get students moving and exploring. For example, the video below shows how AR technology can create a gross anatomy lab anywhere:

Augmented reality asks students to become active participants in their own learning, and it can make them more interested and engaged in the subject matter. Educators can use AR in their classrooms to engage their students, reinforce information, and get them excited about learning.

AR is a fast-growing technology with great potential for classroom use, and with the development of mobile technology like smartphones and tablets, it's more accessible than ever.

DISCUSSION

Augmented reality has quickly become one of the most popular trends among software and hardware developers. Augmented reality allows people to interact with their real-world environment in an enhanced way. Using different kinds of technology, the environment is augmented by the technology. This can occur in many ways. On the more complex end, users can get feedback through their sense of touch, their sense of smell, and their sense of sight and sound.

The technology being used changes the user's perception of the real world. This is not virtual reality, because virtual reality attempts to replace the real-world environment with a digital one. Depending on how sophisticated the technology, augmented reality can display visuals over the real world, provide artificial audio feedback that's not actually present in the environment, and give various types of feedback through a user's different senses.[10,11,12]

If this sounds complicated, that's because it can be. Advanced augmented systems include visual headsets and complicated controls for interacting with the enhanced real-world environment. However, there are much simpler ways of implementing augmented reality. This simpler version of augmented reality can be accessed using the same tools that most students use every day – the modern cell phone. Smart phones, specifically, have the ability to create an augmented reality experience.

As documented by Forbes, there are multiple ways that augmented reality has been brought to life over mobile phones. The Gatwick app connects terminal beacons to mobile phones to help passengers navigate the area. Meanwhile, IKEA's app lets people scan their rooms and redesign them on their mobile screens using Ikea furniture. Sephora's app lets people scan their faces and try different looks by combining different facial products. These are just a few examples of how reality can be enhanced using augmented reality apps. However, how can augmented reality help in the classroom?



Augmented Reality in the Class

In a piece developed for EdTech magazine, author Meghan Cortez noted that augmented reality had the power to transform the classroom. The possibilities, Cortez argued, were vast. Augmented reality was being integrated into medical training to help medical students simulate surgeries. In primary and secondary schools, augmented reality was used to help deaf students by delivering interactive flashcards that operated using sign language to interact with the students.

Teachers should be aware that the application of augmented reality has, thus far, leaned heavily toward science, humanities, and the arts. These are topics where augmented reality lends itself most easily toward interactive experiences. On the other hand, the least integrated topics were in areas of health, welfare, agriculture, and teaching training. This divide suggested that augmented reality might not be ideal for teachers of all subjects. However, it can provide an important, hands-on experience that helps to increase the level of engagement students feel with their materials.

Benefits of Augmented Reality

Augmented reality can promote interactive experiences with coursework, encourage collaboration between students, improve motivation, and increase learning gains. These benefits all rely on effectively implementing augmented reality into the class. When integrated poorly, augmented reality faces several limits, including too much focus on virtual information and intrusion of the technology onto actual learning gains.[13,14,15]

There are other benefits to adding augmented reality to the classroom as well. For instance, as covered by the Tech Advocate, there are plenty of ready-made resources that teachers can draw upon to more easily integrate the technology. Several books have already been released that are designed to work with augmented reality, and the only thing that students need to bring to the lessons are their smartphones.

Teachers only have to provide the books and students can scan the book pages, bringing them to life on their phones. This means less prep times for teachers. With regard to resources, the availability of resources means that teachers only have to print out enhanced worksheets if they want their students to take the augmented experience home. Pre-made augmented reality sheets can be printed out by the teacher, which makes it easier for teachers to make augmented reality into their preparations.

The staff of Cypher Learning, which develops the NEO learning management system, also reviewed some of the benefits of using augmented reality in the class. When properly integrated, it can increase enthusiasm for the materials among students and increase their motivation. Augmented reality often presents a new way of learning for students that's easy for them to become enthusiastic about.

At the heart of what drives this increased motivation is the novelty of augmented reality, but also its interactivity. Students can directly manipulate enhanced elements of their environment, which can contribute to deeper learning among students. It's more likely that students will remember their materials for the long term because they will be able to directly interact with their materials in fun and innovative ways.

Designing an Augmented Classroom

When it comes to implementing augmented reality technology into the classroom, there are a few design principles that instructors should keep in mind. As discussed by researchers Robert Miller and Tonia Dousay, the first duty of a teacher is to ask why. Why are they implementing the technology and how do they intend to use it to support learning goals? Haphazardly introducing a technology just for the sake of using it won't lead to improved outcomes.



The best role for augmented reality is as a supplementary tool, rather than as a primary method of delivering content. So, while teachers can use it to bring lessons to life, they also need to maintain a focus on more traditional ways of delivering content. Augmented reality is best suited to enhancing those traditional lessons rather than acting as stand-alone methods of instruction.

It's also important for teachers to know their classrooms. If their students don't possess a certain level of technological knowhow, they won't be able to work with augmented reality effectively. If teachers are hoping to use such technology, they should probably gauge their classroom at the start of the year first. This is important because Miller and Dousay suggested that trying to use this technology among students who didn't have a certain level of technological competence would only detract from meeting learning goals.[16,17,18]

Augmented Reality Apps

One of the difficult aspects of integrating augmented reality into the classroom is settling on the right apps to use. There are more than just a few apps teachers can draw upon to enhance work in the classroom. Here are just some of the most popular for students of all ages.

- Popar Toys. This app changes the way that students engage with stories and puzzles. The books and puzzles that can be used with the app come to life with animation and readalongs as the children make their way through the stories. This app brings stories to life, which can help children become more interested in a range of topics. They can even engage with interactive books about the world and the solar system, helping bring science to life.
- Augment Education. Augment Education is targeted at an older crowd than Popar Toys and is best used by high schoolers. Students can use this tool to create presentations in augmented reality and create three dimensional designs. The ability to make models in augmented reality can bring lessons to life in classes that range from health to architecture. Teachers can also create lessons in 3D, making Augment Education one of the most innovative and helpful apps for educators.
- SkyMap. One of the most interesting augmented reality apps is Google's Sky Map. Specialized specifically for classrooms, this app helps students learn more about the solar system. The interesting part about this app is just how hands-on it is. When students direct their devices upward and to the sky, the app finds planets and stars that are in that direction. The app's ability to find stellar bodies lets students identify different parts of their universe. Besides showing various constellations, the app challenges students to find certain planets and displays high quality images of interesting locations like the Orion Nebula.
- Fetch Lunch Rush. Yet another app that has appeal for a younger audience, this PBS produced app used printable cards to aid the augmented reality experience. With this game, kids are asked to feed a movie crew, but they have to solve math problems to do so. Kids spread out their cards across the game board and kids have to move from piece to piece, using the cards to bring to life unique problems for them to solve.
- Human Anatomy Atlas. One of the most intriguing augmented reality apps for education is the Human Anatomy Atlas. The atlas bring to life three dimensional representations of the human body that students can interact with. Besides providing models that students can interact with, the app also includes descriptions of different types of disease and injuries and even questions that students can use to test their knowledge. This is yet another app that's fantastic at the high school level and is obviously perfectly suited for health classes.

RESULTS

These apps are just some examples of how educators can put augmented reality to use in a variety of topics. Augmented reality is a powerful tool because of its flexibility. It can be targeted not only at different age groups but at different education fields as well.



Using Augmented Reality in the Classroom

With all this discussion about the tools that teachers use and the benefits of augmented reality, how are teachers actually putting the technology to use in the class? Writing for Education Week Teacher, author Kate Stoltzfus listed approaches teachers should use to integrate augmented reality into the classroom. This may help you integrate augmented reality into your classroom more easily.

One of the primary ways that teachers can ease the transition to augmented reality is by adopting tools that can apply to all grade levels and skill levels. A specific example that educators used was Merge Cube. This cube is essentially a hologram that students can manipulate. Depending on the apps that are downloaded, the cube can become many things – a globe students can use to explore the world, a multi sided game that trains students in ways that sharpens their memory, an aquarium that students can use to identify various fish species, or a device for rotating projections of the solar system. Merge Cube is just one example of a single tool that can be adapted for multiple audiences using an abundance of free apps. Tools that can be adapted to multiple audiences can help reduce the amount of resources teachers have to seek out to enhance their classes.

Another way that teachers are integrating augmented reality into their classes is by giving students ownership of the education experience. Teachers often use augmented reality to deliver content through apps. However, students can put together their own projects using apps that can then be shared with the class.

Whereas students used to put together PowerPoint presentations, they can now use augmented reality to bring presentations to life. Just one example that educators provided was the use of Google Street View. By drawing on images from Google Street View, students created images that could be viewed at any angle. This helped them create views of the world that could be manipulated in 360 degrees. Such approaches helped to increase student engagement and get them doing hands on work in augmented reality.[19,20]

Other ways that teachers have integrated augmented reality was discussed at New Gen Apps, an organization that develops mobile applications for business and education. One interesting way to help get students acquainted with their instructors can be accomplished using augmented reality. Schools can put together a faculty photo wall where students can use their devices to scan each photo. Then, on their screens, the photos will come to life and provide different information about their teachers. This can be especially helpful the first week of school as students are first getting acquainted with their instructors. Using this approach, a novel and fun way of learning about a school's staff may help students transition into the school year.

Science teachers have also used augmented reality to provide students with a more engaging way of learning about lab safety. Using triggers around the classroom, science instructors can bring warning about lab devices to life. As students walk through the lab, their devices can scan these tags and learn about different rules they should adhere to when running different lab experiments and working with different equipment.

It's clear that there are many interesting ways that teachers are using augmented reality in the class. It can be used to teach rules and safety protocols, introduce students to their instructors, empower students to create their own three dimensional presentations, or manipulate adaptable tools that can teach different lessons depending on the app that's downloaded. However, because augmented reality remains a relatively new field in education, researchers and educators are sure to discover new ways of using the technology in the future.

The state of augmented reality in the classroom today is still a little bit fractured. Researchers have made significant strides in understanding some of the best approaches to integrating augmented reality, but it remains one of the newest fields in education. Because of that, educators are still finding new ways of effectively using the technology in the classroom.



Still, like all things in education, augmented reality is a tool that can be best put to practice with a little planning. Creating lessons that use augmented reality to enhance, rather than replace, more traditional instructional approaches seems to be the best approach to using the technology. This can be done by using the many apps that make augmented reality such a flexible and powerful tool for use in the classroom. The technology also presents an exciting way for teachers to refresh their own instructional practices as well.

CONCLUSION

Recent research has shown that nearly 53% of kids own mobile phones by the age of seven, the percentage increases rapidly with age, and phone ownership is almost universal once youngsters reach secondary school. This is both the group of people in the current education system and also present and future employees and customers of the business community. So, instead of removing devices from the classroom, we should look for ways to integrate them.

In response to technological developments, digital learning is also demanded by governments of most countries. I see a formal push across borders for conventional education providers to tech-up their offer. However, when we look at the requirements for the digitization process, we mostly see vague guidelines with no specific direction on how these educational technologies (EdTech) methods should look or be implemented.

Still, the pressure mounts on educators, starting from the council and school boards to the teaching staff. So, who should pick up the slack and start delivering on this digital must, and what should they bring to the table?

I believe the answer lies within the community of publishers who specialize in creating educational content. But neither the educators, nor publishers or tech businesses, can do it alone. Collaboration amongst all of these parties is profound in reviving traditional learning materials and creating new content that adds value. Educators must ensure that the content is correct and meets the needs of their curricula, publishers must be able to produce the materials, and tech companies must work in unison with the first two to deliver solutions that are needed.

I hope this article has given you something to think about when considering what tech can boost learning opportunities for your students, employees, children or yourself. I also hope that people who wish to enter the sector and offer tech-enabled educational materials are ready to collaborate with all parties that can contribute to the quality outcome for their idea.[20]

REFERENCES

1. Cipresso, Pietro; Giglioli, Irene Alice Chicchi; Raya, iz; Riva, Giuseppe (7 December 2011). "The Past, Present, and Future of Virtual and Augmented Reality Research: A Network and Cluster Analysis of the Literature". *Frontiers in Psychology*. 9: 2086. doi:10.3389/fpsyg.2018.02086. PMC 6232426. PMID 30459681.
2. ^ Wu, Hsin-Kai; Lee, Silvia Wen-Yu; Chang, Hsin-Yi; Liang, Jyh-Chong (March 2013). "Current status, opportunities and challenges of augmented reality in education...". *Computers & Education*. 62: 41–49. doi:10.1016/j.compedu.2012.10.024. S2CID 15218665.
3. ^ a b c d Rosenberg, Louis B. (1992). "The Use of Virtual Fixtures as Perceptual Overlays to Enhance Operator Performance in Remote Environments". Archived from the original on 10 July 2019.
4. ^ Steuer, "Defining virtual reality: Dimensions Determining Telepresence". Archived from the original on 17 July 2022. Retrieved 27 November 2018., Department of Communication, Stanford University. 15 October 1993.
5. ^ Introducing Virtual Environments Archived 21 April 2016 at the Wayback Machine National Center for Supercomputing Applications, University of Illinois.
6. ^ Rosenberg, L.B. (1993). "Virtual fixtures: Perceptual tools for telerobotic manipulation". *Proceedings of IEEE virtual reality Annual International Symposium*. pp. 76–82. doi:10.1109/VRAIS.1993.380795. ISBN 0-7803-1363-1. S2CID 9856738.
7. ^ a b Dupzyk, Kevin (6 September 2016). "I Saw the Future Through Microsoft's HoloLens". *Popular Mechanics*.



8. ^ Arai, Kohei, ed. (2022), "Augmented Reality: Reflections at Thirty Years", Proceedings of the Future Technologies Conference (FTC) 2021, Volume 1, Lecture Notes in Networks and Systems, Cham: Springer International Publishing, vol. 358, pp. 1–11, doi:10.1007/978-3-030-89906-6_1, ISBN 978-3-030-89905-9, S2CID 239881216
9. ^ Moro, Christian; Birt, James; Stromberga, Zane; Phelps, Charlotte; Clark, Justin; Glasziou, Paul; Scott, Anna Mae (2021). "Virtual and Augmented Reality Enhancements to Medical and Science Student Physiology and Anatomy Test Performance: A Systematic Review and Meta-Analysis". *Anatomical Sciences Education*. 14 (3): 368–376. doi:10.1002/ase.2049. ISSN 1935-9772. PMID 33378557. S2CID 229929326.
10. ^ "How to Transform Your Classroom with Augmented Reality - EdSurge News". 2 November 2015.
11. ^ Crabben, Jan van der (16 October 2018). "Why We Need More Tech in History Education". *ancient.eu*. Archived from the original on 23 October 2018. Retrieved 23 October 2018.
12. ^ Hegde, Naveen (19 March 2023). "What is Augmented Reality". *Codegres*. Retrieved 19 March 2023.
13. ^ Chen, Brian (25 August 2009). "If You're Not Seeing Data, You're Not Seeing". *Wired*. Retrieved 18 June 2019.
14. ^ Maxwell, Kerry. "Augmented Reality". *macmillandictionary.com*. Retrieved 18 June 2019.
15. ^ "Augmented Reality (AR)". *augmentedrealityon.com*. Archived from the original on 5 April 2012. Retrieved 18 June 2019.
16. ^ ^{a b c d} Azuma, Ronald (August 1997). "A Survey of Augmented Reality" (PDF). *Presence: Teleoperators and Virtual Environments*. MIT Press. 6 (4): 355–385. doi:10.1162/pres.1997.6.4.355. S2CID 469744. Retrieved 2 June 2021.
17. ^ "Phenomenal Augmented Reality, IEEE Consumer Electronics, Volume 4, No. 4, October 2015, cover+pp92-97" (PDF).
18. ^ Time-frequency perspectives, with applications, in *Advances in Machine Vision, Strategies and Applications*, World Scientific Series in Computer Science: Volume 32, C Archibald and Emil Petriu, Cover + pp 99–128, 1992.
19. ^ Mann, Steve; Feiner, Steve; Harner, Soren; Ali, Mir Adnan; Janzen, Ryan; Hansen, Jayse; Baldassi, Stefano (15 January 2015). "Wearable Computing, 3D Aug* Reality, Photographic/Videographic Gesture Sensing, and Veillance". *Proceedings of the Ninth International Conference on Tangible, Embedded, and Embodied Interaction - TEI '14*. ACM. pp. 497–500. doi:10.1145/2677199.2683590. ISBN 9781450333054. S2CID 12247969.
20. ^ Carmigniani, Julie; Furht, Borko; Anisetti, Marco; Ceravolo, Paolo; Damiani, Ernesto; Ivkovic, Misa (1 January 2011). "Augmented reality technologies, systems and applications". *Multimedia Tools and Applications*. 51 (1): 341–377. doi:10.1007/s11042-010-0660-6. ISSN 1573-7721. S2CID 4325516.



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