

Revolutionizing Education

Bringing Virtual Environments into the Classroom



A Survey of
XR Teaching
and Learning

XRA
XR ASSOCIATION

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Overview

The XR Association (XRA) promotes the dynamic global growth of the extended reality (XR) industry, which includes virtual reality (VR), augmented (AR), mixed reality (MR), and future immersive technology. XRA and its member companies are leading the way in the responsible development and adoption of XR by convening stakeholders, developing best practices and research, and advocating on behalf of our members and the greater XR industry.

The XR Association represents the broad ecosystem of the XR industry, including headset manufacturers, technology platforms, component, and peripheral companies, internet infrastructure companies, enterprise solution providers, and corporate end-users.

Extended reality technologies have the potential to enhance the learning experience by creating virtual environments that allow students to explore and learn about a wide range of subjects in an engaging and interactive way. In the fall of 2022, XRA partnered with the International Society for Technology in Education (ISTE) and EKP Capitol to collect quantitative data and qualitative insights about educators' perceptions of XR technology and the potential for XR use in middle and high school classrooms. The ISTE-led survey received nearly 1400 responses from all 50 states and U.S. territories. Qualitative teacher interviews were conducted with seven full-time teachers who use XR in the classroom.

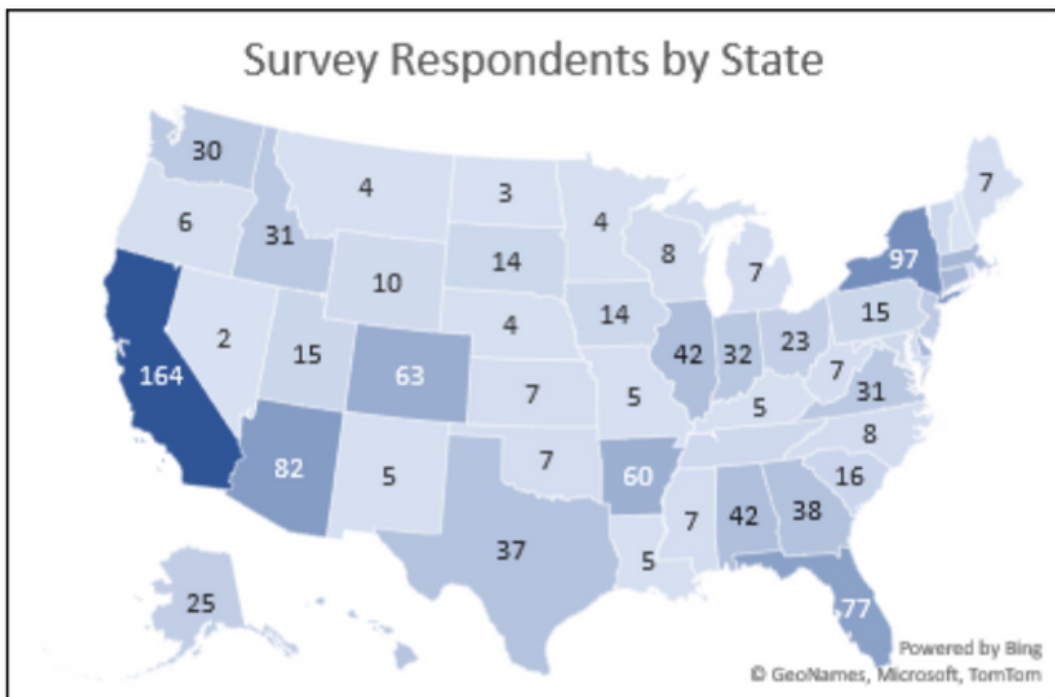
Conducting the survey had two primary goals:

1. Identify the ways in which middle and high school educators are already using XR technology in the classroom and their beliefs about its educational value.
2. Advise teachers, edtech decision-makers, nonprofits, and philanthropic funders about urgent XR-focused questions that need to be addressed.

The teacher interviews had two primary goals:

1. Gain a deeper understanding of the current uses and future potential of XR in the classroom.
2. Uncover what hurdles still exist that are limiting the widespread adoption of XR technology in education.

Together, these two research assessments provide a comprehensive and detailed look into the emerging use of XR in the classroom that will help advise teachers, edtech decision-makers, non-profits, policymakers, and philanthropic funders about the urgent needs and barriers that should be addressed and prioritized to help XR thrive. Included in this summary are takeaways from the [XR in Education Infographic](#) released by XRA in December 2022, as well as additional context from survey research completed by ISTE and teachers interviewed by EKP Capitol to support and deepen the information in the infographic.



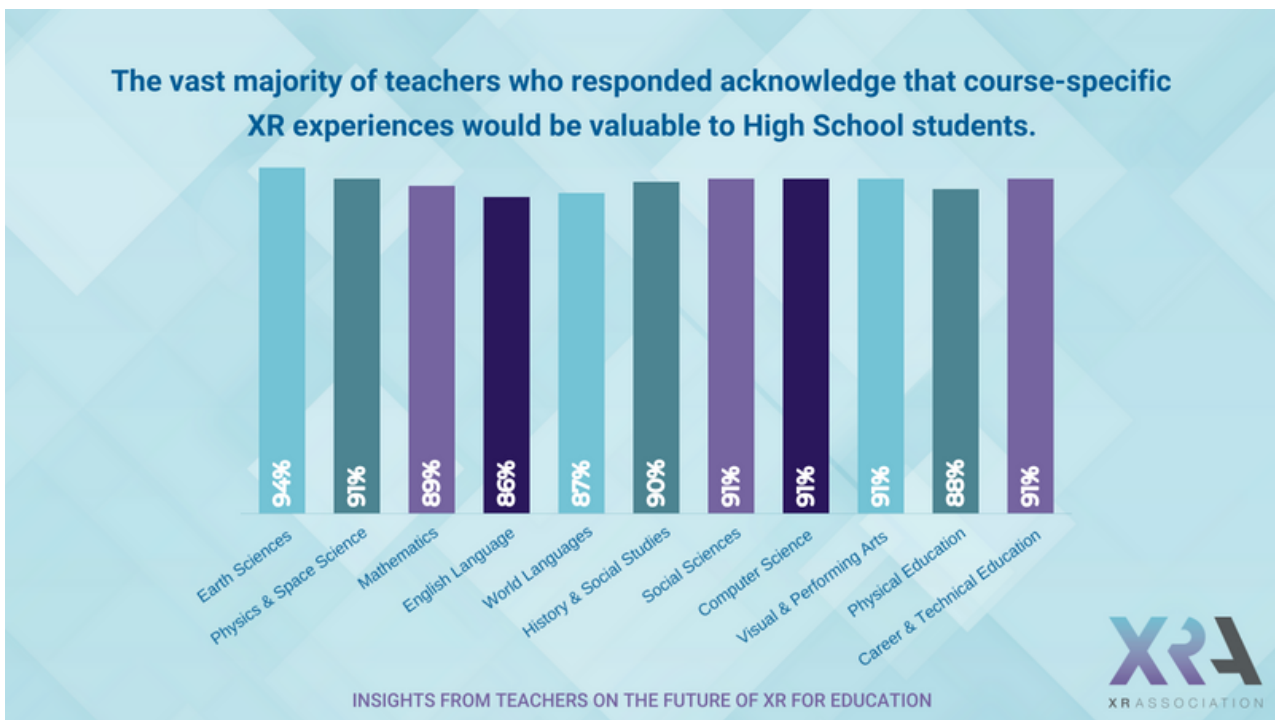
The research questions that guided the survey and interview sought to understand teacher sentiment on several topics surrounding XR use in the classroom, including settings where XR can be applied, attitudes around XR in the classroom, scope, and structure of inclusion in lesson plans, and hurdles to adoption – including any concerns offered by teachers.

Classroom Use Cases for XR Technology

Education using XR has the potential to expose learners to new perspectives, encourage user empathy, as well as provide educators and students with a standardized, reproducible environment for optimized instruction. The D.I.C.E method, coined by Stanford researcher Jeremy Bailenson of the Virtual Human Interaction Lab (VHIL), suggests that applications in XR can be useful when replacing real-world experiences that are:

- **Dangerous** – such as experiences that come with inherent risks like visiting a volcano site;
- **Impossible** – such as taking a tour of our solar system;
- **Counterproductive** – such as trying to teach a lesson that has impractical or undesirable results – for example, teaching about the effects of deforestation by having a person actually cut down trees;
- **Expensive** (and rare) – such as experiences that are too costly or unique for the average person to experience, like scaling Mount Everest or visiting the Mona Lisa at the Louvre Museum.

The D.I.C.E method does not apply in all possible education use cases but can often serve as a useful guide for teachers and administrators when evaluating when and where to use XR in school. Effective implementation of XR in schools can mean identifying targeted uses for instruction, for example, using XR as a supplementary learning method to pair with traditional instructor-led teaching. In fact, 78% of the 1400 surveyed teachers agree that XR-based learning is easy to integrate into their lessons. Additionally, teachers believe that course-level XR experiences would be beneficial to students, and 90% of teachers believe that XR technologies are a good or great experience for most subjects.



XR technologies can be used to create immersive and interactive learning experiences that can increase student engagement. Through XR, students can experience subjects and concepts in a more interactive and hands-on way, which can be more engaging than traditional 2D web-based. A [2019 Gallup study](#) found that high student engagement was significantly positively correlated to student academic growth in multiple subjects, along with post-secondary readiness in math and reading. XR's ability to make content more interactive and collaborative in virtual environments creates a need for higher degrees of engagement in students, helping to support academic growth.

Marco Flores, a teacher based in California, found that students are more motivated to complete virtual 3D assignments because they can experience the course material first-hand. "Every time my students put on the headset, almost 100% of them say how cool it is. It's really a game changer for them," he says. Students are drawn to using XR in education because they say it gives them a sense of ownership over their learning. A sense of agency, or the feeling of being in control, is an important factor in making XR learning effective and lasting. When learners feel they have agency in their learning environment, they are more likely to be motivated to learn. Additionally, a sense of agency can lead to increased self-confidence and a sense of accomplishment, as learners feel like they are actively contributing to their own learning and growth. And teachers agree; 77% noted how XR increases engagement in course material.

Another advantage of using XR in the classroom is the ability to customize learning experiences to meet the needs and interests of individual students. XR technology allows instructors to create personalized learning paths and adapt content to the needs and abilities of all students. This can be particularly useful for learners who may struggle with traditional instructional methods or who need additional and/or targeted support.

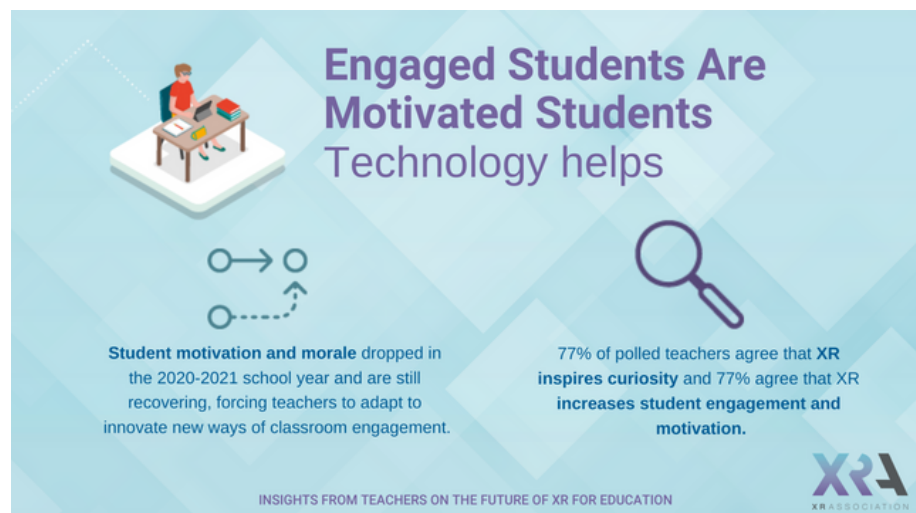
XR for Technical and Career Training in the Classroom

Beyond classroom instruction, XR for use in career and technical training helps students prepare for their futures beyond graduation. 77% of surveyed teachers agree that XR learning can help students build career skills. Sean Wybrant, a high school computer science teacher from Colorado encourages his students to work with local nonprofits and build custom XR experiences for the community. This hands-on requirement elicitation has helped students prepare for the professional world in ways which would be difficult without the technology.

Another veteran computer science teacher, Chad Magendanz, sees XR as a way to introduce students to IT concepts and materials who otherwise may have been hesitant.

Students unfamiliar

with IT are drawn to XR because they can work on projects and topics they are passionate about, which can include everything from fashion design to healthcare, and open up a world of opportunities to use the technology in creative and engaging ways which they can apply to future careers. Whether it's through classroom instruction or extra-curricular activities, XR can motivate students and encourage engagement with instructional material.



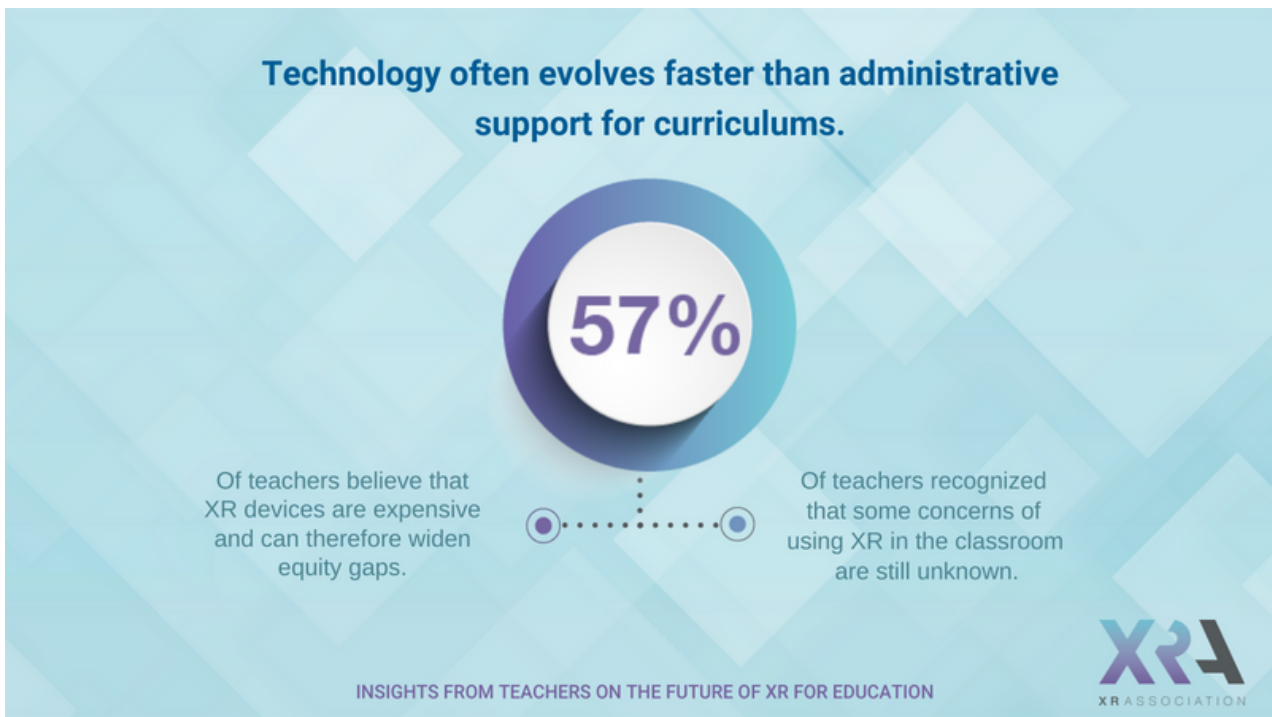
XR Can Help Solve Education Challenges

The use of XR in education can also address many of the challenges impacting rural communities. Distances between home and school in these communities create higher barriers of access to teacher-led physical classrooms. XR can help mitigate this problem by removing barriers to content and creating equal access to quality education regardless of where a student lives. In fact, 66% of rural teachers see the value of using XR in education, which is a rate higher than for either suburban or urban teachers. Meanwhile, the COVID-19 pandemic forced a transition from in-person to virtual learning, leading to feelings of isolation and taking a toll on learners' mental health. In fact, 80% of parents voiced some level of concern about their child's mental health. XR has the unique ability to connect virtual learners to teachers and other students, making learners feel like they are "in person" and decreasing feelings of isolation.

Hurdles of Including XR in the Classroom

XR can enhance student engagement in the classroom, improve retention of information, encourage collaboration, and spur creativity and innovation. It's also important to note that incorporating XR in the classroom comes with its share of logistical issues. For example, deciding how to grade students on what they learn through XR, and aligning content to existing course curricula are potential challenges which may need to be addressed. Teachers should determine whether content is age appropriate and educational. Sara Putterman, a computer science teacher from Pennsylvania found herself purchasing VR equipment through grants because there wasn't room in the school's budget for the technology. She says "IT support for new technology in the classroom is tough to get, but it's not the IT department's fault. It's asking a lot for them to manage 4500 kids and figure out VR hardware and software." Introducing new technologies like XR into schools requires more than just supporting content. Having the right infrastructure services and support that aid IT administrators and additional leadership stakeholders in adopting XR is important to overcoming the hurdles of implementing XR at scale in schools.

While best practices for classroom management are still in development, 82% of teachers believe XR experiences are generally well-designed. Teachers also agree that XR should support a variety of academic, engagement, and career-related outcomes while aligning to academic standards is essential to justify increased usage in their lessons.



Despite the logistical hurdles of bringing XR into classrooms, teachers have a positive attitude toward the use of XR. 78% of teachers agreed with statements that describe the value of XR technologies, and 87% noted that such experiences are memorable for students.

To learn more about XR in education, visit xra.org and download Chapter 4: Designing Immersive Learning for Secondary Education of the Developers Guide on education. XRA is also launching a podcast series to unpack the nuances of XR in education; you can be notified of new episodes by following XRA on [Instagram](#), [Twitter](#), [LinkedIn](#), and [Facebook](#).

Acknowledgements

The XR Association wishes to extend its sincere thanks to the members of the XRA Education Working Group, including [Microsoft](#), [Schell Games](#), [Meta](#), [TransfrVR](#), [Unity](#), [Great Lakes Reality Labs](#), [Pearson](#), and others for their assistance, contributions and leadership in the development of *Revolutionizing Education: Bringing Virtual Environments into the Classroom*.

Glossary

Virtual Reality (VR) – Virtual Reality is a computer-generated simulation of a three-dimensional environment.

Augmented Reality (AR) – Augmented Reality superimposes computer-generated images or information on top of the physical world.

Mixed Reality (MR) – Mixed Reality combines elements of AR and VR so the user is able to see and interact with both real and virtual objects in a single integrated environment.

Extended Reality (XR) – Extended Reality is a general term to refer to the range of immersive technologies including AR, VR and MR.