

FUTURE OF  
CHILDHOOD

# Swimming with sharks and walking on Mars:

Synthesis of a cross-sector forum on  
immersive technology in secondary education

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Spring 2023

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## Joan Ganz Cooney Center

The Joan Ganz Cooney Center is an independent research and innovation lab within Sesame Workshop that advances positive futures for kids in the digital world. We conduct research on emerging technologies and collaborate with technologists, digital media producers, and educators to put this research into action to support children's learning and well-being. We facilitate an international network of researchers and partner with young people themselves, elevating their voices in our research and engaging them in co-designing digital media experiences. We also work directly with policymakers and investors to drive national conversations and decisions that help children thrive.

## SUGGESTED CITATION

Tare, M., & Rood, E. (2023). *Swimming with sharks and walking on Mars: Synthesis of a cross-sector forum on immersive technology in secondary education*. Joan Ganz Cooney Center at Sesame Workshop.

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Virtual, mixed, and augmented reality, termed “extended reality,” or XR, have great potential for classroom-based learning. Yet many questions about the use and widespread adoption of these emerging technologies remain. To share insights, opportunities, and challenges, the [Joan Ganz Cooney Center at Sesame Workshop](#) and the [XR Association \(XRA\)](#) hosted Immersive Media and Learning, a one-day forum in 2022, to explore the use of XR technologies in high school settings.

This report documents and synthesizes key takeaways from the forum. The report is meant for **educators** considering how to incorporate XR-enhanced learning at their schools; **industry** professionals seeking to understand possible uses in high school classrooms and develop products that enhance teaching and learning; and **researchers** investigating what XR best enables and how it may improve a host of learning outcomes.

The report is organized into themes and examples shared by forum participants. It raises important current limitations to XR adoption in education, with suggestions for improving the design of XR technologies and their interoperability with other hardware and software used in schools. The report concludes by synthesizing recommendations for equitable design and adoption of immersive media in secondary school classrooms.

Throughout the report, we link to recordings of the talks from the forum and to references of cited and supplemental materials that teachers, technologists, and researchers may find helpful.

#### IMMERSIVE MEDIA FOR LEARNING WAS CO-HOSTED BY THE XR ASSOCIATION

The XR Association promotes the dynamic global growth of the XR industry, which includes virtual reality, augmented reality, mixed-reality, and future immersive technology. XRA is leading the way for the responsible development and adoption of XR by convening stakeholders, developing best practices and research, and advocating on behalf of its members and the greater XR industry, which includes headset manufacturers, technology platforms, component and peripheral companies, internet infrastructure companies, enterprise solution providers, and corporate end users.

“ *Our goal is to support access to the technology, learn what is needed to design experiences and applications that will be usable by educators and administrators, and to identify challenges and hurdles which need to be addressed.* ”

STEPHANIE MONTGOMERY,  
VICE PRESIDENT OF RESEARCH AND BEST PRACTICES, XRA

# About the forum

On May 17, 2022, the Cooney Center team partnered with the XR Association (XRA) to host a virtual forum. Researchers, educators, manufacturers, creators, and developers were invited to discuss their experiences in creating and using XR technologies in a high school setting, toward a goal of learning from each other.

[Immersive Media for Learning](#) was organized to address the following guiding questions:

- ? How can partnerships between developers and educators optimize the design and usability of XR applications to promote cognitive, social, and/or emotional development of diverse learners?
- ? How can XR provide learning experiences that are authentic, equitable, and personally meaningful to students?
- ? How can XR help learners make connections both to curricular material and to other people? What kinds of learning experiences are best suited to and enhanced by XR?
- ? How do we ensure that XR-enhanced learning experiences prioritize student safety and well-being?
- ? What supports (e.g., tools, integrations, training) are needed for widespread and efficacious XR adoption in schools?

## THE AGENDA

A wide range of speakers<sup>1</sup> was invited to explore these questions. Their talks are available online. The forum agenda included:

[Welcome](#) by Michael Preston of the Joan Ganz Cooney Center and Stephanie Montgomery of XR Association.

[Keynote by Gabo Arora](#) and discussion with Susanna Pollack of Games for Change.

[Lightning Talks](#) moderated by David Kleeman of Dubit, featuring Idris Brewster of Movers and Shakers, Régine Gilbert of New York University, Samantha Bindman of foundry10, and Julia Woodward of the University of South Florida.

[XRA Teen Survey](#) findings presented by Peirce Clark of XRA.

[What's Possible with XR in High School Education?](#) panel hosted by Medha Tare of the Joan Ganz Cooney Center with Kwaku Aning of the San Diego Jewish Academy, William Cavada of Mt. Pleasant High School, Marie Graham of The Mount Vernon School, and Mark Suter of Elida High School.

[Keynote by Steve Isaacs](#) of Epic Games.

[Fireside Chat with Joseph South](#) of ISTE with Michael Preston of the Joan Ganz Cooney Center.

“ *Advocating for educators and working together with ed tech creators and developers, it was always so clear to me that we needed all people's voices at those tables. We need student voice in all of these conversations. We need educators, we need tech companies. And I think they all want the feedback from one another.*”<sup>2</sup>

STEVE ISAACS,  
EDUCATION PROGRAM MANAGER, EPIC GAMES

<sup>1</sup> See Appendix A for speakers' short bios and full affiliations.

<sup>2</sup> This report includes quotations from forum speakers. Some have been edited for clarity in written form.

## XR: What is it and what is it good for?

Virtual, mixed, and augmented reality (termed “extended reality,” or XR) are emerging technologies that allow students to interact with computer-generated, three-dimensional simulations. Through VR (a fully immersive experience where students wear a headset to “be” within the simulation) and AR (an enhanced experience with a tablet, glasses, or other interactive screen), students have the opportunity to play with, build in, manipulate, or explore a virtual context. VR and AR are being widely adopted for training in a wide range of industries. These tools are best suited to helping people experience what would be “dangerous, impossible, counterproductive, or expensive” referred to as “DICE” by scholar Jeremy Bailenson of Stanford’s Virtual Human Interaction Lab (2018). Industry leaders see this

framework as a critical lens for determining what use cases are strongest and most beneficial for secondary students (XR Association, 2022).

Immersive tools are being used in classrooms in a range of ways. They can enhance understanding of content knowledge, for instance, allowing social studies students to take virtual field trips to historically important events or providing science students with visualizations of physics or anatomy. Immersive technology is showing strong promise for helping students with conceptual and abstract learning, a specific impact noted by classroom practitioners who participated in the forum.

XR is also showing great promise as a means of developing young people’s 21st century skills, particularly when embedded in project-based learning. Students can design and build their own immersive worlds using XR technology, offering a wide range of outcomes, from creativity development to collaboration to willingness to take risks in learning.



## High schoolers as the focus of the forum

While XR technologies are becoming more common in households (Cureton, 2023)—particularly for gaming in a metaverse<sup>3</sup>—costs remain high and out of reach for most young people. Schools are the setting best equipped to offer equitable access to this emerging technology. Designing for a universal audience, not simply gaming enthusiasts, is critical for the industry. It is also the right thing to do so that XR does not become yet another means of widening the digital divide.

Additionally, XR shows great promise as a learning tool to supplement and complement teaching and learning. This holds true not only in technology, maker, or coding programs but also in core academic classes. In fact, as expressed in his opening remarks, Joan Ganz Cooney Center executive director Michael Preston believes that XR will be central to learning in classrooms of the future:

“*Virtual reality has existed for just about as long as Sesame Street, but it has not yet seen scaled adoption, even though we can recognize its potential for transforming human experience in all kinds of ways. We are interested in education not only as a space for developing fundamental skills—reading, writing, and arithmetic, but also for visions of the future we want our kids to have. We want them to be inspired, empowered to create, and to be able to grow smarter, stronger, and kinder in a complicated world.*”

While XR integration in elementary and middle schools is being explored (see [Immersive Media and Child Development](#) for a discussion of a previous Cooney Center convening), at present most XR is being designed for ages 13+. For these reasons, the forum focused on high school, especially on audiences potentially underserved with new technologies. As Joseph South and Michael Preston discussed in their [fireside chat](#),

this means employing notions of universal design for learning and “designing for the edges” (Rose, 2017) so that both hardware and software are usable by a diverse range of students.

During the forum, XRA program development manager Peirce Clark shared findings from a [commissioned survey](#) of 600 13–19-year-olds across the U.S. from a mix of public and private schools. Relevant highlights included:

- + Two in five teens report having used either VR or AR in school, primarily in technology or media classes.
- + Nearly four in five teens think XR will positively impact their creativity, gaming, and learning.
- + Thirty-eight percent of teens said they would own a headset in the future.

Teens were also interested in learning more about XR in the future, with more than half—and 61% of boys—expressing interest in taking future college courses that include VR. As Clark summarized, teens recognize that immersive technologies provide opportunities for education, creativity, and self-expression not just in the classroom but in the workplace in the future.

At the same time, Clark noted that youth also have concerns about XR technologies including cost, access, privacy, their addictive nature, and the fact that they keep people indoors.

## AR adds collaboration to learning

As with VR, AR involves using computer data to generate an experience apart from our physical reality. The difference is that with AR technologies, users remain rooted in and aware of the physical world around them, with sensation augmented or enhanced by devices. Well-known examples of AR include Snapchat filters and Pokémon GO.

As noted by Julia Woodward in the [lightning talks](#), AR experiences can be designed for smartphones, headsets, and projectors. They can help teach conceptually challenging information, such as circuitry, and they can allow students to experience virtual field trips.

Notable benefits of AR include that the technology may be safer and more comfortable than VR (immersive headsets can prompt VR sickness such as nausea, Woodward explained). Additionally, AR can be used collaboratively, which is beneficial in the high school classroom setting. In her estimation, the current challenges of AR include the difficulty of managing hand-held devices, low field of view (i.e., how much of the virtual world can be seen, particularly in one's peripheral vision), and expense.

### AR IN ACTION: ACTIVATING CIVIC SPACES WITH VIRTUAL MONUMENTS

Idris Brewster founded the ed tech nonprofit [Movers and Shakers](#) to elevate the histories of Black, brown, Indigenous, and LGBTQIA+ communities by creating augmented reality technology experiences within public spaces and classrooms. At the forum, he spoke about his Kinfolk initiative that uses AR to create “digital monuments” at locations around New York City where time and money would prevent physical statues from being created:

*“We allow people walking along the street of Central Park to finally see the hidden histories that have been buried there through the building of Central Park....And so we’re doing the legwork of working with historians, curriculum writers, educators, artists, designers to bring these histories to life in a new way that’s accessible.”*

His goal is to expand the model across other cities, creating 100 new monuments over the next two years. Examples like these show the applicability of AR technology to social studies classes.



## VR enhances storytelling and builds empathy

Creator and professor Gabo Arora highlighted the power of using XR to bring stories to life and reflected on the ways that VR films make an impact on audiences. At the forum, he spoke about his signature virtual reality piece, [Clouds Over Sidra](#) (2015), a partnership between the UN SDG Action Campaign, Vrse, and UNICEF Jordan documenting the life of a Syrian refugee girl in a camp in Jordan. As he explained, VR film adds the possibility of connection:

“ *It’s really just trying to show how life is and what the reality of things are. But that’s the power of the very ordinary experiences of just walking or standing next to a window with a child next to you in the virtual space. [It] is very emotional and very compelling.*”

Arora reflected on the unique power of VR films: they tap into a deep empathy, allowing viewers to experience the world, quite literally, from another’s perspective. The film has been viewed widely by policymakers, diplomats, and philanthropists, activating remarkable advocacy and fundraising for the Syrian refugee crisis.

From this experience, Arora was inspired to partner with Steven Spielberg’s Shoah Foundation to create *The Last Goodbye*, another powerful VR documentary capturing a Holocaust survivor’s return to Majdanek, the Nazi death camp in Poland where he was imprisoned and his family murdered.

These examples, while not initially designed for the secondary classroom, demonstrate the powerful potential of using VR to connect to social studies content, present and past. Arora said that the technology enhances storytelling in the way that it taps into our empathy, and added,

“ *It’s very easy to get seduced by the technology, but really it’s the ability to tell a story with this new technology that makes things really amazing.* ”

Arora noted that the power of VR storytelling demands both on-boarding and “after care” so that participants can process what they have experienced. He also described the need for curriculum developers to partner with storytellers to develop impactful content.

### Tapping into students’ creative potential through XR projects

Gabo Arora’s [keynote](#) introduced the important role of creativity in using XR technology, reminding participants that new approaches work best when approached with openness and flexibility:

“ *I really encourage, if you go forward, that the design process for a lot of these things should be playful, should be patient, should be tolerant of risk, because there is an enormous amount of risk and failures that happen when you try to work with new technologies and try to create new experiences with them.* ”

Following his keynote, Arora and Susanna Pollack, president of Games for Change, discussed the opportunity of inviting young people to not only consume but also create with these technologies. Pollack shared her organization’s [student game-design challenge](#), which includes resources for middle and high schoolers as well as educators.

Arora’s message about XR as a tool of creativity was amplified throughout the subsequent talks. Steve Isaacs, who is currently the education program manager at Epic Games and a former public school educator, discussed in his [keynote](#) the ways that immersive technology can support teachers in offering learning experiences aligned with the [standards](#) set forth by the International Society for Technology in Education

(ISTE), which call for technology to support a new generation of creators. Isaacs linked student creative power to future job prospects, sharing how critical it is that students learn to think in three dimensions and re-create real-world experiences virtually. These skills are in demand in the workforce, indicated by the number of jobs available and the salaries for those jobs.

One avenue to meet this demand is through a “player to creator” pathway where, for example, companies like Sony, Epic, and Riot Games create paid apprenticeship programs for students to learn needed skills. These opportunities, Isaacs said, should serve underrepresented youth and prepare them for this growing professional field.

In the [educator panel](#), teacher Mark Suter described this kind of future-oriented, creative learning in the context of a high school classroom. He shared how his students create VR simulations in his technology classes. He emphasized how he encourages students to focus on the creative process with VR, rather than any end product.



He asks them to set their own goals, with milestones and deadlines, and his grading is based on their effort and the challenge they embrace:

“ In fact, their final projects, I tell them, ‘I don’t care if you finish your project.’ They’re like, ‘what do you mean?’ I said, ‘pick something that you think would be difficult. And then a half step above that. If you get done too early and you sit there and do nothing, that’s a problem. But if you pick something too difficult, get as far as you can, working bell to bell every day.’

## EXAMPLES OF STUDENT PROJECTS

Educators who participated in the forum shared a range of student work examples that showcase the ways that XR-based projects can encourage young people’s creativity and design:

- + [Mental Health by Alexis and Sam](#). Students of educator Kwaku Aning created this project as part of Comic-Con’s online experience. In this video, two students are describing how they created a representation of mental illness from a parent and student perspective.
- + [VR Job Training Simulations Project](#). Educator Mark Suter’s website describes how his students used VR to make simulations of different jobs.
- + [Elliptical Gracious Festivity](#) and [Remarkable Usable Zone](#) are two examples of virtual rooms created by William Cavada’s students using Mozilla Hubs.



Screen capture from student project on Mozilla Hubs

## Connecting students to real-life applications and skills

In the [educator panel](#), teachers described the range of student-led projects that inspired them, from developing a VR game that can be used by children in physical therapy to building custom VR training modules for clients in the community who need them. Many of these projects align with Digital Promise’s [Powerful Learning](#) principles that emphasize authentic, challenging, and collaborative projects that help to make student learning interesting and motivating. They also support the development of 21st century skills such as teamwork and communication.

## XR ENHANCES SERVICE LEARNING

Educator Marie Graham worked with her students to bring an XR-enhanced physical therapy experience called the “island” to fellow youth. In the forum, Graham shared an image that captured a powerful story:



Photo courtesy of Marie Graham

*“This is the moment the first patient used the island to do physical therapy. This kid in the picture had a catastrophic football injury and had really not wanted to do any PT or OT. When we brought the [VR simulation] in, he’d been there two weeks. He’s the one leaning over in the photo. And the other kid is showing the [physical therapist] what we were doing on the iPad with the experience. And this kid did this for 30 minutes, and this patient did not want to take it off.”*

## XR prompts rethinking of assessment

As Gabo Arora pointed out in his [keynote](#), new technologies have the potential to challenge us to rethink the status quo and to imagine new ways of doing things. XR is no different, and one important part of teaching and learning that is being reconsidered, as XR tools enter classrooms, is assessment.

Samantha Bindman, director of research at [foundry10](#) (an education research organization with a philanthropic focus on expanding ideas about learning) [discussed](#) the organization's recent work on ways that XR is shifting teacher thinking about assessment. She said that assessment is not often included in research on technology adoption but noted how XR can help teachers be more creative and think more expansively about the ways they see and measure student learning.

Bindman described how XR-enhanced learning may help students by reducing cognitive load as they visualize information and by increasing their sense of connection to the material. Because the experience may

differ significantly from other modalities of teaching and learning, more open-ended approaches to assessment can help teachers understand and appreciate what students are gaining through XR-enhanced instruction. Bindman noted that educators may need to expand the ways they capture student learning, including more formative assessments, portfolios, student feedback, and reflection on both learning and experiences:

“ *Our ultimate goal is to support educators so that they have the tools they need to think about assessment from the beginning and then gather the data they need to make improvements and find ways of using XR tools that are going to work best for their students.* ”

Finally, she said, more needs to be done to understand how assessment within the XR experience might work.



## Fundamental challenges: Ease of use and student safety

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The [educator panel](#) consisted of technology enthusiasts, including both classroom teachers and technology coordinators responsible for supporting others in implementing emerging tools in meaningful ways. The importance of ease of use was emphasized as a challenge facing schools as they work to bring XR opportunities to the classrooms of teachers who have less tech confidence or know-how. The educators also discussed the barriers related to tech accessibility that they consider in order to work with students equitably.

The panel noted that technology infrastructure remains a barrier: XR tools are not presently designed to be plug and play and to integrate with existing classroom technology. Teachers need, for instance, to be able to manage a whole class of headsets and to link projects to their learning management systems. This requires hardware and software that protect student identity and will be approved by strict district IT standards. Companies developing software for schools need to be transparent about student data and privacy.

The current reality of XR in classrooms requires a high level of know-how and a fair amount of working around issues. Software to enable fleet management for VR headsets would, according to Mark Suter, speed up adoption considerably.

Another issue raised by William Cavada is connectivity for students when they are outside of a technology classroom, such as during distance learning. Cavada described how he uses Mozilla Hubs for student VR projects because they do not require sophisticated hardware and can be more easily accessed at home by students who may have barriers to engagement:

“ *I teach at a school of students who are predominantly first-generation. Over 80% of our students speak a language other than English at home, and most of them are Latino or Asian American. And so it’s really important for us here at our school to have something that students can access.*

Another need the educators described is additional content that is not coding-heavy to make it easier for students and teachers to get started. Kwaku Aning remarked that his ultimate goal is to teach design to young people; VR is just the vehicle. This requires tools that are designed with a lower floor (e.g., are easier for teachers and students to find success with when first starting out) while also having a high ceiling for what is possible.

## Critical needs: Universal design for learning and neurodiverse students

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Reginé Gilbert, a user experience designer and educator at New York University, emphasized the importance of universal design for learning, also known as UDL, in the [lightning talks](#). She described how she applies an inclusive design [framework](#) to XR and other technologies to address the needs of a neurodiverse student body. Technology tools and classroom pedagogies should be designed to provide multiple paths of engagement, address potential barriers to learning, and include universal supports. As she shared:

“ *Not everyone has access to high-speed internet. Not everyone knows English. And when it comes to the experiences that we share in virtual reality or augmented reality, are we sharing things that can be accessed by folks with disabilities?*

Gilbert challenged the audience to consider how AR and VR tools, which rely heavily on visual processing, might work with assistive technology and might be designed to allow for multiple physical modalities. Gilbert's reminders about these limitations connected with best practices articulated in the educator panel related to teacher pedagogy with XR tools: immersive technology may best be thought of as one pathway of engagement in a class that complements other ways that young people may learn material.

At the same time, the educators involved in the [panel](#) were enthusiastic about XR as a new tool for neurodiverse learners. Marie Graham spoke of the promise of using VR as a tool for students on the autism spectrum and those with ADHD and encouraged developers to create products for those users.

## Professional development and teacher support

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A significant hurdle for widespread adoption of XR is the lack of professional development and support for educators. Educators on the [panel](#) said that, first and foremost, teachers needed to see how XR might support them in meeting curricular goals. Marie Graham spoke of the work she does to support teachers who are unfamiliar with the technology so they can understand what it can do to meet their instructional needs:

“ *I had a teacher who wanted to use this in her anatomy and physiology classroom. She was very hesitant, so I just let her take a headset home. It's doing pop-ups where people can actually play with things without feeling like people are watching them. It's looking at the curriculum at the beginning of the year and helping them find connections.*

One theme that emerged in the educator panel was the need to support learners—both teachers and students—in holding a growth mindset as they explore XR. Kwaku Aning reflected on the shift in expertise that comes as teachers and students learn alongside each other: oftentimes students master the technology more quickly, and the role of the teachers becomes that of supportive guide and resource finder, rather than instructor. Aning reflected on his own shift in understanding of this role. He tells students:

“ *We need to find someone who understands the source code that you weren't able to understand on your own. I will find you your resources, and I will create a scenario for you where all you have to do is be able to explore and use your imagination.*

On the topic of how to encourage educators and administrators to adopt XR, the panelists recommended trying out the technologies with other teachers and sharing successes with administrators to build support. They also highlighted the benefits of assigning XR-based projects for students with diverse strengths. Marie Graham said that administrators and teachers who are less familiar with XR often become excited when they see the ways that the technology engages students with all sorts of skills and interests. She explained:

“ *It's not just [for] the tech kids, but I'm always like, bring me the storytellers, bring the artists, bring the designers....When you try to leverage interest towards administrators, they see all these types of kids coming from all different areas to XR.*

# Pathways to adoption of XR-enhanced learning

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Joseph South, chief learning officer at ISTE and former advisor to the Secretary of Education, joined the Cooney Center's executive director Michael Preston for a [fireside chat](#) to consider a path forward for the use of XR in schools. Drawing from his years of experience in K–12 education policy and research, South said that the adoption of new technologies follows some typical paths, where devices get less expensive over time but motivation to use them may go down as their novelty fades. Technologies need to demonstrate impact in order to sustain longer-term use.

South suggested that manufacturers and schools could “center equity in the adoption process,” for example, by developing early-stage technologies in partnership with lower-resourced schools or classes with students with learning differences in order to ensure their products serve a diverse range of learners from the start. He cited the practice of “designing to the edges,” referencing Todd Rose’s 2017 book, *The End of Average*, as a proactive method for ensuring more inclusive functionalities for all users.

“ *We designed for the average, and the average literally doesn’t exist. There is no average student. But if you design for the edges, and you’re designing for as many use cases as possible...that’s going to open up all kinds of possibilities....Some of the most exciting technologies that we all use every day were originally designed for edge cases.* ”

South suggested that in addition to supporting 21st century skills, such as collaboration, XR environments may encourage students to learn by doing. The virtual environment allows for a hands-on approach to exploring

topics that may be difficult to manipulate otherwise, which can support students in mastering new skills and content through a tool that engages and excites them.

He also pointed out that the successful expansion of immersive technology in the classroom would depend on partnering with educators themselves and understanding their interests, practices, and goals.

“ *I think it’s on us as schools and leaders to listen to the educators and find out what they would like to be able to do with it, what their learning goals are, and then bring the technology to them. The classic mistake we make with every new technology is we drop 100 X’s into your classroom....All we know how to do is to parachute in the technology. But if you’ll start with the pedagogical rules, start by asking teachers what they want to do with it and then do some preparation and then bring it to them.* ”

Echoing other speakers, South urged that diverse educators and students be brought into the development process. He also encouraged thinking big about learning goals and how technology might enable unique learning experiences, such as allowing students to swim with sharks or walk on Mars.

In this concluding discussion, Preston reflected:

“ *The storytelling component that we’ve touched on a few times today brings the idea of getting kids whose stories may not otherwise be heard to have a platform for sharing what it’s like to be them with their classmates and teachers.* ”

The power of this new technology, he said, is in helping give young people a voice, build empathy, and bring forth greater equity in education.

## Key takeaways

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- + XR shows great promise as an educational tool to enable deeper learning and allow students to experience the world beyond the classroom walls. The technology can both enhance disciplinary content learning and build important 21st century skills. Additionally, XR can be a tool for students to make and create.
- + XR adoption in classrooms asks teachers to take a new and different role with students. Rather than being the “sage on stage,” teachers become partners and co-learners with their students, collaborating to figure out the technology, how it intersects with other tech tools and the curriculum, and how it changes student learning experiences. The adoption of XR necessarily encourages shifts in both pedagogy and assessment. Teachers need support to make this shift, including time to experiment, professional development, and clarity about XR interoperability with other tech tools such as learning management systems.

- + Equity and accessibility should be built into the design from the start. Centering diverse users in the development process to ensure XR technology is accessible to a wide range of learners is critical for XR products in the educational market. Product roadmaps should include accessibility as a core design goal, instead of an extra step taken at the end of the process.
- + Educators prioritize student privacy and safety in technology classroom use. Industry needs to honor and design for that, being transparent about student data and taking educator and district feedback into account.
- + Assessment of immersive learning should capture a range of skills and domains, including 21st century skills. Additionally, XR may enable student insights and understandings that are not captured in traditional exams. Formative assessments can be a useful tool for teachers learning how to adapt their approaches to measuring to student learning.



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XR Association. (2022). [XR Association developers guide: An industry-wide collaboration for better XR. Chapter 4: Designing immersive learning for secondary education](#).

### Resources from the Joan Ganz Cooney Center and the XR Association:

[How K–8 teachers are using virtual and augmented reality in classrooms today](#) (2020).

Researchers at the Joan Ganz Cooney Center provide snapshots of how teachers are using VR and AR in elementary and middle school classrooms.

[Health and safety of VR use by children in an educational use case](#) (2020). A study commissioned by XRA to investigate the health and safety impacts of the use of VR technology on children ages 10–12 in an educational setting.

[XR Association developers guide: An industry-wide collaboration for better XR](#) (2022).

See chapter two on safety, chapter three on accessible design, and chapter four on secondary classroom use (cited above).

### For further reading:

[Accessibility of educational virtual reality](#). Academic article describing an investigation into VR use at home during COVID, with implications for remote learning.

[The art of game design: A book of lenses](#). Book on the design of games, with practical activities that could be adapted to classroom use. The newest edition includes examples of VR- and AR-based games.

[Augmented reality + virtual reality: Privacy & autonomy considerations in emerging, immersive worlds](#). Report from the Future of Privacy Forum provides recommendations for policy and design with regard to XR technology use.

[CIRCL primer: Virtual reality in education](#). Publication from the Center for Integrative Research in Computing and Learning Sciences on VR in learning settings.

## RESOURCES AND READING

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[Don't forget to assess: How teachers check for new and deeper learning when integrating virtual reality in the classroom.](#) Academic article by foundry10 that documents teachers' exploration of assessment with virtual reality use in classrooms.

[An introduction to learning in the metaverse.](#) Online guide to the metaverse for educators, created by Meridian Treehouse.

[Making 360° media: A Conversation about immersive storytelling and media literacy.](#) Interview with William Cavada published by Digital Promise Global.

[Powerful learning.](#) Framework from Digital Promise that outlines four principles of engaging curriculum.

[Survey of educational augmented reality in academia and practice: Effects on cognition, motivation, collaboration, pedagogy and applications.](#) Synthesis of current research on augmented reality written by scholars at the Graduate School of Education at Harvard University.

[Virtual reality 101: What you need to know about kids and VR.](#) Research report from Common Sense with research-backed key findings, parent attitudes, and tips related to kids' use of VR.

[A whole new world: Education meets the metaverse.](#) Policy brief from Brookings drawing on research about children's learning to inform design of educational experiences in the metaverse.

### **Resources shared by forum participants:**

[Immersive Learning Research Network.](#) International organization bringing together cross-sector expertise to research and develop applications for immersive learning.

[ISTE Standards for Students.](#) Classroom standards for integration of technology in the classroom, created by the International Society for Technology in Education.

[LIT Lab.](#) YouTube channel with videos from the Learning Innovation and Technology Lab at the Harvard Graduate School of Education.

[Student Privacy Pledge.](#) Industry-created promise to safeguard student privacy in the collection, maintenance, and use of student personal information.

[XR Access Initiative.](#) Community committed to making virtual, augmented, and mixed reality accessible to people with disabilities.

[XR \(Extended Reality\) Community Group.](#) Online community group hosted by EDUCAUSE.

[Unreal Educator Accelerator.](#) Teacher professional development courses for incorporating interactive 3D in the classroom, created by Epic Games.

[UKjapanVR.](#) Blog of a UK-Japan network focused on location-based VR for children.

## Short biographies and affiliations of speakers

**Kwaku Aning**, director of the Center of Innovation and Entrepreneurial Thinking at San Diego Jewish Academy.

**Gabo Arora**, executive, LIGHTSHED.IO; founding director of Immersive Storytelling and Emerging Technologies (ISET) at Johns Hopkins University; former creative director of the UN.

**Samantha Bindman**, director of research for foundry10.

**Idris Brewster**, founder and chief executive officer of Movers and Shakers.

**William Cavada**, media teacher at Mt. Pleasant High School in San Jose, CA.

**Peirce Clark**, program development manager at XR Association.

**Reginé Gilbert**, user experience designer, educator, and author of *Inclusive Design for a Digital World: Designing with Accessibility in Mind*.

**Marie Graham**, VR/AR lab director and high school teacher, The Mount Vernon School in Atlanta, GA.

**Steve Isaacs**, education program manager at Epic Games.

**David Kleeman**, strategist, analyst, author, and speaker; senior vice president of global trends for Dubit.

**Stephanie Montgomery**, vice president of research and best practices at XRA.

**Susanna Pollack**, president of Games for Change (G4C).

**Michael Preston**, executive director of the Joan Ganz Cooney Center.

**Joseph South**, chief learning officer at ISTE and former director of the Office of Educational Technology at the U.S. Department of Education.

**Mark Suter**, computer science, game design, and entrepreneurship teacher at Elida High School in Elida, OH.

**Medha Tare**, senior director of research at the Joan Ganz Cooney Center.

**Julia Woodward**, assistant professor at the University of South Florida and director of the Engaging Computing Design (EnCoDe) Research Lab.





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