



How Immersive Learning Technologies Affect Student Achievement

A Research Synopsis

Our goal is simple – we want to equip educators with the resources to excel in their craft and do what they do best - *inspire the next generation.*

BY OPTIMA INDEPENDENT



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This comprehensive guide is a valuable resource for educators seeking to harness the power of immersive learning technologies. It delves into research and real-world examples demonstrating the positive impact of these technologies on student achievement. Additionally, the guide identifies areas for future advancements in educational technology and offers practical steps to implement immersive learning in your educational setting. Whether you're advocating for funding or conducting research, this synopsis provides essential insights.

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HOW IMMERSIVE LEARNING TECHNOLOGIES AFFECT STUDENT ACHIEVEMENT

Immersive learning is an educational approach seeking to fully engage learners in simulated or real-world environments. By creating experiences that are both captivating and informative, immersive learning aims to enhance knowledge retention, critical thinking, and problem-solving abilities. This innovative methodology is made more accessible in educational settings through the advancements in spatial computing technologies.

Spatial computing encompasses a range of technologies that enable the interaction between humans and digital content in three-dimensional space. Unlike traditional computing, which primarily relies on two-dimensional interfaces, like computers, smart phones and TVs, spatial computing leverages advanced technologies to create immersive experiences for users. The most widely recognized spatial computing technologies include:

- **Virtual Reality (VR):** Immerses users in entirely computer-generated environments.
- **Augmented Reality (AR):** Overlays digital information onto the real world.
- **Mixed Reality (MR):** MR blends elements of both VR and AR, creating hybrid experiences.

These technologies provide the foundation for expanding immersive learning opportunities by offering interactive, multisensory, and engaging experiences for students all without leaving the classroom.



By utilizing immersive learning devices, educators can transport students to virtual worlds, augment physical spaces, or create blended experiences. For instance, students can explore historical sites in VR, overlay famous artworks along their classroom walls in AR, or practice medical procedures in simulated environments with MR. These experiences can foster a deeper understanding of complex concepts and inspire creativity, collaboration and innovation.

In essence, immersive learning is a powerful tool, leveraging the potential of spatial computing technologies to create transformative educational experiences. By engaging learners on multiple sensory levels and providing opportunities for active participation, immersive learning can revolutionize the way K-12 students learn and retain information.



APPLICATIONS IN THE CLASSROOM

Though adoption of such innovations is just now being introduced in the K-12 space, higher education institutions have increasingly embraced such technologies as tools for teaching, learning, and research. A testament to this trend is the UK, where a staggering 96% of universities and 79% of colleges have integrated Augmented or Virtual Reality into their operations. An academic review by [UKAuthority](#) in 2019 highlighted the prevalence of these technologies in health and medicine, as well as engineering and technology domains. This widespread adoption signals a growing recognition of the potential of immersive experiences to enhance student engagement, facilitate complex concept understanding, and prepare graduates for the demands of the modern workforce.

Although percentages have not been published, similar trends are seen in the United States. In July of 2024, [Meta](#) announced 15 university partnerships across the United States. At schools like [Arizona State University](#), a students' first biology lab experience is likely to involve immersive learning technologies. The university has ditched traditional intro bio labs—the kinds where students wear a full-length lab coat and learn to use a pipette—in favor of virtual reality experiences. In ASU's initial review of their VR pilot program, they found that students who were enrolled in the VR-version of Intro to Biology had “dramatically higher grades and better engagement” compared to their peers in the conventional class.

Similarly, K-12 schools are striving to introduce immersive learning technologies to their students. A recent study by [GfK](#) reveals some insights into what 1,000 US K-12 educators think about Virtual Reality. According to the survey, a significant majority of teachers (85%) believe VR would have a positive effect on their students and 83% believe VR might improve student learning outcomes. The anticipated benefits are impressive:

- ✔ Increased Motivation (84%): VR's immersive nature can make learning inherently more engaging, sparking curiosity and a desire to explore new topics.
- ✔ Enhanced Understanding (77%): VR experiences can bring complex concepts to life, allowing students to visualize and interact with the material in a way that traditional methods cannot.
- ✔ Greater Collaboration (71%): VR can create shared virtual environments where students can work together, fostering teamwork and communication skills.

Why are education institutions around the world jumping in line to purchase and utilize immersive learning technologies? Because they offer unparalleled experiences for students that solve educators' main problems: Student engagement, test scores, growing enrollment numbers, personalization with growing class sizes, equality gaps, and more.

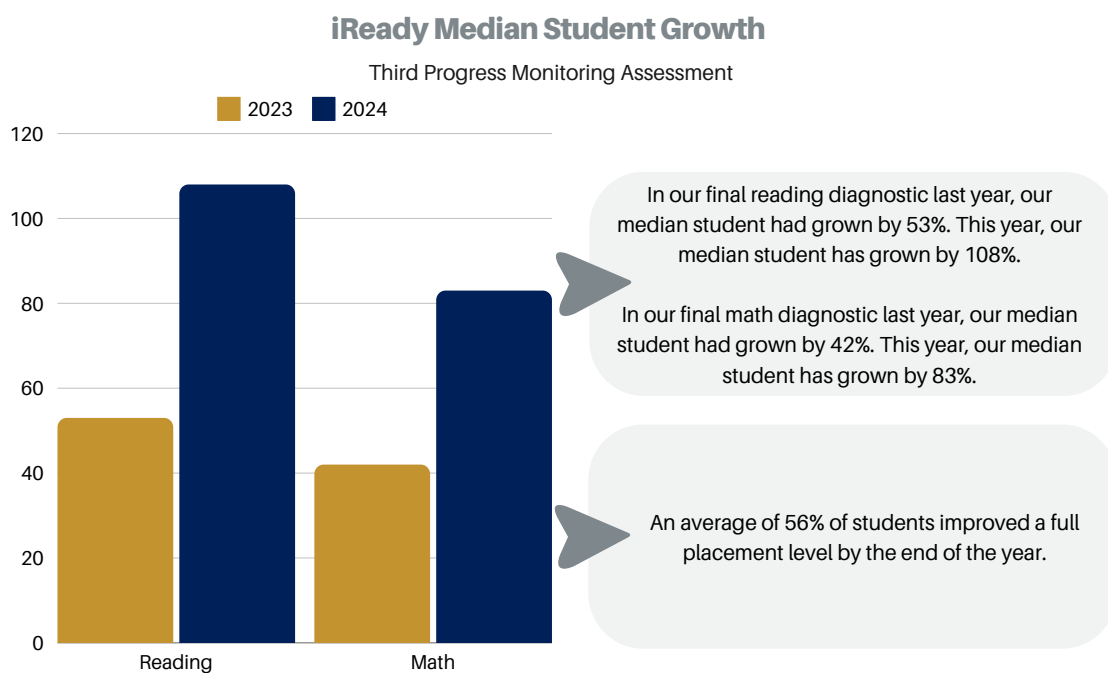
STUDENT ENGAGEMENT & TEST SCORES

The COVID-19 pandemic inflicted a significant blow to education, with standardized test scores serving as stark indicators of widespread learning loss. Disrupted routines, unequal access to technology, and heightened stress levels collectively contributed to a decline in academic performance. These challenges disproportionately impacted marginalized students and exacerbating existing educational inequities. As a result, educational systems worldwide are grappling with the urgent task of addressing these learning gaps and implementing effective recovery strategies.

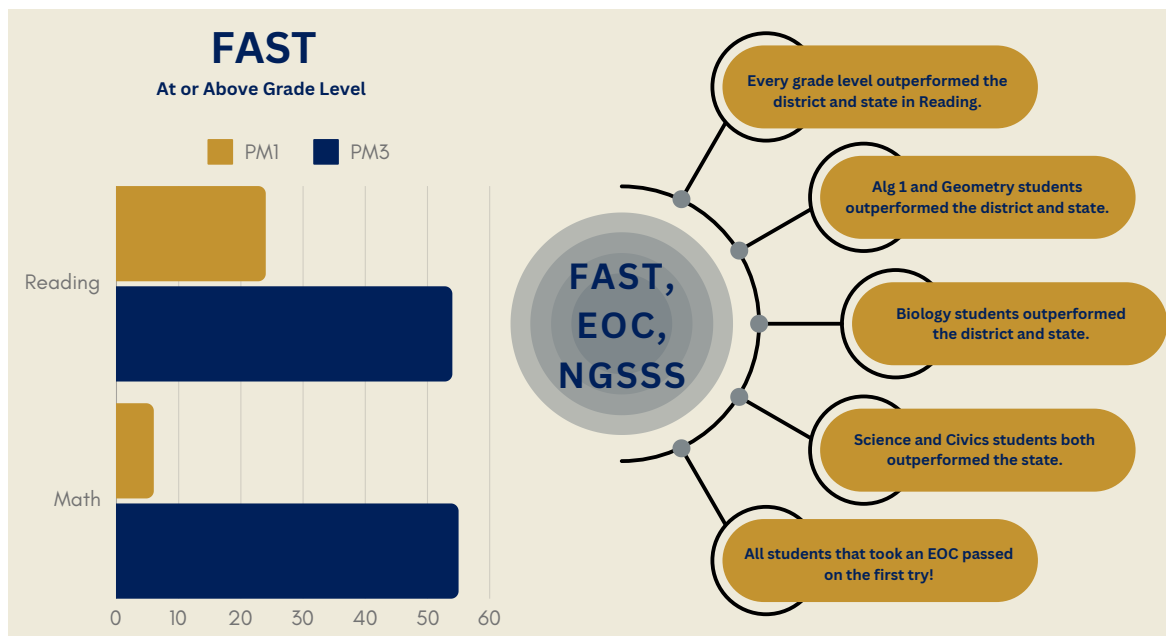
One innovative online school in Florida, [Optima Academy Online \(OAO\)](#), turned to Virtual Reality to address learning gaps. The school team recognized some of students' main pain points during COVID-19 were low engagement with online coursework, lack of interaction with peers and instructors, and limited to no access to one-on-one academic support. After just two years in operation, OAO saw significant learning gains with their innovative approach to online education.



At the end of the 2023-2024 school year, OAO's average student had grown 108% in reading and 83% in math. Additionally, 56% of enrolled students improved by a full grade level according to scores from [i-Ready](#), a national standardized test.



Compared to district and state levels in Florida, OAO students outperformed the district and state students in Reading at every grade level and outperformed the district and state students in Algebra 1, Geometry, Biology, Science and Civics courses.



Similarly, a study published in [Frontiers in Education](#) explores the idea that Virtual Reality encourages student engagement and deepens students' understandings of complex concepts. This study considers the impact VR has on first-year engineering students, specifically on their understanding of three-dimensional vectors.

The study divided 94 first-year engineering students enrolled in an introductory physics course at a large, private university into two groups. The experimental group learned vectors through a VR simulation and the control group learned vectors with a conventional lecture-based approach. The VR group navigated a virtual environment specifically designed to visualize vector concepts using PC-powered VR equipment with each headset having two controllers.

Results were promising. While students in both groups benefited from active learning strategies, students in the experimental group had greater improvement in visualizing the relationship between vectors, components and angles. This shows Virtual Reality helped students grasp the underlying concepts of vectors, necessary for practical application in their professional careers.

A secondary survey was given to the experimental group showing over 90% of students agreed VR helped them learn and understand three-dimensional vectors, visualize metamathematical problems involving vectors, and understand the location and meaning of angles. Students in this group also agreed time spent in VR was valuable and said they would recommend VR to a peer struggling in this course. Over 80% of students in the experimental group said they would search for courses with VR-support in the future and more than 75% said they would attend VR sessions even if they did not count towards their grade.

GROWING ENROLLMENT NUMBERS

Virtual Reality also presents a groundbreaking opportunity for schools to expand their reach without the constraints of physical infrastructure. By immersing students in interactive, virtual environments, VR-powered online classrooms can dramatically enhance engagement and collaboration. Unlike traditional online platforms, VR allows for face-to-face interactions, fostering a sense of community among students and teachers. Through captivating experiences like exploring the Versailles Palace or solving algebraic equations on the moon, VR transforms learning from passive consumption to active participation, ultimately driving higher student retention rates and increased enrollment.

[NEOM](#), a collection of futuristic-like communities in Northwest Saudi Arabia, found themselves in need of a robust, interactive, and engaging online education solution. NEOM X (Online Education)'s international proposal was highly competitive, but was ultimately answered by [OptimaEd](#), an education experience company based out of



Naples, Florida. OptimaEd will provide its Digital Content Library, containing the largest educational virtual reality (VR) library in the world. OptimaEd will also provide NEOM X with VR headsets, professional development, and an educational hub allowing students to build connections and friendships across cultural and geographic regions. Through this partnership, OptimaEd's VR application will initially support around 100 students through an immersive flagship program. Within the next 10 years, NEOM X plans to expand, possibly enrolling thousands of international-based students.

On a more local scale, the [Bridgeport-Spaulling Community School District](#) in Michigan introduced The Portal to their community just in time for the 2023 back-to-school season. The Portal Powered by Optima Academy Online is the first and only full-time online school option to serve Bridgeport-Spaulling and the surrounding school districts in Michigan. This VR-enhanced online school is tuition free and available for fifth through ninth graders. Through this partnership, the Bridgeport-Spaulling school district has increased capacity for growing enrollment, additional online courses to offer students, and access to dual credit pathways for their students.

PERSONALIZATION WITH GROWING CLASS SIZES

It's important to remember that students are complex individuals with different personality types, learning preferences, aptitudes, and attitudes toward knowledge acquisition. Students have consistent preferred ways of learning. For example, some tend to pick up information best when it is presented verbally, others when it is presented visually and still others prefer reading. These learning styles are good indicators of how successful a student will be in a particular learning environment. With growing class sizes, educators are struggling to cater to diverse learning styles. Immersive technologies can offer a solution, personalizing learning to meet individual needs and paces and ensuring all students receive the support they require to succeed.

At Optima Academy Online, personalized learning through immersive technology is achieved daily. "One of our elementary math teachers drew a giant number line starting on a beach, going through the shoreline and into the ocean, with zero written at the shoreline. As students physically walked the number line and explored positive and negative numbers, every learning range of student walked away with a new degree of knowledge. The teacher remarked this was the first time he had ever taught this lesson where every child walked away with understanding." Kim Abel, Head of School, says.

OA School Counselor, Kortni Spaulding, elaborates on this idea stating that in her experience the most meaningful way Virtual Reality has enhanced their online school platform is how it helps their neurodivergent learners. Ms. Spaulding says that students who struggle with ADHD become so immersed in VR all outside distractions are removed and they have the opportunity for physical movement when needed. Students with anxiety or autism spectrum disorder can connect with their peers in a way they would normally be inhibited from doing in a traditional school setting. They can securely practice social scenarios and role-play social situations with peers, teachers and administrators from the comfort of their own home. These interactions positively affect their ability to connect in-person.

CLOSING EQUALITY GAPS

Immersive learning technologies also hold immense promise for addressing equity gaps in K-12 education. By providing students with simulated, real-world experiences, VR and AR can level the playing field, offering equal access to opportunities that might otherwise be inaccessible. For instance, students in rural areas can virtually visit world-renowned museums, while those with disabilities can climb Mount Kilimanjaro.

A prime example of immersive technology's potential in limiting inequality is the work of the [Skill Immersion Lab](#), which focuses on immersive learning experiences for young people. By providing access to VR simulations across various fields, the Lab aims to inspire and equip students from diverse backgrounds with essential skills for the future. Similarly, [Level Up Philly](#) provides a safe place for Philly youth to hang out with each other, eat free meals, do their homework, receive tutoring, and connect them with other resources they may need. Around 1,000 – 1,200 students visit Level Up weekly during the school year, coming from about 140 different schools. Utilizing a \$650,000 grant from the city's Community Expansion Grant program, Level Up built a STEM lab featuring Virtual Reality headsets to give students career-ready exposure building VR experiences among other skills.



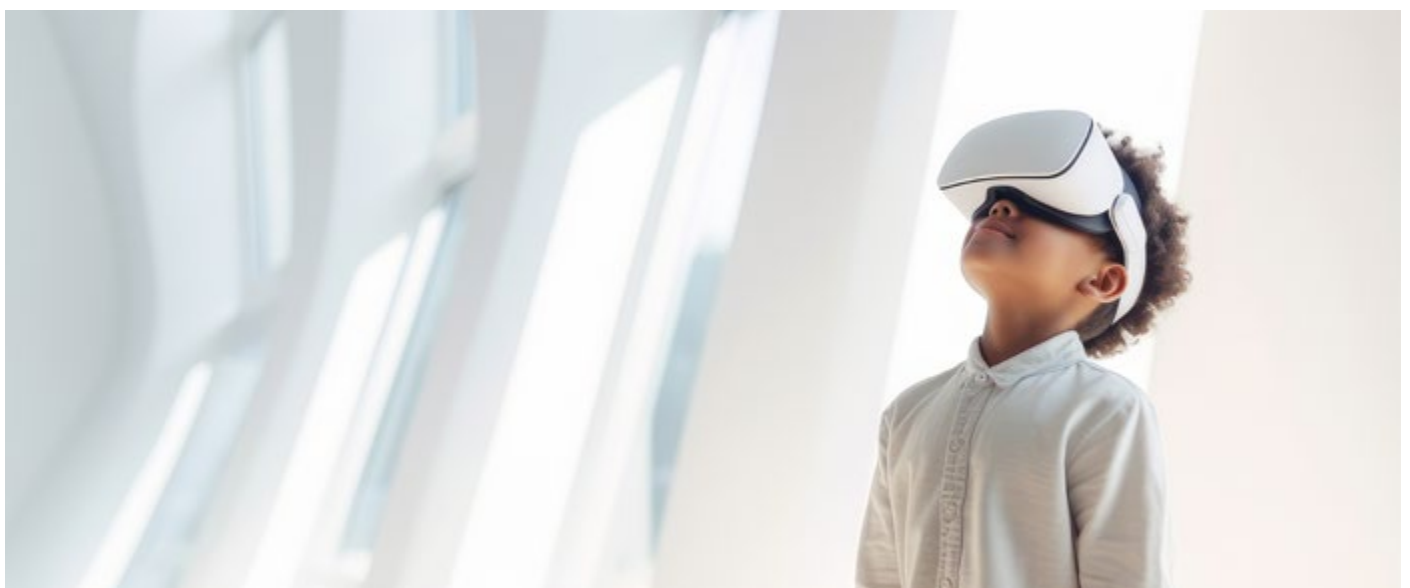
IMMERSIVE LEARNING TO INCREASE STUDENTS' FUTURE EMPLOYABILITY

Career & Technical Education (CTE) leaders in Virginia and North Carolina are tapping into the potential of immersive learning by providing Virtual and Augmented Reality experiences to their students according to [EdTech](#). Immersive learning can give students more access to practical experiences, increasing their ability to get a well-paying job upon graduation. Students at Harnett County Schools, in North Carolina, and Fairfax County Schools, in Virginia, use immersive technologies to gain practical skills as electricians, welders and healthcare providers. Jennifer Alps, an administrator at Fairfax County Public Schools says, "We're submersing students in scenarios that we can't duplicate or recreate in the four walls of the classroom." She says, "these technologies are crucial for bridging the gap between theory and hands-on experiences."

Virtual reality has is also being utilized to increase and refine technical skills in surgical residents. Yale University School of Medicine completed a study with 16 surgical residents randomly assigned to two groups, a control group and VR-trained group. Each subject then performed a laparoscopic cholecystectomy under the supervision of an attending surgeon. Gallbladder dissections were completed on average 29% faster for residents who were VR-trained and non-VR-trained residents were nine times more likely to fail to complete the surgery independently and five times more likely to injure the gallbladder or burn non-target tissue. This study, published in the [National Library of Medicine](#), shows that immersive virtual reality offers students transferable technical skills to help them succeed in the workforce.

Beyond technical skills, 21st century employers are looking for candidates who possess strong soft skills. Employees need to be collaborative, team players, and understand how to resolve workplace conflicts. Dozens of innovative companies like Walmart and Fidelity are tapping into immersive technologies' potential for employee soft skill training. Why? Because virtual reality offers users a sense of presence, meaning the simulating environment feels so real users interact with people and objects as they would in real life. This sense of presence is what is missing in traditional, online soft skills training and allows the training to be more authentic, memorable, and have lasting effects.

Vanderbilt University's English Language Center (ELC) uses VR's ability to enhance soft skill training to support international ESL students in a project named ["Let's Keep Talking: Immersive Small Talk to Support Networking Skills."](#) ELC staff began this pilot program after recognizing that international students can struggle with the complexities of American small talk. One graduate student told an ELC consultant that he "just sits silently," not knowing how to connect with professors and peers, and he was "worried he was missing opportunities for building professional connections." This innovative program will involve VR practice sessions to offer authentic experiences in professional small talk and networking skills.



IMMERSIVE TECHNOLOGY'S ADVANCEMENTS FOR EDUCATIONAL USES

While immersive technologies like VR offer immense potential for education, several challenges must be addressed to ensure the highest degree of comfort and safety for K-12 students.

One key opportunity for growth is physical discomfort. Early VR headsets, such as the Meta Quest 2, can cause headaches, eye strain, and motion sickness due to factors like display quality, weight, and lens clarity. However, newer models, like the Meta Quest 3, are making strides in addressing these issues through improved optics, reduced weight, and enhanced comfort features. Educators using headset devices may consider alternative head straps to reduce strain and provide a better fit for children and teens.

A common misconception with VR is that it is bad for young children's and adolescents' growing eyes. Although there are no long-term studies, ophthalmologists agree there is no reason to be concerned that VR headsets will damage eye development, health or function says the [American Academy for Ophthalmology](#). "Age limitations for VR technology might make sense for content, but as far as we know this technology poses no threat to the eyes," said Stephen Lipsky, MD, a pediatric ophthalmologist who practices in Georgia.

Beyond physical comfort, the virtual realm presents unique growth points for safety and well-being. Cyberbullying and online harassment can manifest in new and harmful ways within immersive environments. Safeguards, such as restrictions and robust reporting mechanisms, are essential to protect student users. Additionally, the collection and use of personal data in VR raises ethical concerns. Transparent data privacy policies, user control over data sharing, and safeguards against misuse are paramount.



While research is ongoing, the relatively recent adoption of VR means there's a limited understanding of its long-term effects. Age restrictions for VR headsets vary by device, but establishing appropriate guidelines based on developmental considerations is crucial. Continued research into the cognitive, emotional, and physiological impacts of VR is essential to inform safe and effective educational practices. While research is ongoing, the relatively recent adoption of VR means there's a limited understanding of its long-term effects. Age restrictions for VR headsets vary by device, but establishing appropriate guidelines based on developmental considerations is crucial. Continued research into the cognitive, emotional, and physiological impacts of VR is essential to inform safe and effective educational practices.

UNDERSTANDING TOP EDUCATIONAL VIRTUAL REALITY SUPPLIERS

The educational VR landscape is rapidly evolving, with new platforms and specialized solutions emerging constantly. This analysis focuses on key players in the general K-12 education market, highlighting their strengths and weaknesses. This analysis is not intended to be a comprehensive list of educational VR suppliers.



GENERAL K-12 VR PLATFORMS

[Optima Independent](#): Stands out as the most configurable platform, offering an extensive content library including 250+ locations, 2,000+ IFXs and over 40 pre-made experiences. All material is Cognia-accredited and aligned with other national standards. Its flexibility allows teachers to tailor VR experiences to specific curriculum needs. However, pricing information and hardware compatibility should be considered.

[Victory XR](#): Offers a competitive entry-point with individual student accounts, making it accessible for schools. However, the depth and breadth of content might be limiting. The platform is also less configurable, not truly allowing teachers to build their own experiences for their students.

[Prisms](#): Provides mostly single-user experiences to strengthen content mastery in math and science. Schools might not use the technology as broadly since it only caters to STEM subjects. Furthermore, the platform does not allow teachers to set up their own VR experiences.

[Kai XR](#): Shows promise with increasing configurability, but currently lags in terms of content options and flexibility. They entered the VR space only offering experiences for cardboard headsets fitted with a smartphone, so the bulk of their content is non-interactive.

[ClassVR](#): A Top EdTech Product Winner in 2022, ClassVR is positioned as an entry-level solution, offering limited interactivity and exploration compared to other platforms mentioned. It might be suitable for specific, guided experiences for younger children but lacks the depth for open-ended learning.

SPECIALIZED VR SOLUTIONS

The VR industry is expanding beyond general education, with specialized platforms addressing specific educational needs such as healthcare, CTE, and developing soft skills.



Healthcare Training: [Oxford Medical Simulation \(OMS\)](#) is a leading example, offering immersive simulations for medical professionals. Its no-code platform and partnerships with renowned institutions, like the Mayo Clinic and John Hopkins University, underscore its potential to revolutionize healthcare education.



Vocational Training: [Ocuweld](#) demonstrates the application of VR in technical fields like welding, providing safe and accessible training environments for high school aged students who may not have access to expensive and, sometimes dangerous, equipment.



Developing Soft Skills: Companies such as [Virtual Speech](#) offer a wide range of self-paced virtual reality scenarios aiming to improve specific soft skills, such as giving a speech. Virtual Speech allows users to upload presentation slides, review their body language after the presentation, and get feedback on pace and delivery.

PARTING NOTE FOR EDUCATORS INVESTING IN IMMERSIVE LEARNING TECHNOLOGIES

Integrating immersive technologies into your classroom is an exciting step toward transforming your students' learning experience. Before diving in, it's essential to lay a solid foundation.

The following list provides a comprehensive overview of key considerations for educators looking to implement immersive learning. By carefully reviewing these points, you can make informed decisions, build a strong support network, and maximize the impact of your immersive learning initiatives.

CAREFULLY RESEARCH AVAILABLE DEVICES AND SOFTWARE TO IDENTIFY SOLUTIONS THAT ALIGN WITH YOUR SCHOOL'S SPECIFIC NEEDS, GOALS, & BUDGET

Consider factors such as compatibility, ease of use, content library, and technical support. Ensure that the chosen technology provider offers comprehensive onboarding training, ongoing support, and resources to facilitate a smooth implementation to maximize the benefits for educators and students. Prioritize platforms and content that can be adapted across multiple grade levels and subject areas to maximize investment and utilization. Remember not all devices are as immersive as others. Consider the devices Degrees of Freedom (DOF), giving you insight into how interactive the platform will be. Meta Quest 3s have six DOF while less immersive offerings may have three DOF. Also consider how many users the platform supports in one session.

FIND YOUR ON-CAMPUS SUPPORT TEAM

Assemble a dedicated on-campus support team comprising educators, technology specialists, and administrators to champion immersive learning initiatives. Foster a collaborative environment by recruiting supporters from various grade levels and subject areas to contribute to the planning, implementation, and evaluation of immersive learning programs. Conduct a comprehensive long-term cost-benefit analysis to assess the financial implications of investing in immersive learning technologies. Consider both direct costs (hardware, software, training) and indirect benefits (improved student outcomes, increased engagement, reduced operational expenses).

SECURE FINANCIAL RESOURCES

Securing funding for immersive learning initiatives is crucial for their successful implementation. A variety of grant opportunities exist at the local, state, and federal levels.

Where to Find Grants

- **Government Agencies:** Explore websites of federal agencies like the [Department of Education](#), as well as state departments of education for grant announcements.
- **Private Foundations:** Research private foundations with interests in education, technology, or innovation.
- **Corporate Sponsorships:** Reach out to technology companies or businesses aligned with your project goals for potential sponsorships.
- **Online Grant Databases:** Utilize platforms like [GrantWatch](#) or [Foundation Directory Online](#) to search for relevant grants.

Crafting Strong Grant Applications

- **Understand the Grantor:** Carefully read the grant guidelines and align your proposal with the grantor's priorities.
- **Develop a Compelling Narrative:** Clearly articulate the problem your project addresses, the proposed solution, and its expected impact. Include as many primary resources as possible, such as statistics or anecdotes.
- **Showcase Projected Student Outcomes:** Emphasize how your immersive learning initiative will benefit students and improve educational outcomes. Reference research on immersive learning technologies to show projected results.
- **Create a Realistic Budget:** Develop a detailed budget outlining how the funds will be used to support your initiative. Include a timeline.
- **Build a Strong Team:** Highlight the expertise and qualifications of the project team and your desired third-party vendor.
- **Seek Feedback:** Request input from colleagues and mentors to strengthen your application.

By diligently researching funding opportunities and crafting well-prepared grant applications, educators can increase their chances of securing the necessary resources to bring immersive learning technologies to their classrooms.



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