



# Transforming STEM Education

With VR & AR:  
Practical Applications

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# Introduction

**The value of STEM – science, technology, engineering, arts, and maths – in education cannot be underestimated. STEM helps students to develop a wide range of valuable skills that will benefit them in later life, such as problem solving, critical thinking, curiosity, persistence and initiative.**

**STEM is also critical to the economy, which makes it a priority for education policymakers. In the UK, around a third of the total workforce (9.4 million people) are in STEM employment across all industries, and this is predicted to grow by up to 10% by 2030<sup>1</sup>.**

There are many challenges to delivering effective STEM education in schools. Finding teachers qualified to teach the STEM subjects can be difficult, and when teachers are appointed, they are often hampered by a lack of resources and inadequate or outdated facilities.

In a recent survey of 900 UK schools, a third said the current level of investment in STEM facilities was harming learning outcomes. The Association of Science Education said the findings raised questions about “students’ ability to access hands-on learning experiences and high-quality practical science education”<sup>2</sup>.

What’s more, not all students are interested in STEM subjects, making it challenging to maintain engagement in the classroom. Recently, there has been a push to increase interest and participation in the STEM subjects among female students in particular, to address the longstanding issue of women being underrepresented in STEM roles.

As with other areas of the school curriculum, teachers are increasingly employing new and innovative methods of teaching to help engage students in the STEM subjects and improve their understanding of the topics.

The evolution of education technology has helped to bring learning to life in ways not previously possible, and this is particularly notable in STEM. One innovation that has made a significant impact is virtual reality and augmented reality (VR/AR), which, thanks to its immersive and experiential nature, is helping to enhance students’ experience of the STEM subjects.

VR/AR is changing the way STEM is being taught in the classroom, helping teachers to create dynamic learning environments that are inspiring their students’ imaginations and deepening their understanding. This piece will explore the potential of VR/AR as a tool to transform STEM learning and some of the practical applications of the technology.



1. <https://explore-education-statistics.service.gov.uk/find-statistics/supply-of-skills-for-jobs-in-science-and-technology/2023>  
 2. <https://explore-education-statistics.service.gov.uk/find-statistics/supply-of-skills-for-jobs-in-science-and-technology/2023>

# Enhancing engagement and understanding

**Today's students are used to using advanced digital technology on a daily basis. Many of them have smartphones, tablets, laptops and games consoles at home, and some even have their own VR headsets for gaming. If these devices are engaging them in their personal lives, it makes sense to utilise them in their education too.**

One of the key benefits of using VR/AR in an educational setting is its ability to support learning across a diverse range of subject areas with rich, engaging content that enhances students' understanding. This is especially beneficial for the STEM subjects.

For a long time, the STEM subjects were taught from a traditional, teacher-centric perspective, with heavy reliance on textbooks and passive learning. While this has now evolved, with more hands-on, experiential teaching methods being used, it is not always possible for teachers to make abstract STEM concepts tangible and understandable within the limits of the classroom.

This is where VR/AR can be an invaluable resource. Using VR headsets, students can access VR and AR content that can bring some of the more complicated scientific, technological, engineering and mathematical principles to life. For example:

- In biology, students can view plant or animal cells up close in incredible detail, or watch complicated biological processes take place in front of their eyes, such as pregnancy from fertilisation to birth.
- In maths, students can access scenes and scenarios that can help them understand concepts like ratios, fractions and symmetry.
- In engineering, students can explore behind the scenes of NASA's Jet Propulsion Laboratory, or even view the components that make up a VR headset.
- Using AR, students can hold and manipulate various objects from science and engineering, from a human heart to a car engine.

Evidence shows that these kind of immersive learning experiences, in which the learner takes an active role, can make STEM lessons more engaging and increase knowledge retention.

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***A report by the US-based Information Technology & Innovation Foundation (ITIF), said: "Immersive experiences have been shown to reduce cognitive load and distance, encourage higher engagement, and improve memory recall for complex or abstract topics, such as STEM subjects that often rely on two-dimensional representations of otherwise intangible concepts."***<sup>3</sup>

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One study said using immersive VR in the context of education and training "appears to be particularly advantageous compared to other instructional settings that rely on analogue media such as text or hands-on exercises, as well as traditional forms of instruction"<sup>4</sup>.

3. <https://itif.org/publications/2021/08/30/promise-immersive-learning-augmented-and-virtual-reality-potential/>

4. <https://www.sciencedirect.com/science/article/pii/S2949678024000035>

# Promoting creativity and innovation

Studies show that, in addition to having value in their own right, STEM subjects can contribute to the development of creativity in young people, and the study of STEM is linked with higher levels of divergent thinking<sup>5</sup>.

Thanks to its ability to inspire creativity and innovation among students, VR/AR has the power to bring STEM teaching to life. In a virtual world, students are not constrained by their physical boundaries. There, they can interact with and manipulate their environment, create objects and structures and visualise concepts and ideas.

By crafting their own content, students gain a deeper understanding of the subject they are exploring. They can visualise complex ideas, experiment with their designs, and receive real-time feedback, fostering a growth mindset.

These unique experiences offer a level of interactivity and immersion that can spark students' imaginations and inspire them to further STEM learning opportunities. What's more, they can be shared with classmates, fostering valuable teamwork and communication skills.



## Further reading

*"We are entering into the creator economy right now, so we are enabling our students to become creators."*

Dr Sreejit Chakrabarty, Director of AI at GEMS DAA and the Cluster Edu-Innovation Lead at GEMS Education.

*[Discover how GEMS Dubai American Academy is turning students into creators with ClassVR](#)*

5. <https://pmc.ncbi.nlm.nih.gov/articles/PMC10301799/>

# Case studies and success stories

## Across the world, teachers are bringing STEM subjects to life in classrooms and STEM labs using VR and AR.

In Alabama, USA, Montgomery Public Schools have implemented virtual reality and augmented reality in their elementary school STEM labs with great results. The idea started at Dalraida Elementary School with Principal Bryan Cutter.

"I wanted to find a way to use VR to immerse students in experiences where they can virtually travel to different places and have experiences that enhance the curriculum," says Principal Cutter. "What really got me was seeing how students can (use the AR component to) hold a frog in their hand, and that we can (virtually) take them inside of a heart."

School STEM Facilitator Jennifer Noah was especially impressed with the way the content aligned to state standards and with the level of engagement it provided students.

"One of our third-grade standards is teaching about severe weather," she says. "So, we used VR to virtually take students inside of a tornado. They were actually able to see the inside and the debris that was surrounding them. That engagement is just amazing to watch. Many of our students didn't know much about tsunamis or hurricanes, even though we're semi close to the coast. They might hear about them on the news, but I was able to take them into a tropical storm and it made that learning so much more authentic."

Teachers at Dalraida noted increased engagement, with students excited by the concepts they'd encountered via their VR headsets. The successful results prompted the district to adopt VR across all its elementary schools.

At Colegio Escolapios Soria in Spain, teachers have been enhancing science lessons with VR, increasing student engagement using 3D models, 360-images and videos.

Teacher Rubén Blanco Briongos says: "We mostly use VR in our science and natural science lessons. We've used it with animals, landscapes, cycles of life – so much. You can bring the world into the classroom. For example, using a computer I could show you a picture of a volcano on a flat screen. Or with VR, I can show you a 3D model of a volcano that you can hold in your hands, or a 360 image that completely immerses you. It's just so engaging. VR makes teaching much easier."

Simon Pile, a primary school teacher in the UK, used VR in his classroom to create opportunities for independent exploration and creative mathematical thinking.

"Geometry, estimation, prediction and logical reasoning are all key areas of mathematics and we wanted to stretch our pupils' reasoning through contextualised, VR learning," he explains.

"As an immersive mathematical experience, it is very powerful and also means that you are encouraging students to think about the world around them in different, creative and explorative ways. In doing so, we found that having these opportunities then fed into students applying their mathematical understanding within their social times and across a wide variety of subject areas. The impact of this meant that the children were constantly re-applying and re-visiting their mathematical skill base, because of having had the opportunity to apply their knowledge and understanding in such a fun and unique context."<sup>6</sup>



6. <https://www.classvr.com/case-studies/>

# Practical tips for VR implementation

**With the range of benefits of using VR/AR in STEM learning so apparent, it's no wonder more and more schools and teachers across the world are looking to adopt the technology in their classrooms and STEM labs. For those who are considering a VR/AR solution, here are some considerations and tips for successful VR/AR implementation.**

- First, it's important to have a rationale for using VR/AR. What are you looking to achieve? How will you incorporate the technology into your STEM curriculum? Don't think of VR/AR as an add-on to what you are already doing, or another piece of kit to add to the rest. Instead, VR/AR should be seen as an essential element of your STEM offer. Try to align the VR/AR resources and activities with your STEM learning objectives and include it as an integral part of your STEM lesson plans. Consider how you will assess the learning outcomes – what will successful implementation look like?
- Choosing the right VR/AR tools is vital. There are different solutions on the market, but they are not all equal. You will want to invest in a platform and devices that are specifically tailored for educational use and offer a wide range of resources. Budget will always be a consideration, but it is also important to consider how user-friendly and accessible the platform and devices are, and whether the available resources align with your curriculum or syllabus. Will the content be continually updated?
- Is there training and support to use the VR/AR software and hardware? Some companies might just sell you the technology and leave you to your own devices (literally). Teachers will need initial training and then ongoing support to get the most out of the technology and to successfully integrate it into their STEM learning plans.
- Are there professional development programs or online resources you can access? Can you collaborate with peers to learn from and inspire each other? These are all considerations that will need to be taken into account.



# STEAM ahead with VR/AR

**VR/AR can play an important role in enhancing STEM learning in schools. It can help educators meet several key objectives for students, such as increasing engagement and understanding of the STEM topics, promoting creativity and innovation, widening participation and developing essential skills.**

This is backed up by academic research as well as the experience of educators around the world, who have seen firsthand the difference VR/AR can make in their STEM lessons.

If you would like to share your experiences of using VR/AR in your STEM lessons, or if you would like to collaborate on innovative approaches to STEM education using VR/AR, get in touch: [sales@classvr.com](mailto:sales@classvr.com).



# Want to see ClassVR in action?

*Book a free, no-obligation, demo.*

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