

Empowering Educators with XR for Immersive Learning: Vol3DEdu project's insights

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Background Information

Digital skills

Digital skills are becoming increasingly essential for gaining getting access to a range of products and services within the educational sector. According to the Education and Training Monitor (European Commission, 2020), teachers need to be equipped with the necessary skills to take advantage of the potential of digital technologies for the purpose of improving the teaching and learning process and prepare their pupils for life in a digital society.

Digital technology

Making better use of digital technology for teaching and learning is essential to reap the benefits of technological innovation and improve education. Pedagogical use of digital technologies depends on the availability, accessibility and quality of ICT resources. At the same time, empirical evidence suggests that improvements in infrastructure alone do not systematically lead to the integration and pedagogical use of digital technology in schools across Europe. If digital technology is to benefit pupils and educators, the right environment and support is needed (European Commission, 2020).

The need

Equipping educators with digital skills and enhancing the quality of remote learning are key priorities of the EU's Digital Education Action Plan (2021-2027). Undoubtedly there is an urgent need to coordinate global efforts for digital skills education and training (Jackman et. al 2021) as the concept of digital literacy is increasingly prevalent in the educational sector (Peddy et. al 2023).

The Vol3DEdu project

The Vol3DEdu project addresses the evolving landscape of distance learning by integrating Extended Reality (XR) technologies and Volumetric 3D assets into lesson plans and storytelling techniques.

The Vol3DEdu project is a transnational partnership between University College Dublin (UCD), Volograms Limited, University of Aegean (UAegean) and CARDET organisation. It is co-funded by the Erasmus+ Programme of the European Union (Vol3DEdu, 2022).

Vol3DEdu aims to complement the purposeful use of eXtended Reality (XR) digital technologies in education for teaching, learning, assessment and engagement. This includes the development of Volumetric 3D educational teaching content, advanced digital pedagogy and expertise in the use of digital tools for teachers, including accessible and assistive technologies and the creation and innovative use of 3D digital education content in current practices. Equally, it includes developing the XR digital skills and competences for teachers in EU and beyond.

Technology: Volumetric Video

What it is?

Volumetric video is a media format that allows reconstruction of dynamic 3D objects from real life and their visualisation in immersive applications such as augmented reality and virtual reality.

Volumetric video (VV) is an emergent digital media that enables novel forms of interaction and immersion within eXtended Reality (XR) applications. VV supports 3D representation of real-world scenes and objects to be visualised from any viewpoint or viewing direction; an interaction paradigm that is commonly seen in computer games. This allows for instance to bring real people into XR. Based on this innovative media format, it is possible to design new forms of immersive and interactive experiences that can be visualised via head-mounted displays (HMDs) in virtual reality (VR) or augmented reality (AR) (Pahr, D. et al, 2021).

Technology: Volumetric Video

The importance of the tool

VV as an emergent format of 3D digital media receives increasing attention among researchers, creatives, and audiences. These can use multiview input and create impressive results, while the computational complexity is still very high. Bridging the gap to the animation world, i.e., making VV editable and animatable is an area of further research. Also, the content delivery pipeline is an area of research opportunities, e.g., regarding coding, streaming, related standards, as well as quality assessment and related metrics. While prototypes have been demonstrated, real-time processing for applications like holographic telecommunication is still in early stages of development (Smolic, A. et al, 2022).

The potential of using the Volumetric Video in education is introduced in the study of Hackett et al, 2021, where the concept of implementing it as a method in military training and medical education is very impressive. VV gives the opportunity to learn in an environment that provides realistic and immersive educational simulations, improves the quality of evidence and the pedagogical strategies (Hackett et al, 2021). For its role in education, the Volumetric Video is being a reference from Young et al (2023), where it is presented as a tool that can create virtual field trips, historical re-enactments, and lessons where students can engage interactively with the teaching content on a personal level. This is a technological tool that provides the opportunity for the user to engage more, explore different perspectives and environments and adjust their way of learning and preferences to the process.

Technology: Volumetric Video in education

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Teacher training in lesson planning with 3D- based tools

Kompaniets et al (2019) provide a concrete example of how 3D modelling and augmented reality can be integrated into the teaching process, especially when lesson planning for computer science education is involved.

This paper gives insights about the development and ways of application of AR-based tools that can be of high value for teacher training programs that use 3D tools for higher educational effectiveness. By analysing the 3D simulation application in the classroom, we can acknowledge the effectiveness of it in teaching anything, from algorithms in computer science to literacy or mathematics.

Vol3DEdu Project

The Vol3DEdu project is a collaborative effort under the Erasmus+ KA220-HED initiative that aims to change the educational setting with the integration of innovative Volumetric Extended Reality (XR) tools and technologies and structured teacher training based on this innovation. Particular attention was given to the free accessibility and use of toolkits from teachers by underrepresented regions to contribute to the “Opening up Education” initiative. Furthermore, the project supports multilingualism within the educational content production, which is a forefront aspiration for diversity and inclusion.

Objective
Address the digital transformation of teachers through eXtended Reality (XR) content development.
Support teachers in Europe and beyond to enhance their education in terms of XR applications in education, and apply innovative XR based curricula in their pedagogical strategies.
Support the diversity of students’ learning styles through stimulating innovative learning and teaching practices.

The project's packages

Vol3DEdu is a project consisting of four different work packages (WPs) and each has its own role in the process to achieve all objectives mentioned above. In this paper, we will be presenting the results of one of the workshops conducted through WP4, where the Volumetric 3D assets in education and dissemination are being discussed and evaluated by teachers from all distinct levels of the educational system (Primary, Secondary and High Education).

	Objective
	WP1: Project Management
	WP2: Ethics Requirements & Volu App Training
	WP3: Pedagogical lesson plans with implemented Volumetric 3D assets
	WP4: Evaluation of Volumetric 3D assets in Education and dissemination

Methodology

The methodology of the project lies in the digital transformation of education through the integration of XR (Extended Reality) technologies, specifically focusing on volumetric 3D Content. The methodology approach is structured based on workshops, which are, in total, four.

The first workshop considers ethics and compliance matters of the project, giving results on how teachers can be trained being provided a mobile application that is user-friendly and always based on workshops already conducted for the educators, in order to create the right tools, as the second one focused on developing a comprehensive understanding of critical aspects related to OER (Open Educational Resources).

The third workshop is the educational content set for the use of the XR content and is dedicated to developing and integrating it for educational purposes. It is very enlightening to have pedagogical lesson plans with implemented volumetric 3D assets.

Finally, the fourth workshop of the project is a task unit structured to evaluate the volumetric 3D assets in education and their integration into lesson plans.

The objectives of this package focus on creating and formatting the teacher training materials, the teachers' digital skills development, policy influence, and ways to disseminate and exploit with strategic movement, in order to ensure educational practices. The workshop presented in this paper, was conducted on September 1-2, 2023, and was focusing on effective lesson planning and storytelling in XR (Extended Reality). The outcomes were measured with the use of a questionnaire.

Participants

The project's target group for the fourth workshop conducted included teachers across Europe, particularly Malta, Greece, and Cyprus, focusing on the adoption of innovative XR-based teaching strategies, so that it completes one of the objectives, which is to evaluate teachers' digital skills before and after the intervention, so that improvement can be measured.

The project had approximately 100 teachers as participants overall.

Results

Participants' active participation was one the basic highlights of the workshops, providing high levels of active participation, discussion, practical and collaborative exercises engagement, as well as a high level of interest in learning and applying new strategies based on XR contexts.

The engagement of the teachers with other aspects of the workshop, such as the activities involved (lesson planning with XR technologies integration, group work, ideas and experiences sharing) has shown their high interest. Participants provided constructive feedback on the workshop content and methods of delivery, and there was a significant interactive relationship between participants and workshop facilitators, where many questions and discussions that considered practical applications of the concepts taught took place.

Results

94% of participants correctly identified what a lesson plan is

50% of the participants listed some components, like lesson aim, objectives, technological tools, activities and exercises

88% of the participants understood what SMART acronym is meaning (Specific, Measurable, Achievable, Relevant, Time-bound) and its applicability in lesson planning

32.5% of participants correctly identified the importance of determining prior knowledge and aligning it with the learning objectives.

92.8% acknowledged the need for varied teaching strategies for different learning styles, in the formative assessment based questions

81.8% recognised the importance of formative assessment in following student progress

92.8% acknowledged the need for varied and diverse teaching strategies

72.3% showed understanding of the importance and necessity of combining immersion and storytelling for XR educational experiences with impact

Discussion

The powerful use of storytelling and its integration in XR-based technologies and lessons is reflecting on the participants' will to innovate in their teaching class. What is important and critical is that there is motivation and a positive attitude for continuous professional development and learning.

The fourth workshop successfully addressed the participants' skills in lesson planning and storytelling, especially in the context of XR-based educational tools and methods. Future training can respond to gaps that can be perceivable in the initial phase of lesson planning and can later support the differentiated approach for the teaching strategies.

The continuity of professional development and collaboration are very important and critical for the sustainability in the educational progress and the ensurement of educational practices' effectiveness and innovative character.

Conclusion

It is highly important to acknowledge that we have the grounds to promote innovative and structured learning progress. This project addresses the support of XR and VV digital education at teacher level, such as curricula and learning outcomes to facilitate teachers competence and use of the tools.

Conclusion

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