The Need of Immersive Technology in Digital Higher Education Ecosystem

Нуждата от потапящи технологии в цифровата екосистема на висшето образование

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Абстракт

През последните десетилетия ежегодно се появяват нови цифрови технологии, които се интегрират в сферата на образованието и обучението. Настоящата система за висше образование е предназначена да произвежда компетентни студенти и за постигането на тази цел в образователните институции се въвеждат нови цифрови технологии. В настоящата статия е направен теоретичен преглед на съвременните тенденции в изследванията на потапящите технологии и тяхното приложение в сектора на висшето образование. Изследването и анализът разглеждат появата и развитието на концепцията за потапящо образование в контекста на цифровата екосистема на висшето образование.

Abstract

In recent decades, new digital technologies have emerged annually and have been integrated into the education and training industry. The current higher education system is designed to produce competent students, and emerging digital technologies are being introduced in educational institutions to achieve this goal. This paper provides a theoretical overview of current trends in immersive technology research and its application in the higher education sector. The research and analysis examine the emergence and development of the concept of immersive education in the context of the digital ecosystem of higher education.

Ключови думи: european digital ecosystem, digital higher education, immersive technology, immersive reality, immersive education trends.

JEL: A22, I25, O31

1. Introduction

The deployment of information and communication technologies (ICTs) has come to characterize the contemporary period as a highly dynamic, collaborative, and transformative era — though their diffusion remains uneven. The advent of digital tools has brought about significant changes in the field of education, particularly in the methods of teaching and the cultivation of students' abilities and competencies. This signifies that the processes of digitalization and connectivity are precipitating transformations in society, and thus in education. In order to meet the challenges of this new era, it is necessary to construct novel learning scenarios that facilitate multiple access to information, new applications and equipment, the expansion of

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quality content for digital media, and the expansion of learning opportunities through the application of realistic and interactive environments. The research question of this study is as follows: *What is the need of the digital higher education ecosystem for immersive technologies for education and learning*?

In recent years, technology has become increasingly integrated into educational settings, thereby transforming the manner in which students learn and teachers instruct. It is a challenging endeavor to define the necessity of immersive technology. In the present era, the prevailing trends and insights pertain to the utilisation of educational technology and its ramifications for students and educators. From interactive learning platforms to virtual classrooms, the impact of educational technology is far-reaching and profound. The purpose of this study is to provide an overview of current educational immersive technology trends with a focus on the digital ecosystem of higher education. To this end, it is essential to identify guidelines that will facilitate the development of a digital ecosystem for higher education based on immersive technologies at a later stage.

2. Understanding of European Digital Education Ecosystem

The advent of digital technologies has ushered in a new era of educational, employment, and research opportunities, as well as novel methods for achieving goals. These technologies have also facilitated the transcendence of physical communities, geographical locations, and social positions. The ongoing digitalization of society, coupled with the rapid advancement of technology, has prompted European countries to conduct ongoing reviews of their strategic policies.

The European Union's consistent policy on the digital transformation of European countries is outlined in relevant international declarations, strategies, and other documents. The aforementioned European Union documents, including the Europe 2020 strategy, the Digital Agenda for Europe, the Action Plan on Digital Learning, and others [1] – [3], are designed with the objective of influencing the development of Europe's digital economy. In the context of the ongoing pandemic, the significance of digital literacy has become particularly evident. The pervasiveness of digital technologies in all aspects of modern life, including the economy, education, communication, and daily activities, has underscored the pivotal role they play in our society. It has become increasingly apparent that the success of any endeavor hinges on the level of digital literacy of the individuals involved.

In March 2021, the European Commission adopted the document *The 2030 Digital Compass: the European way for the Digital Decade*, which defines the goals and strategies for the successful digital transformation of the European Union by 2030. This transformation is expected to positively impact the sustainable development of European economies. The Action Plan *Path to the Digital Decade* establishes ambitious objectives, including the goal of ensuring that 80% of the population aged 16-74 will possess digital skills by 2030. The primary avenues for digitalization are oriented towards: the acquisition of digital expertise by the general public, the provision of highly skilled professionals in digital technologies; the establishment of secure and sustainable digital infrastructures; the transformation of business operations through digital technologies; and the digitization of public services [4].

In light of the accelerated pace of technological advancement, the necessity for ongoing training in the mastery of cutting-edge technologies is paramount. The rapid evolution of digital literacy, information and communication technology (ICT) skills, and abilities underscores the importance of continuous training in the latest innovative technologies. The pursuit and integration of novel pedagogical approaches and digital technologies for the instruction of diverse subject matter has emerged as a pivotal objective for educators at various levels of the educational system. The abrupt transition of educational institutions to distance and flexible online learning has brought to light the primary impediments to a quality educational process and successful learning by students. Since the inception of the quarantine measures, scientists and educators

globally have encountered significant challenges that impede the establishment of an effective online learning process. These challenges encompass a range of factors, including the lack or slow speed of internet connectivity, the inadequacy of the hardware and software resources available to both teachers and students to meet the demands of distance learning, and the insufficient level of information and communication competence among educators.

In recent times, there has been a notable proliferation of innovative educational technologies, including those that offer an immersive experience, within the field of education. As indicated in the 2*019 Augmented and Virtual Reality Survey Report*, the education sector is the primary investor in the advancement of the VR and AR industry, particularly in light of the anticipated integration of immersive technologies across all levels of education and the subsequent training of future citizens. Experts anticipate that by 2025, virtual, augmented, and mixed reality will have reached a level of ubiquity comparable to that of mobile devices [5].

One of the primary domains of digital transformation in European countries is the digitization of educational systems and the integration of novel educational technologies into the educational process. These endeavors are bolstered by governmental support and disseminated through information portals. In the United Kingdom, for instance, the UKAuthority portal [6] serves as a repository for research, exemplary practices, and innovations in the deployment of technologies for the provision of contemporary public services that align with the needs of the public sector and the citizens it serves.

UKAuthority engages in a collaborative endeavour with JISC (Joint Information Systems Committee), a non-profit entity within the United Kingdom that facilitates the provision of network and IT services, as well as digital resources, to support the operations of higher education institutions and research initiatives pertaining to emerging technologies [6, 7]. As evidenced by the JISC survey, the majority of higher education and postgraduate institutions in the country (101 respondents) have expressed interest in the use of augmented and virtual reality. Of these institutions, 82% (mostly representatives of higher education institutions) have indicated interest in the use of immersive technologies, with 49% describing their level of interest as v*ery high*. These institutions have cited the potential for immersive technologies to enhance the educational process by providing more opportunities to acquire knowledge on a topic than the traditional method. Consequently, 96% of universities and 79% of colleges are currently employing AR and VR for research purposes to a significant extent. In the majority of cases (58% of universities and 43% of colleges), these technologies are utilized in a single department or faculty. Some educational institutions employ blended learning models in multiple departments (9% of universities and 21% of colleges). The survey also identified the primary obstacles to the pervasive integration of VR and AR in education, namely the high costs, lack of dedicated support and expertise, and the requisite knowledge of educators. Additionally, the survey revealed that a greater number of organizations are exploring the use of virtual reality (VR) than augmented reality (AR), with applications in healthcare and medicine, as well as engineering and technology [6].

In light of the considerable prevalence and integration of immersive technologies in contemporary educational settings, which foster a proclivity for digital citizenship among the current generation of students, international organizations are actively engaged in the implementation and promotion of pertinent educational initiatives. The Erasmus+ programme, with the support of the European Union, is implementing the ImTech4Ed (Immersive Technologies for Education) educational project, which involves researchers, teachers and students from universities in Germany, Greece and Cyprus. The primary objective of the project is to facilitate interdisciplinary international collaboration for the advancement of immersive technologies and their subsequent integration into the educational process at various levels of education [8].

As part of this project, the Charming Network (European Training Network for Chemical Engineering Immersive Learning) was established with the objective of developing a theoretical framework, concrete

models, and methodological recommendations for the implementation of immersive learning in science and technology. Additionally, the Network aims to facilitate the application of these approaches in academic settings, including schools and higher education institutions, as well as in industry, particularly in the field of chemistry and chemical engineering [9].

The advancement and integration of immersive technologies into the educational sphere is contingent upon the collaborative endeavours of educators, scientists, IT professionals, and industry representatives. These individuals have collectively developed virtual reality and videoconferencing platforms, including Edify (https://www.edify.ac/) and XR ACADEMIA (https://www.xracademia.com/). The current focus of scientific conferences and research results is on trends related to augmented reality, virtual reality, mixed reality, data visualization, and artificial intelligence [10], and their potential impact on education, innovative companies, and the research environment.

It is crucial to examine and evaluate foreign experiences in this field in order to facilitate the advancement and integration of immersive educational technologies in Bulgarian higher education.

3. Current Immersive Education Trends

Immersive education provides learners with opportunities to engage with both physical and virtual environments in ways that enhance their perception and interaction with these environments.

Personalized Learning Experiences

In the contemporary educational context, the primary benefit of educational technology is its capacity to facilitate personalized learning. Adaptive learning platforms that employ data analytics and artificial intelligence are designed to tailor learning to the specific needs, preferences, and learning styles of individual students [11]. By providing learners with bespoke learning pathways and targeted feedback, these platforms facilitate independent learning and enable students to optimise their academic potential.

Enhancing Student Engagement

The use of interactive digital learning tools and games has been demonstrated to enhance students' engagement with the learning process, encouraging active participation. Virtual simulations, AR and VR experiences facilitate immersive learning, enabling the realisation of abstract concepts and fostering deeper understanding. The integration of technology in the creation of engaging and interactive learning environments has been shown to boost student motivation, participation, and retention of course material [12].

Access to High-Quality Educational Resources

The advent of the internet has transformed the landscape of educational resources, facilitating unprecedented access to a vast array of information and materials for students and educators across the globe. Open educational resources (OER), including digital textbooks, videos, and online courses, offer cost-effective alternatives to traditional learning materials while promoting equitable access to education. Moreover, online databases and digital libraries provide students and educators with access to a wealth of scholarly research and educational content, enhancing the learning experience and expanding opportunities for academic exploration [13].

Facilitating Collaborative Learning

The advent of digital technologies has opened up new avenues for enhanced collaboration and expedited communication between educators and learners. These technologies, by virtue of their ability to transcend spatial limitations, have the potential to cultivate a global learning community. Online collaborative tools,

including video conferencing, discussion forums, and shared document platforms, facilitate peer-to-peer collaboration, group projects, and virtual teamwork. The promotion of collaboration and knowledge sharing through technology enhances social learning experiences and prepares students for success in a digital, interconnected world. The empowerment of educators through data-driven insights Learning management systems (LMS) and educational analytics tools provide educators with valuable data insights into student progress, engagement, and performance [14]. By analyzing learning analytics and assessment data, educators can identify areas for improvement, track student achievement, and tailor instruction to address individual learning needs. The implementation of evidence-based teaching strategies, optimization of curriculum design, and improvement of learning outcomes for all students can be achieved through data-driven decision-making.

Addressing Equity and Inclusion

The potential of technology to bridge the digital divide and promote inclusivity in education is significant. Flexible learning opportunities for diverse learners can be provided by mobile learning technologies, remote learning platforms, and online educational resources. These offer flexibility and accessibility for students with disabilities, those from disadvantaged backgrounds, and those in remote or underserved communities [15]. Ensuring equitable access to technology and digital resources allows educators to create more inclusive learning environments and empower all students to succeed academically.

Cultivating Digital Literacy and 21st-Century Skills

The integration of technology in education has been demonstrated to enhance subject-specific knowledge while simultaneously cultivating essential digital literacy and 21st-century skills. As students interact with various digital tools and platforms, they develop critical thinking, problem-solving, and information literacy skills that are necessary for success in today's digital age. Furthermore, collaboration on digital platforms fosters communication, teamwork, and adaptability, which are increasingly valued in the workplace [16]. By incorporating technology into the learning process, educators empower students to become proficient digital citizens who are equipped to navigate.

Fostering Lifelong Learning and Growth

The application of technology in the field of education has the potential to extend beyond the traditional classroom setting, thereby creating opportunities for lifelong learning and professional development. Online courses, webinars, and virtual workshops provide educators and professionals with access to cutting-edge research, best practices, and skill-building opportunities [14]. Through self-paced online learning platforms and virtual communities of practice, educators can continuously expand their knowledge, enhance their skills and practices in education. By fostering a culture of lifelong learning and professional growth, technology transforms education into a dynamic and collaborative journey of ongoing discovery and development.

Leveraging Artificial Intelligence for Personalized Instruction

Artificial intelligence (AI) has the potential to transform the landscape of personalized instruction and student support. AI-powered tutoring systems and intelligent educational assistants analyze student data and learning patterns to deliver targeted interventions, adaptive feedback, and personalized learning pathways [18]. By employing natural language processing and machine learning algorithms, these AI systems can engage students in meaningful interactions, diagnose learning gaps, and provide tailored support in real time. By harnessing the power of AI for personalized instruction, educators can optimize learning outcomes, increase student engagement, and unlock the full potential of every learner.

Promoting Global Citizenship and Cultural Understanding

The use of technology in education facilitates cross-cultural exchange and global collaboration, which in turn promote greater cultural understanding and appreciation among students. Virtual exchange programs, international partnerships, and online collaborative projects facilitate connections between students from disparate countries and cultures, thereby fostering intercultural dialogue, empathy, and global citizenship. Through virtual cultural exchanges, students gain firsthand insights into diverse perspectives, traditions, and worldviews, which prepare them to flourish in an interconnected and culturally diverse society [19]. By leveraging technology to promote global awareness and cross-cultural competence, educators cultivate students' capacity to navigate global challenges and contribute constructively to a multicultural world.

4. Conclusion

Scholars are exploring the application of digital technologies in education from overseas [20]. From personalized learning experiences and enhanced student engagement to access to high-quality educational resources and data-driven insights, digital technology has the potential to transform education and create new opportunities for students and educators alike. By embracing emerging technologies, leveraging digital tools, and fostering innovation in education, higher education institutions can ensure that learners are equipped with the requisite skills, knowledge, and competencies to thrive in a rapidly changing world.

Integrating immersive technology into higher education curricula facilitates the delivery of a modern, dynamic and engaging learning ecosystem that meets the digital needs and preferences of today's students. The use of technology in higher education enables institutions to provide personalized instruction tailored to each student's unique learning style and pace. This can be achieved through a variety of digital tools, including interactive online platforms, virtual classrooms, and immersive learning experiences. In addition, immersive technology can be used to increase student engagement and collaboration both inside and outside the classroom. This can be done through the use of multimedia tools, virtual group projects, and online discussion forums that allow students to actively participate in their learning process.

Acknowledge

The authors acknowledge with gratitude funding provided by the Bulgarian National Research Fund under administrative contract KP-06-H65/5 of 12.12.2022.

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