



The Potential of Virtual Reality for Teaching and Learning Purposes

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Abstract

Many spheres of activity are undergoing changes due to the active development of information computer technologies, which contributes to the modification of various fields of knowledge, education and science. The purpose of this study is to explore the potential of virtual reality technologies in learning as an important part of the modern educational process. VR in education is aimed not at replacing the teacher, laboratory and practical classes, but at motivating the student and teaching him in a new way. The research proves that one of the main advantages of using VR in teaching foreign languages is the creation of an authentic language environment. Students can immerse themselves in virtual scenarios where they can interact with native speakers, hear real conversations, and participate in simulated communication situations. It helps students develop communication skills in a foreign language in a realistic environment. VR in education can enhance collaborative learning. Learners can interact with their peers and the virtual environment, making the experience more active. It can additionally offer students a personalized learning experience by allowing them to explore the virtual world at their own pace and in the way. Students can improve their comprehension of the subject matter by using VR technology to deliver personalized feedback. VR has a notable benefit in education as it offers a cost-effective solution. Instead of arranging physical models or field trips, educational institutions can generate a virtual environment that can be accessed by many students simultaneously. The analysis revealed that the use of VR in education has the capability to revolutionize the learning experience for students through immersive and captivating engagement that can enhance their comprehension of the subject. Providing an interactive VR experience has the potential to connect theoretical concepts with practical applications, thereby equipping students with the confidence to face future challenges.

Keywords: digitalization, education, virtual reality, digital technologies, virtual environment

1. Introduction

Many spheres of activity are undergoing changes due to the active development of computer technologies, which contributes to the modification of various fields of knowledge, education and science. In modern conditions, mobility is important for a person, the ability to adapt quickly and constantly improve their knowledge in a particular field. Higher education, like other areas of the social sphere, is undergoing a process of digital transformation. In addition to the pandemic and the forced transition to distance learning, the state is actively pushing universities towards digitalization. The state plays an important role in the introduction of digital technologies into society. The state policy on digitalization of the economy is directly related to the transformation of the education system, including vocational education, as the economy is tasked with providing the necessary workforce with well-developed digital skills. The purpose of this study is to explore the potential of virtual reality technologies in learning as an important part of the modern educational process.

From the point of view of digitalization, the priority direction of educational policy is to improve the quality of education at all levels. The competitive advantage of educational institutions is determined by their willingness to introduce new generation technologies into the educational process. The creation of a digital educational environment in vocational education institutions contributes to improving the quality of student training, effectively solving various tasks of the educational process. Digitalization implies not only the introduction of computers and the Internet into the learning process.

These include virtual and augmented reality technologies that can be successfully used in fields such as surgery, astronomy, chemistry, engineering, physics, anatomy, history, art, foreign languages. Innovative technologies of augmented (AR) and virtual (VR) reality open up new horizons for the educational sphere. AR and VR solutions for education help schools, colleges and universities rethink their approaches to learning and make the learning process more interactive, practical and exciting.



AR and VR can revolutionize educational practice by making complex concepts more understandable and accessible to students of all ages. Due to virtual reality, students can interact with three-dimensional models, study and recreate historical events and scenarios, as well as make virtual trips to anywhere in the world or even into space.

Digital technologies will not be able to completely replace existing achievements in the field of didactics. It should also be remembered about the various types of educational activities, the variability of competencies formed by students, different types of tasks and actions performed in the learning process. If the purpose of digital classes is not to recreate practices, but to find effective ways to provide students with the necessary information and opportunities to apply this knowledge, then digital technologies can become a significant additional educational resource.

1.2 Digital learning

Digital learning has become a huge advantage in the learning system, including a foreign language, due to certain properties, which include: the ability to study anywhere in the world; the possibility of asynchronous learning; the use of various methods, technologies and methods of teaching, learning within a variety of disciplines, both applied and theoretical.

The availability of computer tools is becoming one of the main conditions for digital learning. Such tools most often include electronic textbooks, computer testing, multimedia tools, asynchronous e-mail, webinars and other ways of exchanging information in real time, mediated by computer networks and the Internet. The level of modern digital developments makes it possible to use this model in the practice of teaching foreign languages with maximum efficiency. Digital learning allows to get wide access to educational resources, which will increase the level of educational potential of society and the quality of education in general. The use of an interactive language course using a mixed learning model expands the creative capabilities of the teacher and allows to educate a successful independent, self-governing student.

Electronic platforms provide the opportunity to hold conferences and webinars, but in order to bring them closer to direct communication, ideal technical conditions and special teacher training are needed. Learning a foreign language in a virtual classroom requires the constant attention of students. It is necessary to change the types of speech activity in the classroom. The traditional method of teaching foreign languages has proven its effectiveness. The main provisions of the methodology remain relevant at the present time. It is necessary to take into account the fact that it is impossible to directly transfer those forms and methods of teaching a classroom-based system to digital learning without taking into account its features. The educational text should be different in form with the addition of interactivity (hyperlinks, tooltips, video sequence, glossary). Working with an electronic text provides more independent search work for students, arouses interest and increases motivation to learn the language. Clicking on hyperlinks inside the text increases the amount of information, promotes a quick change of activities and reduces the overall fatigue of students in the classroom. Developing and creating context are key elements of learning a language with the support of technology. Language learners need to conduct training in the target language environment and apply it in practice. Supported by high-performance computers, it can generate a simulated three-dimensional environment and provide students with multi-channel sensory stimuli such as visual perception, auditory perception and touch, as well as implement natural modes of interaction such as voice, tactile, gesture and multi-sensory channel interaction.

1.3 Virtual reality

Due to the rapid development and expansion of the field of application of the latest computer technologies in various fields, VR technologies are of particular interest for consideration. The article provides an overview of modern digital technologies in education, including the use of virtual, augmented and mixed reality at RUDN university (Peoples' Friendship University of Russia).

VR technology and device appeared in the early 1960s, and many studies on VR and its applications have already been carried out in recent years. Virtual Reality (VR) refers to a three-dimensional (3D) environment generated by computer technology, which can provide a context similar to visual simulation and other senses [2].

Virtual reality is an environment created through the use of special hardware and software. It allows participants not only to immerse themselves as deeply as possible in the subject being studied, but also to interact with it. This is how it differs from AR – augmented reality.

Among the different technologies available, Virtual Reality (VR) has been proven to be valuable for educational purposes. VR can be described as a technology that provides a sensation of being immersed in a digital environment. The main objective of VR is to make the user feel close to another reality, using the human's five senses. This technology integrates a diversity of devices that maybe



used to help create a realistic and multisensory experience (e.g., Head-Mounted Displays (HMD), motion tracking [6]).

With the help of systems and various virtual reality tools, the impact occurs on the main sensory organs: tactile, auditory, visual, thereby creating a high-quality simulation of the surrounding world, where the user, being a part of it, can control its objects and objects, be in the virtual world not as an observer, but as an active participant.

The created effects affect the user's consciousness and allow them to experience sensations close to real ones. This simulated reality with the illusion of being present in an artificial world has several types of VR. Non-immersive virtual reality is the least immersive implementation of virtual reality technology. This is usually a computer with a high-resolution screen, a powerful processor, and manipulative devices such as a mouse and keyboard. Flight simulators are a typical example of non-immersive virtual reality. Semi-immersive virtual reality is a type of virtual reality that provides a more immersive experience than non-immersive virtual reality, but still does not fully immerse the user in a virtual environment. This often includes a large projection screen or multiple television monitors and motion tracking devices. Full immersion in virtual reality is the most exciting form of virtual reality. This is usually a virtual reality headset that provides a 360-degree field of view, as well as portable controllers or gloves with sensors that track the user's movements and allow him to interact with the virtual environment.

Virtual reality technology for desktop computers is most widely used in language learning, which is called immersive virtual reality. Many studies have proven the effectiveness of desktop virtual reality in language learning, showing that it can increase learning motivation and academic performance, develop cognitive abilities and facilitate the achievement of complex goals of learning a foreign language in collaboration. One of the main advantages of using VR in teaching foreign languages is the creation of an authentic language environment. Students can immerse themselves in virtual scenarios where they can interact with native speakers, hear real conversations, and participate in simulated communication situations. It helps students develop communication skills in a foreign language in a realistic environment. For example, *Il Divino: Michelangelo's Sistine Ceiling* in VR is a Virtual Reality experience powered by Unreal Engine where you can walk through and learn about the Sistine Chapel Ceiling. Attendees can step onto Michelangelo's own scaffold to learn about how he painted the ceiling or enter a Vatican conservator's mobile aerial platform to see the ceiling up close and learn about the controversial cleaning. In all, there are over 100 clickable elements connected to an hour of commentary talking about Michelangelo's monumental work.

When learning a language, immersive virtual reality has more advantages than desktop virtual reality, which can provide more channels of sensory stimulation and create a more realistic and ideal learning environment. A virtual reality headset can also provide multi-channel interaction, which can make the presentation of non-verbal information more expressive. The use of immersive virtual reality technology in language learning has only just begun, and there are still many opportunities for further research. VR in education is aimed not at replacing the teacher, laboratory and practical classes, but at motivating the student and teaching him information in a new way. The VR simulator "A journey to ancient China" was developed by the RUDN VR laboratory. The simulator scenario is a trip to ancient China, during which the student is invited to visit the Gogong Palace Complex and complete a number of tasks, including tasks for assembling Chinese characters, visiting the Chinese theater, the city of Shanghai (in the form of a 360-degree panorama) and answering questions about Chinese set expressions.

High internal motivation has a direct connection with the improvement of the student's educational results, his self-confidence and initiative. VR allows to maintain the internal motivation of students when performing complex tasks. Learning in virtual reality increases student engagement, thereby increasing their concentration on completing the task. As a result, students make more efforts to direct cognitive resources to solving complex problems.

1.4 Conclusion

One of the most important advantages of virtual reality is the ability to manipulate objects. Being in a virtual environment, the student enters the stage of a specific active experience, where he gets an empirical experience of interacting with an object, and then can move on to the stage of reflexive observation, retreating from the task and reviewing what he has experienced. Object manipulation is also embedded in the concept of operational learning, which is specific to VR technology, as it assumes that VR technology provides a convenient system and feedback for manipulation. Due to VR, students can study the properties and shapes of objects in the virtual environment by manipulating them.



VR in education can enhance collaborative learning. Learners can interact with their peers and the virtual environment, making the experience more active. It can additionally offer students a personalized learning experience by allowing them to explore the virtual world at their own pace and in the way they prefer. Students can improve their comprehension of the subject matter by using VR technology to deliver personalized feedback. VR has a notable benefit in education as it offers a cost-effective solution. Instead of arranging physical models or field trips, educational institutions can generate a virtual environment that can be accessed by multiple students simultaneously. Moreover, technology can create a secure and regulated learning environment for students, particularly when working with complex machinery or hazardous materials [4].

The use of VR in education has the capability to revolutionize the learning experience for students through immersive and captivating encounters that can enhance their comprehension of the subject. Providing an interactive VR experience has the potential to connect theoretical concepts with practical applications, thereby equipping students with the confidence to face future challenges. With the continuous advancement of technology, it is highly probable that VR will become an essential component of the education system, offering students a potent means to amplify their learning [5].

There are numerous proven advantages of using VR technology in education. First of all, VR provides outstanding visualization, which cannot be obtained in traditional classroom. It reflects the world that young generations feel comfortable in. It is inclusive, allowing everybody, everywhere, regardless of status, financial situation and disability to participate in education process. It gives virtually unlimited access to information, books or articles. Modern technology used in a classroom increases engagement, stimulates cooperation and involvement. It is used for highly efficient blended learning, encouraging self-study and individual pursuit of knowledge [3]. The immersive nature of VR allowed students to explore scientific phenomena, conduct virtual experiments, and gain a deeper understanding of complex concepts. Correspondingly, a central benefit of VR – the teachers' role shifts from a knowledge provider to a knowledge facilitator, helping students to independently learn using VR by empowering students to engage control over their learning process [1].

It is worth noting that learning in virtual reality proceeds inseparably from the most cognizable environment, which is difficult to reproduce in a classroom setting. Accordingly, with the help of VR, a teacher is able to solve another urgent problem of education – the development of knowledge and skills without taking them out of context. Contextual learning involves fully immersing the student in an authentic, meaningful virtual learning environment. The analysis demonstrates that the characteristics of virtual reality increase its potential as an educational technology. The virtual environment allows to form skills based on context, control the level of cognitive load, as well as form complex mental functions of a learner. It can serve as a medium for actively gaining empirical experience and a tool for developing problem-solving skills and behavioral characteristics. Moreover, learning in virtual reality leads to increased motivation and involvement of students in the learning process.

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