Expanded Reality: Just a Trend of our Time or do We Need Technology?

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Abstract: The article defines the concepts of distance education, distance learning and performs their general analysis. Their main forms, types and meanings in the educational system, as well as advantages and disadvantages are considered. The historical foundations of distance learning and all the stages of its formation are clearly traced, followed by the definition of characteristic features. Describes possible ways to eliminate existing problems and improve the quality of such learning. Considerable attention is paid to distance learning technology and its resources, in particular, expanded reality. Its key features, strengths and weaknesses, importance in the educational process and distance education are outlined.

To create this article we used methods of synthesis and analysis, historical, comparative, and theoretical analysis of scientific literature and thematic journals and collection of data from sources. To achieve the proposed goal, we used the literature of various scientists and researchers who devoted their works to the subject of distance education. This allowed an in-depth study and research on this topic and came to the conclusion that distance learning is not inferior to traditional and is in increasing demand every year. In turn, expanded reality technology is exactly what the modern student needs to fully immerse himself in the world of learning and make the process exciting, interesting and interactive.

Keywords: *Distance education; augmented reality; virtual reality; distance learning technologies; mixed reality; types of distance learning.*

Introduction

The informatization of society, the development and improvement of information and communication technologies, technological progress significantly affect the educational, cultural, social and other spheres, as well as the nature of scientific research. These factors have a direct impact on the content of education related to the level of scientific and technological advances.

Under the influence of the latest information technology, the development of society and the education system is undergoing significant transformations, which have both positive aspects and disadvantages or even threats that may appear under unfavorable conditions. Increasing demands on the quality of education, the need for frequent changes in vocational education or advanced training, the need to adapt to labor market requirements lead to a significant increase in demand for distance and blended learning. Every year the part of distance education among all training options is getting bigger. Therefore, today we can observe a wide range of different forms of distance learning and related technologies. The different types of distance learning focus on different levels and areas of education. They have their purpose and cover different topics, but they have their customers. Students, on the other hand, choose the appropriate type of education due to distance, availability or lack of time, ability to attend class, or simply an unwillingness to be in an educational institution regularly. However, not all students are ready and able to study from a distance. Because not everyone knows how to manage their studies and can make a proportional schedule of classes. Some begin to learn only when the course comes to an end, respectively, and the results of learning are very low, not even meet the minimum requirements. Therefore, a key role in distance education is played by the latest technologies that can not only increase the productivity and efficiency of learning, but also to interest and engage the student in learning.

The trend of today's distance education has been the augmented reality technology, which is an integral part of distance learning and plays a key role in the learning process. Thanks to it, teachers can not only present educational material in an interesting way, but also fully engage students in the learning process, increasing productivity. There are several reasons for this rapid adoption of new technologies, in particular the desire and ability of young people to operate them from a young age. In this way, students can fully immerse themselves in the world of learning and grasp complex concepts, processes, or situations with ease.

Thus, this study aims to trace the stages of the formation of distance education, to identify its characteristic features, as well as the advantages and disadvantages in comparison with the traditional method of learning, to study the technologies used in distance learning mode, in particular the technology of expanded reality and its impact on learning outcomes. In addition, the work is intended to reveal the potential of XR in the field of education, to identify possible ways of its application and to prove that such technology is nothing less than a necessity of our time.

The topics of distance learning and the use of expanded reality technology are very relevant today, which is why they have become the subject of many scientific studies. The advantages and disadvantages of distance learning have been analyzed in their works by such scholars as (Bijeesh, 2013; Bozhok & Vlasenko 2014; Oliveira et al., 2018). Simonson & Berg (2016) in the article "Distance learning" analyzed all the stages of the development of distance learning: from the nascent stage to the present.

Given the rapid pace of life and the constant shortage of time, humanity needs distance learning as an alternative to the traditional method. However, today's realities, especially the Covid-19 pandemic, have shown that the global education system was not prepared for such challenges. This means that it needs reorganization and improvement, which means the introduction of qualitatively new methods, approaches and technologies. Hence directly follows the need to use innovative technology of augmented reality in the process of distance learning, and therefore the study of this topic is very relevant and useful for educators in any country.

This article examined the work of Sysoyeva & Osadcha (2019) and Tsyutsyura & Kyyivska (2020) on the topic of distance learning in general, and the works of Borkowski (2019), Burns (2020), Hamilton (2021) that describe expanded reality technology in the context of distance learning.

Many researchers have worked on the topics of distance learning and expanded reality technology, but far fewer scholars have investigated the problem of using expanded reality technology in a distance learning mode. That is why the topic "Distance learning as a modern educational technology: an expanded reality" is very relevant and requires further research.

Distance learning: origins and formation

Distance learning has its origins in extramural education, which originated in the United States back in the 19th century. At first it was extramural religious education, which over time evolved into full-fledged

training and education of schools. Given the urgent need for professional training for military and government officials and their time constraints, distance learning has reached a new level (Simonson & Berg 2016).

In the middle of the 19th century, courses appeared in Europe that could be ordered by mail. The Society of Modern Languages in Berlin proposed the introduction of extramural courses in French, German, and English. Most of the non-religious correspondence courses by mail focused on learning spelling, grammar, business writing, and bookkeeping, but there were also some where one could learn completely atypical skills, such as manual therapy or hairdressing (Simonson & Berg 2016).

It was not until the beginning of the 20th century that visualization became the key method in the teaching process, in contrast to the traditional teaching of the 19th century, which was based on various practices of oral recitation (Simonson & Berg, 2016). However, it is worth noting that one of the most significant discoveries of that time, the invention of the foil phonograph by Thomas Edison, was made in the 19th century. Thanks to him, the first language laboratories were opened where both visual and audio devices were used for teaching.

The scholar was also one of the first to create films for the classroom. Beginning in 1900, the first correspondence departments began to appear, for example, at the University of Chicago, at the University of Queensland (Oliveira et al., 2018).

In parallel, such institutions as the Distance Education Accrediting Commission (DEAC) were created, which controlled the quality of educational services provided by institutions. The main task of which was to improve the quality of education, both distance and traditional. The commission developed and regulated accreditation standards and procedures for reviewing and approving distance education institutions (Oliveira et al., 2018).

While extramural courses constituted the first generation of distance learning using traditional print materials and communication by mail and telephone, second-generation distance learning included audio recordings and radio and television broadcasts (Hannay & Newvine, 2006).

Improvements in the film industry, particularly the ability to voice-over, contributed to the development of television training courses in the 1950s. Many leading universities introduced this new type of activity into the educational process. Educational material was recorded on tape and offered for viewing in the classroom, or in the library at a time convenient to the student (Hannay & Newvine, 2006).

During the same period, the field of education began to make extensive use of computers and programming to present learning material and assess student achievement and progress. The next significant achievement in the field of educational technology was the connection between computers via the Internet, which was the first step in the development of modern distance learning.

In the late 1970s, the Open University, based in the United Kingdom, began a phase of distance education, where students were sent educational materials such as texts, audio and video, and professors provided advice to students to ensure quality learning. Over the next two decades, four Open University branches opened in Europe and more than 20 worldwide (Oliveira et al., 2018). All of these types of universities provided access to students who could not attend classes or did not meet the requirements for admission to a traditional university.

All this time, scientists and educators have conducted various studies in the field of distance education, which contributed to its active development at the international level. As early as the beginning of the 21st century, more than half of all U.S. institutions of higher education were offering distance education in the form of online courses. The target groups for this training were workers who were recertifying or retraining, people with disabilities, and the military (Simonson & Berg, 2016).

The first and second generation of distance learning methods relied on the technology of the time and were designed to create and distribute learning materials with maximum efficiency, despite the lack of interactive communication between educators and students. Technology tends to change and improve. And so, unlike its predecessors, the third generation of distance learning systems included video technology, e-mail and World Wide Web resources, and it was distance learning that was characterized by close interaction between students and teachers (Hannay & Newvine, 2006).

Today's version of distance learning uses web-based course and class management systems, covering digital materials to read or listen to, videos to watch at your leisure, email, forums, chat rooms, virtual classrooms, etc. Most of these systems allow students to use the functionality built into them at any time, but synchronous technology is also used, providing audio, video, or simply access to learning materials and other documents at scheduled times. There are also shared social spaces, including encyclopedias, shared documents, etc., that are always in the public domain and can be edited by anyone involved in the learning process (Simonson & Berg, 2016).

Distance learning is not just learning with the Internet or a computer, but it is always associated with one technology or another. It

would seem that video, audio, and other multimedia should be the basis for distance learning, but in practice it was different at first - ordinary e-mail correspondence and other text communications were predominantly used. Why is this so? Because teachers had to create their own multimedia, which took a lot of time and effort. In those days it was not an easy task, because most teachers did not have such skills and were not sufficiently computer literate. Today, however, any multimedia and interactive technology is seen as a way to facilitate communication between students and teachers, which removes time and geographic constraints and helps to share information both in traditional classrooms and in distance learning (Simonson & Berg, 2016).

James Taylor (2001) identifies five generations of distance education in his work:

1. extramural education;

2. integrated use of unidirectional media, such as printer, videotape, or audiotape;

3. two-way, synchronous learning using audio or video communication;

4. learning based on asynchronous online learning with the use of interactive multimedia tools;

5. intelligent automated learning, which gives students full control of the process.

The transition to each successive generation has largely been driven by changes in educational theory and advances in technology. And if we follow Taylor's theory, we are probably in the sixth or seventh generation today, Bates (2008). And what all future generations of distance education will look like will depend on the development of educational and pedagogical technologies and technological advances in general.

The concept of "distance learning": its advantages and disadvantages

Technological progress has affected all areas of life, including education. As a consequence, distance education is actively developing. It is a form of education that allows students to gain knowledge without the distraction of other commitments and work, giving people with disabilities and the poor the opportunity to become educated. It is not tied to place or time and allows you to study in a comfortable environment (Baydatska et al., 2021). The latest technology and educational tools, particularly online resources, bring students closer to science and desired jobs, and allow them to learn at their own pace.

Two types of distance learning technologies can be distinguished, namely, innovative and educational and information and communication technologies. The first involves active interaction between students and teachers, the use of telecommunications technology, and is based on psychological and pedagogical and personal approaches. At the same time, ICT are technologies that allow the creation, posting, processing, transferring, and storing of learning materials. They make it possible to organize, support the learning process and become an active participant in it with the help of telecommunication communication technologies, in particular the global Internet and related services (web resources, web platforms, etc.) (Tsyutsyura & Kyyivska 2020).

And if the first type has been used for quite some time and is an integral part of traditional education, the second is at the stage of active introduction into the education system. Its main advantages are flexibility and accessibility under any educational conditions and requirements. And most importantly, it is on the basis of information and communication technologies that a separate independent form of education is developing - distance learning (Tsyutsyura & Kyyivska, 2020)

Distance learning (often replaced by the terms "distance education," "online learning," "e-learning") is a form of learning that involves the physical distance of teachers and students in the classroom and the use of a variety of technologies to connect them and facilitate communication (Simonson & Berg, 2016). Simply put, distance learning is when students are separated from teachers and other students, they don't meet in class, but use Internet resources to communicate and learn directly. In order to describe distance learning as a phenomenon today different terms are used.

Although the terms "distance learning" and "online learning" are often equated and interchanged, they are not identical concepts and there are a number of differences between them. Among them:

- Location. The foundation of online learning is the use of online learning tools and platforms, which can be done remotely as well as in a regular classroom. However, distance learning got its name precisely because it has to be remote and eliminates any possibility of face-to-face communication between the student and the teacher.

- Interaction. Online learning involves interaction with teachers and peers, unlike distance learning, which excludes face-to-face interaction.

- Intent. More often online learning is used as a supplement to the presentation of the main material in the classroom, while distance learning and is the basis of the educational process, where the activity of the teacher is often replaced by instructions on a particular learning platform.

Online learning, in turn, is the use by educators or students of educational tools available on the Internet. They can do this at home to prepare and complete assignments, or while in the classroom with teachers and peers. Online learning tools are also used to create a blended learning environment, which helps to engage students in their work, interest them. They help teachers save time in preparing for classes, checking and grading work, allowing them to pay more attention to each student. That is, this form of learning can be used at any time and in any place, which is common to distance learning as well.

By using terms like online learning and distance education, we are trying to describe a rapidly changing phenomenon. And the terminology often tries to keep up. More synchronous approaches are being replaced or combined with asynchronous learning, forming what is known as blended learning. Every year more and more new terms are added to describe distance learning, Bates (2008).

Distance learning, i.e. activity, of the student and distance learning of the teacher, i.e. teaching, together form distance education. E-learning, virtual learning, or online learning all involve the use of the Internet as a primary resource today (Simonson & Berg. 2016).

Until recently, distance learning has focused on non-traditional students, for example full-time employees, foreign nationals, people with disabilities or other special needs, that is, individuals who cannot attend class or classroom instruction (Simonson & Berg, 2016). However, today online learning has become an integral part of today's education, and this trend is constantly growing.

Modern Internet resources: social networks, training programs, programs for video or conference calls, chats, multimedia, etc. is adapted by teachers to the educational process and find its application in various methods and models of education. So we can distinguish four basic models of distance learning (Baydatskaet al., 2021):

1. Correspondence. Students receive instructional materials in paper form usually through mail delivery. They can choose where and when they work and work at their own pace. However, there is absolutely no interactive communication between the student and the teacher.

2. TV-educational. Special conference or video applications, radio or television broadcasts are used for classes, and students receive all instructional materials in the form of audio, video, or text documents.

3. Multimedia. Videos, audio CDs, or other multimedia are used. Interactive videos can also be created using a computer.

4. Virtual. This model of teaching involves the use of various Internet resources and provides a reliable interactive connection between the student and the teacher.

Today there are quite a few virtual and distance learning systems. Their use, as a rule, is widespread in the system of higher education. However, recently there has been increased interest in various forms of distance learning in schools as well, due to the increased incidence of the Covid-19 pandemic. The leaders of all educational institutions should take appropriate precautions, among them the forced transition to distance learning (Li & Lalani, 2020). In addition to the forced transition to distance education, the number of those wishing to study online has also increased, so the demand for online courses and extramural education has increased.

Since then, more and more schools and universities around the world have been offering distance learning opportunities. And they do so not only because of quarantine restrictions, but also for their own benefit. By studying full-time or distance, the student somehow obtains relevant knowledge, the quality of which is monitored by accreditation commissions, and the university can reduce costs, since there is no need to arrange for classrooms and provide housing. Students get their own benefits from this type of study: they can study where and when they want, they can combine study and work, and they simply feel free and at ease while studying, Simon (2021). In general, we can distinguish four main characteristics of distance learning:

1. Distance learning is, by definition, through appropriate institutions that can provide the necessary learning environment. These institutions are eligible for accreditation whether or not they offer traditional classroom instruction (Simonson & Berg, 2016).

2. It is inherent in the geographical and temporal separation of students and teachers. This way of learning is accessible and convenient. And specially designed curricula bridge social, cultural, and intellectual differences among students (Simonson & Berg, 2016).

3. Interactive telecommunications bring together not only students with teachers, but the students themselves as a learning group. Interaction between all sides of the educational process is very important for both distance education and education in general. Communication between students and teachers, learning resources are becoming less dependent on physical closeness, as communication systems are constantly improving and becoming more accessible to a wider audience of users. Electronic communications, such as email, cell phones, and Internet resources, are most commonly used for communication, but the traditional form of

communication, the postal system, also takes place (Simonson & Berg, 2016).

4. Distance education, like any education, groups students and teachers, coordinating their work. They, in turn, use appropriate learning resources: books, videos, audio recordings, special programs and gadgets that allow the student to access learning materials and the teacher to convey appropriate instructions to students. Social media, including Telegram, Facebook, WhatsApp, and others, help keep members of this learning community connected through the creation of profiles and groups and reduce feelings of isolation, as well as provide opportunities to create new communities of like-minded people (Simonson & Berg, 2016).

In contrast to schools, university practice has long been using different learning environments to meet the needs of students. In addition to traditional learning, we can observe the use of correspondence courses, courses in recorded television courses, etc. In general, we can distinguish the following types of distance learning:

- Online courses. Usually offered as a supplement to your basic education. However, there are exceptions where a new profession can be learned as part of the course provided.

- Hybrid courses. Combines traditional classroom instruction with online learning at home. These courses are based on self-study, but also include face-to-face meetings with educators to provide or explain instruction or instructional material. The amount of classroom and home learning may vary for each course.

- Conferencing. Using specific conference calling apps like Skype, Viber, Google Meet, etc., students and teachers can participate in live lessons despite distance. Communication sessions can be group or one-on-one, depending on the type of class.

- Extramural education. Provides students with relevant materials by regular mail or e-mail. After completing an assignment, students submit them for review, followed by a grade in the same way. Quite often there are so-called "sessions", when a student must attend lectures and undergo appropriate knowledge tests for a week or two in addition to completing assignments remotely.

Extramural education immediately got a bad academic reputation, especially if it was provided by for-profit organizations. Because there was widespread fraud in this form of education and no single true and adequate standard for evaluating the quality of education. And even though accreditation agencies were introduced that set appropriate standards for distance education, compliance with these standards was not always up to

the task. In turn, the introduction of distance learning in traditional institutions raised fears that technology could completely replace real classrooms and displace field workers (Simonson & Berg, 2016).

As we have already found out, there are many forms and methods of distance learning and each of them uses appropriate technologies. But they all have the single purpose of providing students with the information they need and improving their knowledge at the right time and place (Sysoyeva & Osadcha, 2019). With this in mind, at the present stage there are such types of distance learning: synchronous, asynchronous, mixed, mixed mass open online courses (MOOCs), online courses with an open learning schedule.

Years of pandemic and active introduction of a new type of online education have proven that the use of reliable distance learning systems is the basis for the effective functioning of modern educational institutions. Today there is a huge amount of work in the field of distance education, including theoretical and practical research. And they all agree that distance learning must meet at least three basic criteria, namely: technical accessibility for teachers and students; compliance with program learning outcomes; and clear criteria for assessing acquired competencies (Drozdova, 2021).

However, which type of distance education to choose depends on the student and the profession he or she plans to pursue. If we are talking about schoolchildren, the right to choose is left to the head of the educational institution or the local government. Many students consider distance learning a full and practical way to get a quality education without having to attend an educational institution (Simon, 2021). Mainly because it makes it easier for them to balance their other commitments. Mainly because it makes it easier for them to balance their other commitments. However, there are also those who believe that the quality of distance learning is much lower compared to traditional education, although it is much more convenient. Hence the fact that distance education has both advantages and disadvantages. Thus, the advantages of distance learning:

1. Accessibility. Distance learning is available to all potential students who need it. People with health problems, physical or mental disabilities, busy working schedules, or any other social, psycho-emotional, cultural, religious, etc. reasons can study anywhere and at any time convenient. This form of training allows you to successfully combine work and learning (Bozhok & Vlasenko 2014).

2. Financial benefit. Usually the cost of distance learning is different from the cost of full-time. And its price is much less. Thus, some students can save money by choosing a cost-effective tuition option, while others who can't afford a regular education can afford to study at a price they are

able to afford (Bijeesh, 2013). And going back to the previous point, you can study as long as you earn.

However, the economic advantage of distance learning compared to traditional training is not unambiguous. Some heads of educational institutions believe that the cost of distance education is lower than the cost of traditional education. However, one must consider the high burnout rate and high dropout rate in this mode. According to the analysis, the dropout rate of distance education reaches 35% of students, while in traditional education this figure is only 20%. If you calculate all the costs in distance education, including the cost of time, experience, the use of necessary technology, the cost of distance learning will be the same, or sometimes even more (Oliveira et al., 2018).

3. Time savings. By studying remotely, you don't have to waste time traveling to an educational institution, waiting for a bus or other transportation, waiting in lines, etc. Your studying, your class is on the computer, which means it's where you want it.

4. Own pace. You can learn at your own pace and revisit material you've missed or learned poorly. In a class where everyone learns together, not all students learn at the same pace and not all students who fall behind ask for repetition and help. It is in these situations, distance learning is the right solution, because all the materials are provided in advance and you can learn as much as you can handle on a daily basis. And you can also go back to work on the material if you have run out of time to complete the assignment and contact the teacher through special chats or discussion forums if you have questions or doubts. However, self-discipline and self-motivation are extremely important here (Bijeesh, 2013).

5. Learning flexibility. You can study whenever and wherever you want, except when classes or assignments are scheduled for. But even this type of activity allows you to study in any convenient place: in the garden, living room, or cafe, and the time is always coordinated with the teachers (Bozhok & Vlasenko 2014).

6. Recognition. Today, distance education is fully endorsed and recognized by employers. They encourage employees to pursue higher education along with their jobs so they can develop skills and gain experience in their field (Bijeesh, 2013).

But as everywhere else, there is a downside and what is an advantage for one student may be a disadvantage for another. Hence the likely disadvantages of distance learning:

1. The risk of distraction is high. Since distance learning eliminates the possibility of face-to-face communication with teachers and other

students, there is no one to remind about unfinished tasks. In order to successfully complete the course, you need to have clear intentions and motivation and be focused on learning. So if you tend to procrastinate and can't meet deadlines, distance learning is not the best choice (Bijeesh, 2013).

2. Hidden costs. Despite the lower cost, distance education in any of its formats involves additional costs. Because the training takes place online, you need to have a computer and a quality Internet connection. And if the student does not have the right equipment, he must buy it. In addition to a computer, it can be a printer, a webcam, and other computer devices. No one has cancelled the costs of electricity and maintenance of devices, either (Bozhok & Vlasenko, 2014). And, if necessary, postage costs as well.

3. Sophisticated technology. The quality of distance learning depends directly on the technology and how well it works. Because learning is online, any technical malfunctions or outages can undermine the learning process. And if the student does not have the computer skills or appropriate programs, or not enough of them, their learning can be unsatisfactory and uncomfortable (Fojtik, 2018).

4. Quality of teaching. As practice shows, the quality of teaching online is much lower than traditional teaching. Even a highly qualified teacher may not be comfortable posting in an online environment. And technology is not always fully responsive, correctly reproducing or communicating instructional materials. Providers of distance learning should always remember that it is the teachers who determine the result of the training, and technology is only a means to achieve the goals set (Bijeesh, 2013).

5. Doubtful credibility of degrees. Although distance education is now fully recognized, there is always the risk of encountering providers who offer non-accredited degrees and may be seen as scammers. As the number of distance/online programs increases, so does the number of scammers. It is this fact that very often creates problems in the potential employment of distance education students, as their degrees are not always true.

6. Lack of communication. Distance learning allows you to study at a convenient time and anywhere, but it deprives you of live communication with other students or teachers. Interaction promotes critical thinking and builds problem-solving skills. If we talk about schoolchildren, this type of learning leads to a kind of social isolation with all its negative consequences. And university students are deprived of the opportunity to establish contacts with future colleagues and mentors. And while there are special forums and chat rooms where students can share their ideas and communicate, they only partially replace necessary interaction (Bozhok & Vlasenko 2014).

Despite all the disadvantages, distance learning is becoming increasingly popular among students and is one of the educational trends of our time, along with blended learning and expanded reality technology. And there are many reasons for this, particularly the situation around Covid-19, which has forced pupils and students to study online for long periods of time (Sysoyeva & Osadchaya, 2019). Because such a measure was forced and unpredictable, the learning outcomes were worse than in previous years. However, each year the forms of distance learning and the methods of its implementation are changing and improving. Technology is also changing. This is facilitated by the rapid development of the scientific and technological sphere, the process of globalization and the informatization of society.

Distance learning meets all the requirements for an innovative form of education based on the use of Internet technologies and resources, modern multimedia interactive equipment. Distance education can meet the individual educational needs of each student and solve the main problems of traditional education, such as dependence on time and place of classes, lack of individual approach to students, poor motivation of both students and teachers, lack of active forms of teaching and subjective assessment of learning results. Consequently, the main goal of distance education is to combine the advantages of virtual and traditional learning, while solving the main problems of the latter.

Thanks to the use of advanced technology and its adaptive capabilities, distance learning acquires qualitatively new features and allows students to feel as comfortable as possible during the educational process. And the use of the latest expanded reality technologies makes it possible not just to immerse yourself in the learning process, but to experience and feel the entire experience. What is " expanded reality" and what is its role in distance learning?

Expanded reality: just a trend of our time or do we need technology?

Today dictates its own rules and creates new challenges, primarily related to the introduction of new technologies. Reality is increasingly linked to the computer world, creating a variety of fascinating combinations. It is no longer necessary to imagine life in a fantasy universe, it can easily be embodied and tried on yourself. Virtual experiences have become an integral part of our lives, our reality, expanded reality.

Today's pupils and students are people belonging to the new, digital generation. For them, the use of gadgets and Internet resources in everyday

life, for work or study is natural and necessary. They cannot imagine their lives without the latest technology, because it is present in almost all spheres of life, particularly in education.

Technology is changing much faster than the education system can absorb and adopt it. Accordingly, educators must respond to this challenge and adapt the educational process to the new changes and demands. However, they can't do it all at once. Today, most institutions, especially higher education institutions, are introducing innovative learning tools and methods that complement traditional learning, improve it, and make it more accessible. Among such innovations are distance and blended learning modes, STEAM education, the use of artificial intelligence, game technologies and expanded reality technologies (Zazymko, 2021).

As distance learning becomes mainstream and in high demand in times of pandemic, expanded reality technologies are becoming more common and more used. The use of expanded reality technologies in educational settings has continued to grow over the past decade. They help educators create engaging learning environments and actively engage students in better understanding of concepts (Mileva, 2020).

The term " Expanded reality" (XR) refers to a set of technologies combining the real and virtual worlds. It is broad enough to include augmented reality (AR), virtual reality (VR) and mixed reality (MR).

Augmented reality got its name because of the functions it performs, namely it supplements the real environment with computer elements: text, pictures, animation. Its basic principle is to add digital objects to the real world that surrounds us, enhancing our perception. To "deceive" the eye and fully convey depth, augmented reality technology uses sound, video, graphic and tactile effects, as well as location data.

There are four types of augmented reality:

1. Marker-based. This type of AR uses a physical marker (such as a QR code or printed image) that must be scanned with the camera. After identifying the marker, a CGI object is superimposed on the location and the corresponding augmented reality is created.

2. No markers. It uses a GPS or accelerometer embedded in a device (more often a cell phone) to place digital elements in the environment. By far the most common type of augmented reality technology.

3. Augmented reality based on projection. Artificially created light is projected onto any surface, and special sensors record human tactile interaction. This allows manipulation and interaction with computer objects.

4. Superimposed augmented reality. The most common technology of the twentieth century. More often used in retail mobile applications.

Works by recognizing objects and replacing them with a similar, but computer-generated one.

Combined with the development of high-quality devices, these programs can offer a really great experience for people in everyday life and professional activities.

Augmented reality technology is one of the latest developments in computer innovation. It has found its application in various applications, mobile games (the first and best example was the game Pokémon Go), social networks (filters for selfies in Snapchat, which add different effects to images).

In order to use this technology and penetrate into the virtual world, in most cases you only need a camera phone or other gadget, otherwise - special devices. Thanks to it, distance learning can be more effective and productive (Burns, 2020).

Virtual reality is a related technology that also uses computer techniques to create a new digital world. However, its main difference from AR is that all effects are fully computer-generated, while VR tools are simply superimposed on a digital reproduction on top of the real world (Childso et al., 2021). It allows you to interact with computer models in an artificial three-dimensional environment using special devices: headsets, gloves, controllers. They separate the user from the environment and fully immersed in the created computer world. Such simulations are very useful in education, although the equipment can be expensive and the cost of developing a simulation of such reality can be high. The most famous product on the virtual reality market remains the Oculus Quest 2 multimedia system.

Mixed reality is a combination of virtual and augmented reality. Its main task is to show how the augmented world can transition into the virtual world and vice versa. It combines digital and real environments into one in which you can interact with unreal objects in real time. This technology works through special headsets, like Google Glass or Microsoft HoloLens. It can also turn an ordinary Skype call into a "real meeting," and the session can be controlled with your hands.

When it comes to technology, it not only spreads into new areas and complements each other, but is also closely intertwined, forming an entirely new environment. Expanded reality technologies are spreading and developing rapidly. Today, they are involved in many areas, such as trade and marketing, real estate, entertainment, education and training, etc.

Although the technical possibility of using AR and VR has existed for quite some time, the practical application became possible only after the

advent of mobile platforms (such as iOS and Android) and thanks to rapid advances in consumer equipment. Such technologies are potentially useful for many areas, particularly the education industry (Childso et al., 2021).

XR is very often seen as something kids play with. However, research has shown that most students believe that such technology is useful enough for learning. XR is very often seen as something kids play with. However, research has shown that most students believe that such technology is useful enough for learning. What used to be considered an advanced technological device now plays a key role in the learning process (Borkowski, 2019).

Internet access combined with various conferencing platforms, such as Google Meet or Zoom, allow for learning from anywhere in the world. With smart AR glasses, educators can go beyond the usual teleconferencing experience by creating out-of-the-box lessons and "face-to-face" virtual sessions. With a translation and subtitling feature, the glasses broadcast the teacher's translated words in real time, allowing students to bridge the language barrier and the gap between countries and cultures (Del Mar, 2021).

With XR technology, classes come to life and the learning process becomes more lively and interesting. Multidimensional images, engaging animations, and immersive virtual worlds enhance lessons and engage students. They encourage children to work harder and participate in lessons (Mileva, 2020).

In addition to encouraging students to become more engaged in lessons, XR can help students gain a deeper understanding of complex concepts by visualizing how components work or combine in the real world. For example, chemical reactions and biological processes are perceived much better and easier with video simulations, and 3D models of human DNA can help create a visual representation for further productive learning (Del Mar, 2021).

Learning is more effective when concepts are used in practice. XR makes this possible by modeling processes or procedures. It allows you to learn new knowledge and skills even without the necessary equipment and tools, such as a microscope (Mileva, 2020).

Expanded reality allows you to move the learning process into a safe virtual environment. It can be used to simulate many dangerous scenarios for future military, firefighters, pilots, doctors, etc. And they can also perform potentially dangerous procedures by practicing in simulated reality that they would not otherwise be able to perform (Del Mar, 2021). With minimal costs and risks. And the experience gained in virtual reality will

allow you to apply the acquired knowledge and skills in real situations. Generally speaking, expanded reality technologies are designed to give people experiences that, for one reason or another, they cannot get in the material world. Examples of this could be educational games, various applications, etc.

If we describe current distance education, gamification is an integral part of it. Despite the fact that such an idea seems very bold, game-based learning can actually be very useful, as it follows from the research results, Allen (2021).

VR allows students to immerse themselves in a fun educational game that promotes team building and healthy competition (Allen, 2021).

By creating authentic social interaction, virtual reality gamification can greatly enhance distance learning. Because of its versatility, it encourages students to be more active while taking ownership and control of their learning. It also allows them to explore different subjects and roles through various game characters (Allen, 2021).

One of the main advantages of gamified learning is the acquisition of analytical data. These games allow you to quickly and accurately assess students' strengths and weaknesses and suggest appropriate solutions and ways to improve (Allen, 2021).

Augmented reality enriches students by exposing them to inaccessible places and experiences, as not all institutions can afford sophisticated learning materials and field trips. Even while studying remotely, students can visit museums and exhibitions, watch a volcano or tornado erupt, and explore the universe (Mileva, 2020). For example, Google's Expeditions app allows students to see sights anywhere in the world from their smartphone screens, or a realistic model of the globe, for example. Even if the school has ample resources, many students respond better to interactive experiences, such as a 3D globe that moves and changes, rather than a map on a book page. In addition, students associate augmented reality technology with games and social media, so such learning is more desirable in all circumstances (Borkowski, 2019).

In addition, with augmented reality, they can explore learning content on their own, which in turn gives them more will and motivation to improve their skills and explore more learning materials. There are many software products that allow teachers to create their own AR lessons, such as Zappar and Vuforia. These developments allow you to create engaging interactive trainings and to complement existing ones for more effective training of students.

MindLabs, for example, used augmented reality technology to develop a program that teaches STEM to children in a more interesting way. The MindLabs: Energy and Circuits app can be downloaded and used anywhere with a matching set of cards. The app offers a ready-to-use set of maps that allows you to quickly and happily learn about electricity, circuits, and other related concepts. Adult supervision and help is not required (Mileva, 2020).

XR is used in biology, chemistry, geography, and geometry classes. This list could go on, given the versatility of the technologies offered. Some schools even teach students how to create AR, providing them with technology skills that could be useful in their future careers (Borkowski, 2019). Expanded reality technologies create multi-sensory experiences that further enrich learning (Mileva, 2020).

As already mentioned, distance learning is a very demanding form of learning, which creates corresponding problems for both students and teachers. For students, it is a lack of practical experience, and for educators, the difficulty of conducting classes and interacting with students. However, both of these problems can be solved with expanded reality (Mileva, 2020).

And if one of the disadvantages of distance learning is the lack of communication and interaction, one of the main advantages of XR is its ability to promote cooperation between students. Technology provides opportunities for students to collaborate outside of the classroom, such as on homework assignments. And given that the older the children get, the more they rely on each other, avoiding the help of teachers or parents, this interaction is very important (Borkowski, 2019).

There is a growing interest in expanded reality and its potential to improve special education. It has the ability to create interactive experiences by enhancing the real environment with virtual elements. Such technology allows children with disabilities and special needs to learn fully and feel like members of the learning community. And teachers can meet the educational needs of all students. So why does specialized education need expanded reality technology? (Mileva, 2021).

Because these students have different abilities, limitations, and interests. By taking advantage of expanded reality and the child's challenges, teachers can customize learning styles for each student individually. Among the large number of special applications, the teacher can choose the necessary and most appropriate programs for learning, since not all technology students will be able to use on their own at home. Expanded reality is revolutionizing special education by making learning more fun, interactive, and accessible (Mileva, 2021).

Importantly, the use of augmented reality technology is just a few examples of how technology can change and improve education. With the advent of the Internet, students could easily catch up on missed coursework and even gain new knowledge in areas of interest to them. And the active development and proliferation of social learning platforms for students have been catalysts for an overall easy and fun learning experience. And these are just some of the technical advances that are significantly improving the student experience and outcomes (Borkowski, 2019).

To summarize all of the above, it is clear that using expanded reality in distance learning has many advantages, particularly (Hamilton, 2021):

- allows students to share experiences and network regardless of their location;
- provides access to high quality, fun and interactive programs;
- increases student motivation, attention and confidence;
- does not always require expensive equipment or special subscriptions;
- allows online travel through virtual tours;
- allows them to get hands-on experience along with theory;
- allows them to sharpen their skills and apply theoretical knowledge in practice in a safe environment (e.g. bomb squad, pilots, etc.)
- helps to understand complex processes, phenomena, concepts, e.g. the structure of molecules, the interaction of chemical components, cell decay, photosynthesis, etc;
- helps to overcome language barriers and learn a foreign language
- suitable for students with disabilities

More and more colleges and universities are experimenting with XR and trying to use the technology in different industries. Augmented reality can enrich students with useful information and unique learning experiences that students are unlikely to forget (Hamilton, 2021). However, there is a downside. Like any other technology, XR has its drawbacks, including:

1. Technical difficulties. This problem concerns developers of expanded reality applications, because the process is quite long, complex, and energy-consuming. And all that consumers see is a finished product that has passed all the stages of the test.

2. Data privacy. In order to take full advantage of the features and benefits of the XR applications, users must provide permission for the collection and processing of personal information. And since the level of cybercrime is constantly increasing, the developers of XR-technology must ensure reliable protection of all personal data.

3. Financial costs. Augmented reality technologies are available to everyone who has a smartphone or tablet, but VR and MR require expensive investments, because the necessary computer technology is expensive.

4. Discomfort. Some expanded reality devices may cause discomfort, especially if you are using them for the first time or for a long time. They can cause neck and eye strain, headaches, even nausea and dizziness. And some are too heavy, like helmets or glasses.

Technologies of the future are widely implemented in the educational process at universities, especially in distance learning mode. However, there are many obstacles to the widespread use of augmented reality technology in schools, such as cost, lack of knowledge, the young age of students, and the logistics of institutions. These problems have not yet been solved, but there is such a good chance that once XR in education reaches its peak, the possibilities will be limitless (Borkowski, 2019).

Today, the XR technology is still imperfect. For example, Microsoft HoloLens provides control using gestures and voice commands, but so far only responds to two hand movements. But technology is constantly changing and improving, and our lifestyles are changing because of it.

VR/AR can take distance learning far beyond a recorded video lesson with a delayed connection. Regardless of the specialty, said technology can enhance any experience (Allen, 2021).

Powerful emerging technologies will play an increasing role in developing skills and forming knowledge in the younger generation. It is therefore to be expected that more and more innovators will help to develop programs and tools that can integrate AR and VR into learning programs. Indeed, the future of learning is one that is endowed with technology that promotes experiential learning. This is something we can all look forward to (Mileva, 2020).

Understanding this technology and taking advantage of it is vital to improving distance learning. With its help, humanity will be able to explore new horizons and overcome global problems. Of course, the developers will have to make many more discoveries and overcome many difficulties in order to create something striking and useful. Today, however, we are closer than ever to a time when real experiences will be difficult to distinguish from virtual ones.

Conclusions

To summarize, distance learning has many advantages over traditional learning and differs significantly from it. It creates a comfortable

environment for gaining new knowledge and skills and allows you to meet the educational needs of almost every student. This type of learning is not limited by space or time and is easily adapted to students with disabilities or certain characteristics. Distance learning allows employees to learn new professions and improve their skills without disrupting their work and other daily obligations. A key advantage of distance education is that it gives students access to multiple learning tools, using minimal financial resources, because among the great variety of types of distance learning you can choose the best.

The use of the latest technology, in particular expanded reality, makes distance learning fun, successfully combining the computer and real worlds. Advanced developments allow you to fully immerse yourself in the subject and work through even the hidden aspects. This significantly increases the efficiency of learning and the quality of education.

Augmented reality can increase student engagement by allowing students to actively participate rather than being passive participants. Students can truly immerse themselves in trainings and lessons, as well as gain practice and context for the skills and knowledge they need on a particular topic.

Distance learning in combination with information and communication technologies brings new opportunities and benefits, but at the same time this form of learning brings new challenges. The learning outcomes of distance learning students are worse than those of full-time students. Despite the fact that most people today are closely connected to technology, not everyone can fully master complex technologies and programs for distance learning. And for some professions there is no distance form at all. This means that their learning outcomes will be lower than if they were learning in a classroom. Certain types of distance learning completely or partially limit social interaction and interactive communication between the teacher and the student, and therefore deprive the practical experience. Some of these problems can be solved with the help of augmented reality technology, but it also has its disadvantages.

As practice shows, this is a very demanding form of teaching, as it requires a completely different approach from students and teachers. In order to provide a quality lesson, the teacher needs significant training, the creation of appropriate teaching materials and, perhaps, the mastery of new technologies. In turn, the student must be motivated, conscientious, and interested in learning and future results. Since the demand for distance learning is only growing every year, the supply must also grow and meet educational requirements.

Despite its many disadvantages, distance learning provides a much better learning experience for students who prefer to learn comfortably. On the other hand, although distance education is very convenient and flexible, even using the capabilities of XR it is not able to completely substitute and replace the traditional form of education. After all, communication with other students and faculty, sharing experiences, and teamwork are still important aspects for many students. However, it should be noted that with advances in technology and the expansion of Internet resources, the thin line separating traditional and distance learning is slowly fading, as all modern teachers and educational institutions apply educational innovations in their work.

The study proved the effectiveness of the use of augmented reality technology in pedagogical practice and its significant impact on the success of distance learning students. Also, the main methods and means of implementing XR in the educational process were presented, which, if properly implemented, can be used not only in higher education institutions, but also in schools. One of the key aspects that the study was able to identify is a positive attitude towards the latest technology and the desire to master it on the part of both students and teachers.

Given that the emergence of distance learning in a today's format is nothing but a response of the education system to technological progress, development of new technologies and challenges of our time in general, the future of this form of learning depends on the level of mastering and use of advanced technologies, including pedagogical. With further technological advances and better adaptation of teachers to this new way of teaching, the shortcomings of distance learning, like the shortcomings of augmented reality technology, can soon be eliminated.

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