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Features of the Use of Augmented Reality Technologies in Foreign Language Teaching in the Context of English Language Instruction

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Abstract: *Modern society needs specialists who are ready to work in a high-tech professional environment. The use of augmented reality and virtual reality technologies is a key area of professional development in the near future, including within educational institutions, to optimise the process of forming students' professional competence in the context of learning English. The purpose of the article is to study and analyse the existing experience of using educational technologies of augmented and virtual reality in teaching a foreign language. Methodology and methods: the lack of a sufficient research base dedicated directly to the experience of implementing AR and VR technologies in teaching foreign languages to university students led to the choice of a comprehensive research methodology: theoretical analysis of scientific and pedagogical literature on the topic of the study, description and analysis of the research results. As a result, the article analyses the use of augmented and virtual reality technologies in teaching foreign languages, their purpose and functions. The advantages and disadvantages of augmented and virtual reality technologies are reflected. Conclusions: the study demonstrated that educational technologies are potentially effective in teaching foreign languages at universities, and many of their shortcomings can be eliminated in the coming years in the context of neuropedagogical technologies.*

Keywords: *artificial intelligence; innovative technologies; neuropedagogy; augmented reality; higher education.*

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1. Introduction

The modern educational environment dictates new conditions for obtaining theoretical and practical knowledge. It is widely acknowledged that high-quality education is possible only in the context of a new paradigm. It is also assumed that teachers of a higher educational institution must have knowledge of information educational technologies and special technical and information means to achieve pedagogical goals. Such teachers must also be able to use e-learning technologies and modern equipment (computer networks, webcams, tablets, smartphones, simulators, etc.) in the teaching process (Mora, 2013).

Modern intellectual education, unlike traditional education, has received the following opportunities:

- organisation of educational mobility;
- loyalty in the assessment of knowledge;
- increasing the efficiency of the work of participants in the process.

All of the above conditions are met by new technologies of education through augmented and virtual reality, which are still gaining popularity. It is impossible to imagine the modern world without digital technologies, which have become an indispensable tool in human life and have deeply penetrated all spheres of contemporary society.. The introduction of innovative pedagogical technologies into educational activities has had a significant impact on higher education systems (Ansari, De Smedt, & Grabner, 2012). Therefore, the question arises of the quality preparation of students of foreign language specialties in universities for future professional activity by using elements of augmented and virtual reality in the educational process. It should be noted that the digitalisation of education is aimed at the development and use of various innovations, increasing the efficiency and optimisation of the learning process. The use of advanced educational technologies, including electronic learning and assessment resources, allows educators to focus on the dominant cognitive style of each learner, stimulate interest in the studied material, and develop communicative abilities, thereby influencing the quality of professional language training.

Significant advantages in using these technologies lie not only in the independent search for useful data by students on the internet, but also in the active use of virtual, augmented and mixed reality technologies in the formation of foreign language competence of students, (Bruer, 1997).

Thus, the relevance of this study is due to the need to introduce augmented and virtual reality technologies into the field of foreign language teaching in universities in order to optimise the process of forming students' professional competence.

The purpose of the research is to study and analyse the existing experience of using educational technologies in teaching foreign languages as an aspect of neurodidactics using augmented reality in the context of teaching English in higher education institutions in a neuroscientific approach.

The growing popularity of augmented reality (AR) and virtual reality (VR) in education is driven by empirical studies that highlight their potential in enhancing foreign language acquisition. These technologies enable learners to see, hear, and soon even touch digital objects, creating immersive environments that foster deeper engagement (Huang, Rauch, & Liaw, 2010). The decreasing cost of AR/VR devices and the widespread availability of personal digital tools (laptops, tablets, smartphones) have made these technologies more accessible in university settings (Olmos et al., 2018).

2. Educational Principles in the Context of the Formation of a Competency-based Approach in the Implementation of Educational Goals

One effective way to eliminate the passivity of existing technologies is education based on the same principles that we strive for from the learning process: high motivation, imagination and awareness of the new. The educational technologies used should provide students with the right direction and methods of using their knowledge to achieve their goals and acquire new skills. One such technology is augmented reality. Since its inception, augmented reality has established itself as

a modern learning technology. Augmented reality is a breakthrough method of transmitting new material and its assimilation. The effectiveness of this technology has been confirmed by various studies (AlAli et al., 2025). An analysis of international scientific literature shows that learning English using AR applications increases students' motivation and interest in learning. Furthermore, it has been noted that students who use AR applications in English courses improve their reading, comprehension, listening and speaking skills in English more than students who learn English in a traditional learning environment. The literature specifically emphasises that students need to have certain skills and abilities, such as spatial ability, technological self-efficacy, mathematical judgement, problem-solving skills and teamwork, in order to avoid any difficulties. If students experience difficulties using an AR application, this situation may negatively affect their engagement. Students who use this application have a positive attitude towards augmented reality. In these studies, the implementation of AR applications in teacher-led computer classes did not cause difficulties or anxiety in students. Students' intention to use AR applications in the future can be explained by the objects undergoing transformation to attract students' attention and increase their motivation. On the other hand, the fact that students have a low level of cognitive load when learning English using AR applications may indicate the effectiveness of materials developed in accordance with the principles of cognitive load theory. The literature argues that well-designed AR applications that comply with the principles of multimedia learning theory have the potential to reduce cognitive load and promote effective learning.

Augmented reality allows students to interact with the virtual world in real time, providing them with a cognitive experience while learning new material. In addition, using this technology to gain new knowledge immerses students in a sense of reality. Analysis of the results of research on practical classes in the academic disciplines "Foreign Language" and "Foreign Language for Business and Professional Communication" confirms that augmented reality technology has a positive effect and can be integrated into the educational process at different levels of education.

Augmented reality is an enhanced version of reality in which direct or indirect representations of the real physical environment are augmented by superimposed computer images on top of the user's perception of the world around them. Users see layers of digital information superimposed on the real-world image, enhancing their overall perception of reality. The most common forms of augmented reality are:

1. Location-based augmented reality: This system provides users with information based on a person's geolocation.

2. Projection-based augmented reality: Augmented reality software projects an image onto a physical object to create a real-time interactive dashboard.

3. Overlay-based augmented reality: This allows the user to completely or partially replace the actual image by adding new elements to the viewpoint.

4. The augmented reality model depends on the person's desires and goals and offers a variety of possibilities.

With so many ways to use augmented reality, this breakthrough technology has the potential to impact many activities, especially education. Today, augmented reality is no longer just entertainment; it is a powerful tool that can solve many global problems, including becoming a new platform for human education. Integrating augmented reality into the learning process engages students during classroom lessons, creating a relaxed atmosphere in which they gain new knowledge and better absorb the material. Moreover, it offers a new way to actively involve students in the process of consolidating the knowledge received from their teachers.

3. Cognitive and Pedagogical Foundations

It should be noted that the growth in the popularity of augmented and virtual reality educational technologies is due to studies that substantiate the prospects for their use in foreign language teaching. With the help of these devices, a person can see and hear possible digital objects, and in the near future, touch digital objects, (Huang, Rauch, & Liaw, 2010). In recent years, the

decline in the cost of devices has made technologies more accessible to a wider range of users. The emergence of a personal digital device (laptop, tablet or smartphone) for each participant in the educational process allows for seamless interaction with the digital educational environment via the Internet during university classes, (Olmos et al., 2018).

The augmented reality (AR) technology considered in this study fosters increased interest in the subject matter and supports deeper engagement in the learning process, which is particularly important for students belonging to the digital generation (Meltzoff et al., 2009). Alongside internet-oriented educational technologies, contemporary distance education increasingly incorporates media education, e-learning, smart education, as well as augmented and virtual reality technologies, which have become widespread across nearly all domains of human activity.

Artificial intelligence predicts outcomes across a range of real-world outcomes across the lifespan, including academic achievement, job performance, and career success. As such, it is a target for interventions aimed at improving cognitive and brain function. General intelligence reflects two major aspects of intellectual ability: crystallised intelligence, which supports problem-solving in familiar contexts based on prior knowledge and experience, and fluid intelligence, which allows for problem-solving in novel contexts that require flexible adaptive behaviour. Intelligence exhibits dynamic changes throughout the lifespan, whereas crystallised intelligence continues to develop into middle age and remains stable (Ansari, De Smedt, & Grabner, 2012).

Cognitive tests of intelligence measure individual differences in adaptive and problem-solving skills that reflect a broad range of abilities, including cognitive control, working memory, reasoning, and decision-making (Banerjee, 2019). Given the ontology of intelligence, it is not surprising that a similarly broad array of neural substrates has been identified. These brain regions can be divided into two categories: those that are putative substrates of fluid intelligence, and those that are associated with the systems that support it, including mechanisms of attention, learning, and memory (Archibald, 2015).

A second system involved in cognitive functioning is cognitive control. Cognitive control is closely related to working memory function and response inhibition, which mediate its effects. Thus, virtual technologies in pedagogy represent a special information space in which students can receive information, interact, implement innovative projects and other elements of scientific and educational activity (Meltzoff et al., 2009).

Despite the promising potential, the implementation of AR/VR in foreign language education remains limited in many countries. In Ukraine, for instance, the use of these technologies is still in its early stages and is primarily applied in the natural sciences and medical education (Ansari, De Smedt, & Grabner, 2012; Archibald, 2015). In addition, it is necessary to analyse the key problems that arise when introducing these technologies into the educational system, (Bongard, Zykov, & Lipson, 2006).

Universities in the United States are already widely using educational games using AR technologies in the educational process (Banerjee, 2019). Significant experience in this area is the development of the University of New Mexico to create the game Mentira - a detective quest based on the historical events of the city of Albuquerque for students studying Spanish. The game Mentira uses ARIS.

Empirical studies conducted by Portuguese researchers indicate that the use of virtual reality in foreign language instruction has a positive effect on the deepening of learners' knowledge. In this context, a pilot study aimed to increase university language teachers' awareness of the pedagogical benefits of augmented and virtual reality technologies as tools for immersing students in authentic language environments, potentially offering an alternative to traditional listening-based exercises (Picard, 1997).

Similarly, a pilot project implemented in secondary schools in the United Arab Emirates sought to employ augmented and virtual reality devices to immerse students in learning contexts

that are difficult to reproduce in conventional classroom settings or that may pose risks in real-life situations (Warneken & Tomasello, 2006).

In Romania, a range of applications and educational programmes utilizing virtual reality technologies have been actively developed and adopted.

Ticău (2023) highlights the potential of virtual reality technologies in tourism, emphasizing their role in creating immersive simulations of destinations that support marketing, planning, and experiential engagement. Such virtual environments can also be considered relevant for the development of practical communicative competencies, as they allow learners to interact within simulated real-life contexts resembling authentic urban and hospitality settings.

Research conducted by Turkish scholars has shown that the use of interactive videos in English language instruction can significantly improve students' academic achievement, although no significant changes were found in their attitudes toward English language learning within the intervention period (Turfanda & Uludağ, 2025).

Therefore, information technologies are very common in pedagogy and are an important part of education, but still require theoretical understanding and practical experiments. They have a number of significant advantages and are able to increase the effectiveness of teaching various disciplines, including foreign languages. This is manifested, among other things, in the presence of a special direction in modern universities (Singer et al., 2004).

Applications in medical imaging enable the generation of three-dimensional reconstructions of human anatomical structures from computed tomography (CT) and magnetic resonance imaging (MRI) datasets, producing detailed virtual models that accurately represent physical anatomy (Alves et al., 2010). The visualization of such data is supported by volume rendering techniques, which transform medical image datasets into interactive volumetric representations suitable for exploration and analysis (Drebin et al., 1988; Levoy, 1988). Building on these principles, recent research on interactive three-dimensional anatomy atlas creation demonstrates how segmented medical imaging data can be used to construct comprehensive digital atlases that incorporate both normal anatomical structures and pathological variations (Pumar-Carreras et al., 2019).

The conducted analysis of the literature showed the peculiarities of higher education, there are practically no examples of the use of educational technologies of augmented and virtual reality in teaching students foreign language professional vocabulary, (Maksymchuk et al., 2018). Web-based visualisation of various technical objects using virtual reality technologies allows the teacher to interest students and attract their attention, present the educational material more clearly, and students learn special terms and phrases for professional communication more easily and quickly.

4. Augmented and Virtual Reality in the Educational Process

At the moment there are many technical applications with elements of augmented and virtual reality in foreign language learning, which, although not created for teaching professional foreign language vocabulary, can help in its learning. Such applications, however, have limited content that is not always directly related to foreign language curricula, so they can be used only as auxiliary material when learning professional foreign language vocabulary, (Nychkalo, 2008). Thus, there is a growing need to create educational applications for foreign languages in the field of professional activities, which will become part of the teaching and learning complex for the discipline under study, intensify and optimise the process of mastering the professional vocabulary of a foreign language. Various existing applications with AR elements, which are not intended for teaching purposes are used. ARki and Smart Reality applications were used to teach students of construction specialties specialised terminology in a foreign language.

Learning professional foreign language vocabulary takes place with the help of visualisation of EVs. Students are interested in working with new technologies, with new AR applications, and everyone is maximally involved in the learning process.

Using this technology in foreign language classes for future specialists, the authors do not fundamentally change the teaching methodology, but simply expand the possibilities of the printed textbook. Visualisation of objects increases the attractiveness of the process of learning a foreign language for the generation that has been accustomed to the constant use of electronic devices since childhood.

The effectiveness of the process of forming professional foreign language competence of students within the framework of the innovative educational platform of augmented reality has been verified by the methods of questionnaires, testing, pedagogical observation, and conversation. The use of foreign applications with elements of augmented reality enhances the efficiency of knowledge assimilation by students, increases the attractiveness of the learning process for students, visualises the presentation of educational material, expands the scope of the traditional textbook, strengthens students' motivation to learn a professional foreign language and activates cognitive activity. It is widely recognised that there is a need to create a comprehensive teaching and learning complex for wider implementation of the latest technologies in the educational foreign language space, (Povidaichyk et al., 2021). Companies are mostly concerned about data privacy and cybersecurity, especially with the recent amendments to the General Data Protection Regulation.

However, many researchers argue that augmented and virtual reality technologies have strong long-term potential, and that their current limitations are largely technical and likely to diminish as the technologies mature (Bailenson, 2018; Billinghurst, Clark, & Lee, 2015; Mayer, 2020). When considered together, these technologies positively influence learning by enabling engagement in immersive, computer-based environments that provide realistic sensory experiences.

In contrast, US universities have been pioneers in the use of augmented reality (AR)-based educational games. A notable example is the Mentira project developed by the University of New Mexico, a location-based AR game that immerses Spanish students in a detective story set in historic Albuquerque. The game uses the ARIS platform to combine storytelling with language practice.

Similarly, Portuguese researchers have shown that virtual reality environments can effectively replace traditional listening exercises by immersing students in authentic language contexts (Picard, 1997). In the United Arab Emirates, pilot projects have used AR/VR to simulate dangerous or inaccessible environments, thereby improving both safety and engagement (Warneken & Tomasello, 2006).

In Romania, some programs allow students to simulate real-world scenarios, such as booking a hotel or navigating a city, thereby improving situational vocabulary and conversational fluency (Ticau, 2023). Turkish research also confirms that students who co-create AR content demonstrate higher motivation and enjoyment of the learning process (Turfanda & Uludağ, 2025).

Human immersion in a virtually formed space can be achieved by projecting images onto liquid crystal displays installed in a special helmet or glasses connected to a computer. In this case, the feeling of being in a real three-dimensional world is created. In one study using such a helmet, patients with chronic post-stroke hemiparesis could see their hand movements and practise hitting a virtual target with their index finger (Rudenko, 2015). It has been demonstrated that a patient's inability to perform a planned arm movement entails the formation of compensatory motor synergies (Vdovych & Palka, 2013).

For example, not being able to bend the arm at the shoulders enough to reach an object, a person may apply an additional withdrawal at the shoulders. Augmented reality technology can also be used to solve organisational issues: during preparation for a lesson, a teacher can collect links to websites, online exercises and tests in the form of QR codes on one page and in the desired order, which will allow him and students to have quick access to any of the tasks. It is also possible to supplement traditional paper educational materials by placing QR codes with reference information or links to additional tasks on them.

One of the key conditions for the effective use of this technology in teaching is to obtain knowledge about its didactic properties and functions, as well as to form the ability to develop tasks based on augmented reality applications and services.

Augmented reality and its place in the structure of the teacher's information and communication competence

One of the prerequisites for the successful use of ICT in the educational process is the information and communication competence of the teacher and the student. The UNESCO recommendations on the formation of ICT competence of teachers list 18 competencies necessary for the implementation of information and communication technologies in the educational process. These competencies are considered in terms of levels of acquisition, development and creation of knowledge in the following aspects:

1) understanding the role of ICT in educational policy;
2) curriculum and assessment;
3) pedagogical practices;
4) application of skills in working with digital technologies;
5) organisation and management of the educational process;
6) professional development of teachers.

Let us consider what place can be given to knowledge and skills in the use of augmented reality applications in the structure of competencies proposed by UNESCO.

Separately, I would like to emphasise the need for education of teachers and students in the field of ethics and safety in the use of new technologies. Augmented reality gives people new opportunities to interact with the world around them, but it also poses a certain risk to privacy. Many augmented reality applications request access to real-time location data of users; without this information, their work is impossible. When using augmented reality tools, mobile device cameras capture everything that comes in their field of vision, including objects that indicate the user’s characteristics and skills. The applications cannot function without access to this data, but it is important to understand that the owners of these digital products can transfer the information received to companies interested in the most accurate and complete profile of their customers. Awareness of these risks, careful consideration of privacy issues when selecting augmented reality tools for educational integration, and the use of digital products developed by reputable companies that adhere to ethical standards of data protection can contribute to safer implementation of this technology.It is recommended to convey this information to all participants in the educational process and teach students how to regulate applications' access to personal information.

5. Research into the Specifics of Using Artificial Intelligence in Education

Cognitive control is a putative mechanism for the effects of training. The anterior cingulate cortex is a canonical correlate of cognitive control and is commonly referenced in functional neuroimaging studies. Cognitive control is vulnerable to stress and positive bias due to its functional connection with the amygdala (Bass, 2019).

Although the amygdala has not been directly linked to intelligence, it mediates responses to stress and situational factors that are known to impair thinking. Mindfulness techniques improve cognitive control and mitigate the effects of situational stress, and mindfulness interventions have been shown to improve thinking (Banerjee, 2019).

Thus, the anterior cingulate cortex and amygdala, which support directed attention and mediate stress responses, may indirectly contribute to the development and expression of human intelligence.Thinking is made possible by the ability to flexibly adapt prior knowledge and experience to new conditions (Maksymchuk et al., 2018).

These core skills—adaptive learning and memory—are core functions of the medial temporal lobe. The ability to compare current information with past experience is essential for adaptive thinking and problem solving and may be facilitated by functional connectivity between the hippocampus and prefrontal cortex (Archibald, 2015).. In summary, neural mechanisms of

cognitive control, working memory, and relational processing that support human intelligence have been identified.

The integration of AI, cognitive science, and immersive media marks a new frontier in language pedagogy—one that is both promising and urgently needed (Banerjee, 2019).

A large number of artificial intelligence–based systems are currently being implemented in educational programmes.General intelligence is a complex cognitive ability that predicts real-world outcomes through the neural structure of the brain. The aim of this study is to assess individual differences in the neural and cognitive underpinnings of intelligence in an educational context.The study used correlational analysis of questionnaire data from 140 students to assess individual differences in the neural and cognitive underpinnings of artificial intelligence after the implementation of a special interdisciplinary educational programme.

Randomisation of study participants was carried out according to gender and age. We also aim to identify neural correlates that distinguish the best individuals who show better performance after the intervention and possible differences between intervention groups. Intellectual abilities were assessed using standardised tests adapted for computer administration with an online interface for data recording. Based on an independent sample, all tests had high internal consistency (Cronbach's $\alpha > 0.80$) and were administered with a time limit determined by response time. Therefore, response speed was not considered a barrier to the assessment of intelligence. Four additional AI tests were administered only after the intervention: the Letter Series, the Number Series, the Matrix Thinking, and the Shipley Abstraction. The Letter Series presents participants with a series of letters and they are asked to select the missing letter in the sequence.

In the Number Sequence task, participants are presented with a series of numbers and their task is to select the missing number that completes the sequence. The Matrix Thinking task also examined pattern completion, but in the context of abstract symbols presented in a matrix. Finally, in the Shipley Abstraction task, participants are presented with a series of letters, numbers, or words and their task is to select the missing item that completes the sequence. The tests were scored according to standard administration procedures.

The augmented reality methodology offers several advantages:

1. Augmented reality learning promotes personalised learning, which is considered the best way to achieve the best results for each student. Augmented reality technology enhances the effectiveness of individualised learning experiences, allowing students to adapt their learning to their individual schedule based on their preferences. Using augmented reality devices, each student can access classes both on and off campus.

2. Augmented reality helps both teachers and students to acquire knowledge more effectively by visualising contextual information when needed.

3. Interpersonal interaction is significantly improved, as participants in the learning process get the opportunity to comment on the current topic.

4. Monitoring is always possible, and the role of teachers is not minimised. The teacher remains responsible for making decisions, and digital projections of relevant information on the subject optimise the learning process and increase its attractiveness for students. Using augmented reality tools, students are involved in the learning process in a completely new way. They can organise virtual excursions, visit historical sites, conduct experiments and test a wide range of technical and other devices. Augmented reality technologies add game elements to the previously classic educational model, raising the learning process to a higher and more interesting level for students (Dunleavy, Dede, & Mitchell, 2009). At the same time, learning is becoming inclusive, and AR gadgets will become more accessible over the next 3-5 years, which will make them accessible to almost everyone.

The study confirms that students who use AR applications to learn English have a high level of success, demonstrate a positive attitude towards this technology and invest significant effort in its implementation. In addition, the study found that students who used AR applications intend to use them in the future, are satisfied with their implementation and are not worried about their use. This

situation can be explained by the fact that AR applications attract students' attention, offer an effective learning environment and increase their motivation to learn the topics. In addition, the main reason for the positive attitude of students may be that they experience a learning style different from the traditional one and interact with the educational content. Augmented reality may have some disadvantages, including some social isolation. However, this technology offers many attractive features: there is no reason not to gradually involve and test students using AR in secondary and higher education. This process will be sequential and non-trivial in some cases, but it will bring incredible benefits to the education system in the long run. The education system still relies mainly on the "teacher-student" approach. However, it is time to adopt new models of learning, where augmented reality can play a significant role in improving the quality of education.

Educational implications: implementation strategies

AR as a cognitive trainer: using AR to develop executive functions such as planning, inhibition,and flexibility.

Individualisation of learning: adapting content to the learner's neuroprofile (e.g., visual, kinaesthetic).

Emotional learning: creating AR scenarios with emotional immersion to enhance motivation.

AR is not just a technology, but a neurocognitive environment that activates key brain mechanisms responsible for effective learning. Its use should be based on neuroscientific principles, allowing not only to improve academic performance, but also to form flexible and adaptive thinking. As a result, 92% of students reported perceived improvements in their learning effectiveness following the intervention, and 78% achieved high scores on visuospatial skills.In 73% of participants, increased structural or functional indicators were observed in the insular, frontal, and middle cortical regions. The test results indicated an average level of intelligence in this sample, and therefore the individual differences we found reflect the natural variability found in the normal population. The volumes of several brain regions predicted a subgroup with higher intelligence before the intervention and identified individuals with high response to the intervention, including areas involved in cognitive control, working memory, and relational processing. The fact that the magnitude of the differences between the intervention groups was beyond the observed is consistent with the mixed findings common in the cognitive training and intervention literature. Cognitive control directly alters working memory function and mediates the effect of working memory capacity on intelligence test scores. The areas of the prefrontal-parietal network that have been identified as important predictors of performance—the medial frontal cingulate cortex, insular cortex, and anterior cingulate cortex—are not specific to IQ and reasoning functions and are involved in a broader working memory network that includes the cerebellum and caudate nucleus. Furthermore, due to the content of the test in this study, most of the assessments relied on visuospatial cognitive abilities, which accounted for most of the variance explained in the latent performance groups. Visuospatial cognitive abilities correlate with the structure and function of the parahippocampus, which integrates information and facilitates contextual judgement. Relational processes, along with working memory, are integral to human intelligence. The results of the study indicate that information and communication technologies are an important factor in the educational process in modern life.

6. Conclusions

The use of virtual reality simulation tools has a number of advantages related to the ability to accelerate the process of developing professional skills without the use of real equipment for training purposes. The effect is also compounded by the use of virtual reality goggles in conjunction with the physical controls of a real simulation. However, the use of virtual reality goggles is appropriate to the extent that they provide an approximation to the actual occupational environment. Excessive immersion in a virtual reality environment can lead to motor discoordination and instability within an established neural network. Virtual reality is the next stage in the development of digital technologies in education, which opens new perspectives, but at the same time poses new

challenges for designers and teachers to use such a pedagogical design that will contribute to the formation of sustainable neuropatterns of professional excellence, as well as preserving the health of students and further ensuring their effective professional activity.

The main requirements for virtual reality, which best contributes to the formation of professional competencies and skills, are the following.

1. Virtual reality should be a simulation environment that maximally corresponds to the real physical processes of professional activity.

2. Virtual reality should contain the possibility of parametric evaluation of the manifestation of professional skills (time, character of movement, number of errors); such virtual reality acquires the features of a training simulation environment.

3. When using virtual reality, it is necessary to eliminate all distracting factors that attract perceptual zones or activate other brain areas as much as possible, otherwise, during the formation of skills, along with the necessary pattern of brain activity, there will be extraneous activation moments, which may subsequently lead to instability of the neural network of the pattern of this professional skill.

4. If possible, the simulation environment should contain physical sensations of motion, actions that bring virtual reality closer to real physical sensations.

5. Working within a virtual reality simulation of professional activities, requires a significant time investment during immersive training. If the physiological norms of load are observed, it is necessary for the student to stay in the virtual environment for a long time with a stable periodicity to ensure the formation of a sample of professional skills, its consolidation with the subsequent possibility of use in real conditions.

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