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OPPORTUNITIES AND RISKS OF THE METAVERSE IN THE CONTEXT OF DIGITAL UNIVERSITY DEVELOPMENT

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The article is devoted to the study of the opportunities and risks of using the metaverse in the context of digital university development. The primary **aim** is to identify the potential of the metaverse as a tool for transforming the educational process in higher education, to analyze the challenges associated with implementing virtual and augmented reality technologies, and to substantiate the pedagogical conditions for their effective use. To achieve this aim, a set of theoretical and empirical research **methods** was used. The theoretical analysis of scientific literature allowed us to identify the main directions of digitalization of higher education and the principles of formation of an immersive educational environment. Statistical sources and analytical reports of international companies made it possible to assess the dynamics of the metaverse market development in the educational sphere. The generalization method helped to formulate conclusions about the role of the digital university as a new generation institution. **Results.** The study has confirmed that the use of AR/VR technologies and the integration of artificial intelligence contribute to the personalization of learning, increase student motivation, and create new models of interaction in the learning environment. The metaverse allows students to immerse themselves in simulated situations that are close to real professional experience. At the same time, a number of risks have been identified: digital dependence, shifting emphasis in content, information manipulation, insufficient regulatory framework, and the need to improve the digital competence of teachers. The article also emphasizes the importance of ensuring ethical standards and preserving academic autonomy in the context of full or partial virtualization of education. The **conclusions** substantiate the expediency of implementing metaverse technologies in the system of digital higher education, with a comprehensive approach to the technical, methodological, legal, and ethical support of this process. The metaverse is viewed not only as a technical innovation but also as a new form of organizing educational space that requires a deep rethinking of the role of the university in the digital age.

Keywords*: digital university, virtual education, immersive technologies, augmented reality, digital transformation, digitalization.*

МОЖЛИВОСТІ Й РИЗИКИ МЕТАВСЕСВІТУ У КОНТЕКСТІ РОЗВИТКУ ЦИФРОВОГО УНІВЕРСИТЕТУ

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Статтю присвячено дослідженню можливостей і ризиків використання метавсесвіту в контексті розвитку цифрового університету. Основною **метою** є виявлення потенціалу метавсесвіту як інструменту трансформації освітнього процесу у вищій школі, аналіз викликів, пов'язаних із впровадженням технологій віртуальної та доповненої реальності, а також обґрунтування педагогічних умов їх ефективного застосування. Для досягнення поставленої мети використано комплекс теоретичних і емпіричних **методів** дослідження. Теоретичний аналіз наукової літератури дозволив виявити основні напрями цифровізації вищої освіти та принципи формування імерсивного освітнього середовища. Статистичні джерела

та аналітичні звіти міжнародних компаній дали змогу оцінити динаміку розвитку ринку метавсесвіту в освітній сфері. Метод узагальнення сприяв формулюванню висновків щодо ролі цифрового університету як інституції нової генерації. **Результати**. Дослідження підтвердило, що використання AR/VR-технологій та інтеграція штучного інтелекту сприяють персоналізації навчання, підвищенню мотивації студентів, а також створенню нових моделей взаємодії у навчальному середовищі. Метавсесвіт дозволяє занурити здобувачів освіти у змодельовані ситуації, які наближені до реального професійного досвіду. Разом із тим виявлено низку ризиків: цифрову залежність, зміщення акцентів у контенті, маніпуляції інформацією, недостатню нормативно-правову базу, а також потребу в підвищенні цифрової компетентності викладачів. У статті також наголошено на важливості забезпечення етичних стандартів і збереження академічної автономії в умовах повної або часткової віртуалізації навчання. У **висновках** обґрунтовано доцільність впровадження технологій метавсесвіту в систему цифрової вищої освіти за умови комплексного підходу до технічного, методичного, правового та етичного супроводу цього процесу. Метавсесвіт розглядається не лише як технічна новація, а як нова форма організації освітнього простору, що потребує глибокого переосмислення ролі університету в цифрову епоху.

***Ключові слова**: цифровий університет, віртуальна освіта, імерсивні технології, доповнена реальність, цифрова трансформація, діджиталізація.*

Introduction. In the modern world, the rapid development of digital technologies is significantly transforming the educational landscape, promoting the implementation of innovative approaches to learning. One of the most promising concepts is the metaverse, a virtual environment that combines the real and digital worlds, creating new opportunities for the educational process.

According to Future Market Insights, the global metaverse market in education was valued at USD 3.9 billion in 2024 and is projected to grow to USD 98 billion by 2034, with a CAGR of 37.9% (Global News, 2024). The growth of investments in this area is due to the active implementation of innovative technologies in the learning process, including virtual and augmented reality tools.

Thus, the implementation of augmented reality (AR) and virtual reality (VR) technologies in education opens up new horizons for creating interactive and immersive educational environments. Students can participate in virtual laboratory works, visit historical sites, or conduct scientific experiments in a safe digital space. Such approaches not only increase student engagement and motivation but also contribute to a deeper understanding of the material.

However, along with the opportunities, the integration of the metaverse into education also poses certain challenges. These include the need for significant investment in technological infrastructure, ensuring equal access to the latest technologies for all students, and the development of new pedagogical methods adapted to the virtual environment. In addition, an important aspect is the issue of data security and privacy in the digital space.

In this context, there is a need for a systematic analysis of the opportunities and risks of using the metaverse in the educational process of a digital university.

The aim of the article. The aim of the article is a comprehensive study of the potential of the metaverse as a tool for transforming higher education in the context of digitalization, as well as identifying the key opportunities and risks of its implementation in the activities of a digital university. Particular attention is paid to the analysis of changes in the content, forms, and methods of learning, the role of the teacher, and the ethical and regulatory challenges that arise in the process of integrating the virtual environment into the modern educational space.

Presentation of the main material. The study of the peculiarities of modern higher education in the context of the formation of the metaverse should begin with a conceptual analysis of the very concept. The focus is on transforming the virtual space from an information environment into a full-fledged digital world in which active social, economic, and educational interaction takes place. Thus, the concept of the “metaverse” was the basis of Facebook’s rebranding strategy, called “Meta”. The main focus of its activities is aimed at creating a metaverse as a new format for the existence of a digital person in the global 3D Internet (Heath, 2021).

According to M. Zuckerberg, over the next decade, the metaverse will become a space where most users will spend a significant part of their time in a fully immersive three-dimensional digital environment. This space will include both Meta devices (e.g., Quest) and hardware solutions from other manufacturers. To implement this model, various cognitive and technological practices are used, including augmented reality (AR) tools – which complement the physical world with virtual elements – and virtual reality (VR), which creates a completely artificial environment as close to the real one as possible (Vision Protiviti, 2025).

The convergence of AR/VR technologies with the physical world creates a new type of environment that changes the nature of communication between people. In the metaverse, interaction takes place through digital avatars – virtual reflections of the personality. The further development of technologies implies the formation of a complex digital world with its economy, management systems, norms of behavior, legal regulation, and

social and cultural practices. In this space, users can create, exchange, use, and consume digital products, build new forms of entrepreneurship, communities, and even educational systems (Bobro, 2025).

The metaverse covers all spheres of a single social space and represents them in the virtual plane. Key sectors should be represented here: healthcare, science, culture, leisure, business, education, etc. This list is not exhaustive (Kozhyna, 2022), but the role of education as one of the fundamental components of this digital landscape is undeniable. In this context, the digital university plays a key role as a platform for integrating knowledge, technology, and values, capable of ensuring sustainable personal development in the new virtual reality.

One of the leading areas where the metaverse demonstrates its high potential is the higher education system, which is actively integrating with various virtual reality technologies. The implementation of the educational process in the space of the metaverse is an important strategic direction of modern university digitalization. However, the complete transition of university education to an exclusively virtual format is currently impossible, given the significant organizational, technological, psychological and pedagogical barriers (Lopuschnyak et al., 2021).

Modern information and communication technologies already have a significant impact on the content, forms, and methods of university education. In a modern university, the role of multimedia, interactive, gamified educational technologies is growing, gradually replacing classical methods of knowledge transfer, including the assimilation of information through linear textbooks. Today, the key focus of the educational process is on project activities, independent research, teamwork, and creative solution finding. These transformations require the formation of a specialized interdisciplinary environment capable of combining the advantages of traditional forms of education with the modern capabilities of the metaverse. For this purpose, it is important to implement expert methodologies for analyzing and designing educational content (Skliarenko et al., 2024).

Informatization of the educational space has increased attention to online learning opportunities and, at the same time, changed the attitude of society to the very concept of "knowledge". On the one hand, there are unprecedented opportunities for self-study, lifelong learning, and individual educational trajectories. On the other hand, it strengthens the role of universities as professional institutions that act as fulcrums in the boundless information space of the metaverse. After all, scientific and educational knowledge is always based on historically established traditions and requires a systematic and critical approach for their further development.

The metaverse significantly expands the existing transformations in higher education. In a digital university, students are able to directly immerse themselves in physical or chemical processes, visualize historical events, observe atomic reactions or cosmic phenomena, and conduct virtual experiments, including dissection, using applications such as Froggipedia.

The use of artificial intelligence and Big Data technologies allows the collection and analysis of information about students' academic achievements and individual characteristics, creating the most personalized learning paths. The metaverse allows the creation of educational scenarios that meet the interests of a particular student, increasing their motivation to learn. The approach to knowledge assessment is also changing significantly: on the one hand, it is becoming interactive and gamified, and on the other hand, it brings educational tasks as close as possible to real life conditions where the knowledge gained is of practical value (for example, first aid, driving vehicles, or conducting laboratory experiments).

Another feature of the metaverse is that it largely blurs the boundaries between different subject areas. This aspect is especially important for a digital university, where students' interest in interdisciplinary knowledge and integrative education areas is formed.

A serious challenge in the transition to learning in the metaverse is the change in the role of the teacher. The teacher of a digital university is no longer just a carrier and translator of knowledge. Their usual functions include the roles of scriptwriter, director, and educational content designer. Training of pedagogical staff with such new digital competencies should begin today.

In the digital educational environment, the teacher is no longer the only source of knowledge and experience. However, it is the teacher who can see the educational process in a broader context – not just a single topic or specific example but the subject area as a whole.

It is also impossible to abandon the idea of the hermeneutic circle, which reflects the relationship between part and whole, between interpretation and understanding. This idea is the basis of a quality educational process: to understand the whole, you need to know the parts; to understand the parts, you need to realize the whole. Any intellectual activity in a digital university is based on a clear system of concepts that defines thinking strategies and conceptual approaches. These approaches and strategies can be changed to adapt to the new realities of the metaverse, but it is impossible to abandon the foundation on which each subject area has historically been formed.

In the process of digitalization of university education, it is the teacher who remains the one who possesses the integrity of knowledge that students do not yet have, and this is one of their

key functions in the metaverse (Kolodinska et al., 2022).

The organization of the educational process during a pandemic has created a number of problems not only of a technological but also of a purely psychological nature. A natural question that arose among pedagogues in different countries was the possibility of transferring the principles of managing group dynamics and engaging students from an offline space to an online environment (Khomenko et al., 2024). This is where the use of metaverse technologies demonstrates significant practical interest.

However, metaverse tools, like other new digital technologies, carry the risk of replacing many of the natural cognitive functions of the human brain. Digitalization has reduced the need to memorize large amounts of information: it is enough to simply search the Internet. There is no longer any need to navigate the terrain – a GPS navigator will always help. In this regard, some experts talk about the phenomenon of "digital dementia". For example, German psychiatrist M. Spitzer believes that "digital dementia", which occurs due to a decrease in intellectual load on the brain, is a dangerous condition for a modern person (Yahodzinskyi, 2015).

Another significant problem is the insufficient study of the impact of education in the virtual space on students' cognitive processes and psyche. The mixing of virtual and real experiences can potentially lead to the emergence of dangerous patterns of behavior in everyday life. It is clear that an unsuccessful chemical experiment in the metaverse and the real world will have completely different consequences. The results of research on the impact of video games on human behavior show that such user experience shapes attitudes: "The easiest way to succeed is through trial and error. It's the only way to move forward in most games, even if, in the end, losing patience, the user turns to the manual or repeats the actions of others in difficult situations" (Kubiv et al., 2022). The experience of the metaverse engages the user's senses much more strongly, providing a deep immersion that is much more intense than when using conventional computer games. It is not always easy for the brain to distinguish between the experience gained in the metaverse and reality. At the same time, modern technologies allow the use of special suits with full-body movement tracking, providing a full range of tactile sensations without leaving the room. Accordingly, the impact of such experience on a person is significant, and behavioral changes can be much more noticeable. However, the study of this phenomenon, as in the case of video games (Lopuschnyak et al., 2021), is a very complex and time-consuming process.

Within the metaverse, specialized digital content filtration systems are being formed, and tools for uniting target audiences within the new virtual reality are being created. Despite its seeming openness and freedom, this digital ecosystem is deeply dependent on those who determine what content will be available in the virtual space, as well as on developers who technologically shape user behavior and their dependence on the digital environment. If necessary, any user can simply be disconnected from participation in the information process. Thus, in practice, the metaverse may not be so boundless and not necessarily a free space.

For a digital university, this means the need to critically reflect on the principles of accessibility, openness of knowledge, and academic freedom. After all, educational content posted in the metaverse can be integrated into broader ideological or information flows, which threatens to shift emphasis, manipulate facts, and form a distorted worldview. This is especially evident in the humanities, such as history, literature, law, and pedagogy, but similar challenges also affect the natural and technical disciplines. For example, educational content can artificially emphasize the achievements of some scientists and silence the discoveries of others, which leads to the formation of a distorted scientific picture of the world. In extreme cases, this can take the form of the so-called "cancel culture", when scientific results are ignored because of the author's background or social affiliation.

As the metaverse market develops, the relevance of analyzing its ethical aspects is growing. According to researchers, the main threats are related to the possible degradation of moral guidelines in the virtual world, blurring of personal identity, which in the future may have negative consequences for physical reality (Kozhyna, 2022). Overcoming these threats requires the formation of a new socio-humanitarian rationality, which should become the basis for rethinking the logic of the functioning of technology companies that create the infrastructure of the metaverse.

One possible solution is to create new forms of digital "social contracts" and codes of ethics that will define the principles of interaction in the digital environment. Thus, in the field of artificial intelligence, the need to respect human rights, preserve human autonomy in decision-making, ensure freedom of choice, and protect intellectual potential as a systemic value of modern society has already been declared.

At the same time, regulatory frameworks play a critical role, which must be constantly updated according to the rapid development of digital technologies. Today, these technologies are reaching such a level of complexity that their creation and functioning may be difficult to understand even for specialists with a humanitarian education. In this context, law becomes especially important as a tool for protecting digital ethics, and teachers, as carriers of classical educational values, should

play a leading role in shaping students' critical thinking and resistance to information manipulation in the metaverse.

Conclusions. Summarizing the results of the research allows us to argue that the metaverse opens up new horizons for the digital transformation of higher education. Its tools can significantly expand the boundaries of the traditional educational space, providing flexible, interactive, and personalized learning based on virtual and augmented reality technologies, artificial intelligence, Big Data, and gamified approaches. A digital university within the metaverse can become a platform for implementing the concept of lifelong learning, developing interdisciplinary thinking, practical modeling, and new forms of interaction between participants in the educational process.

At the same time, the expansion of educational processes into the metaverse is accompanied by a number of significant risks and challenges that require systematic analysis. In particular, we are talking about the threats of losing critical thinking, reducing cognitive load, simplifying the concept of knowledge as such, as well as the risks of digital addiction, content manipulation, and changes in personal identity. Issues of ethics, information security, meaningful teacher autonomy, and protection of student rights and freedoms are of particular importance in the context of the formation of a virtual educational environment that can potentially affect real social and academic structures.

In the context of the formation of the metaverse, the digital university must not only integrate new technologies but also preserve its humanistic mission. This requires revising pedagogical strategies, updating the regulatory framework, implementing ethical standards, and creating educational models that balance innovation with academic depth. A special role in this process belongs to the teacher as a conductor of knowledge, values, and critical reflection on reality, including digital reality. It is the ability to combine tradition and technology that will determine the success of a digital university in the context of transformations caused by the development of the metaverse.

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