ОСВІТНЯ ДІЯЛЬНІСТЬ

DIGITAL AVATARS IN LEARNING AND KNOWLEDGE MANAGEMENT SYSTEMS

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*Annotation. The aim of the article is to study the concept of digital avatars and to substantiate their potential for optimizing the learning process and knowledge management in the context of information overload. **Research methodology.** The methods of logical generalization, structural analysis and comparative evaluation were used in the work. **Results.** The integration of digital avatars as a tool for personalizing educational content, modeling cognitive processes, and improving interaction between teachers and students is studied. Recommendations for the implementation of digital avatars to increase the adaptability of educational systems are developed. **Practical significance of the research results.** The proposed approaches help to increase the efficiency of the educational process through personalization of learning and improvement of knowledge management.*
Keywords: digital avatars, digitalization, personalized learning, digitalization of education, adaptive education.

General statement of the problem and its connection with the most important scientific or practical tasks. The rapid development of technology and the accumulation of knowledge in the era of information society are factors in the intensification of information processes, which creates the problem of limited human cognitive capacity. In particular, the ability of an individual to effectively perceive, process and apply extremely large amounts of information is limited by the cognitive capabilities of a person. This problem is actualized in the educational sphere, where traditional didactic models demonstrate a decrease in efficiency in the context of dynamic knowledge updating and a growing demand for adaptability and flexibility of the educational process.

Thus, there is an urgent need to develop innovative approaches to learning and knowledge management that would take into account the specifics of the cognitive processes of a modern person and ensure optimal knowledge acquisition in the context of information overload. A promising direction in this context is the integration of digital avatars – virtual models capable of processing large amounts of data, modeling students' cognitive activity and personalizing learning content according to their individual needs.

Analysis of recent research and publications. The problem of information overload and limited human cognitive capacity is actively discussed in modern scientific research. In the last century,

G. Woodill drew attention to the exponential growth of knowledge, which makes it difficult to acquire and apply it [1]. This problem is especially relevant in the educational sphere, where traditional approaches to learning are losing their effectiveness in an information explosion [2].

Researches by P.V. Huk and O.V. Skliarenko [3] emphasize the importance of modernizing educational systems using automated systems to improve learning efficiency. N.S. Bobro [4] analyzes the role of digital transformation and digital platforms in education, pointing to their potential for creating a flexible and adaptive learning environment. A. Krap et al. [5] consider the impact of digital technologies on management methods in the corporate sector, which can be useful for understanding the use of digital avatars in the educational context.

I. Kucherak [6] studies the impact of digital technologies on the formation of key competencies, and M. Marienko and A. Sukhikh [7] analyze the experience of using digital technologies in the educational process of the military academy. T. Wambsganss et al. [8] consider the use of machine learning to develop students' argumentation skills, which may be relevant for the development of digital avatars with enhanced cognitive capabilities.

At the same time, despite the active development of digital technologies in education, the use of digital avatars to model the cognitive processes of students

and personalize learning requires further study. In particular, it is necessary to develop effective methods of integrating data from various sources to create a complete digital profile of the student and algorithms for adapting learning content to the individual needs of students.

Formation of the objectives of the article (task statement). The aim of this research is to analyze the concept of digital avatars and determine their potential for optimizing learning and knowledge management processes in the context of accelerated growth of information.

Presentation of the main research material with full justification of the scientific results obtained. According to the concept of the "knowledge doubling curve" by G. Woodill, human knowledge doubled in volume for the first time by 1500, for the second time within 250 years, by 1750, and for the third time in 150 years, by 1900. During this period, the rate of knowledge growth was relatively slow, allowing society to gradually adapt to new information challenges. However, adaptation became more difficult when the doubling process was reduced to 25 years, peaking in 1950. Nowadays, this period is even shorter and is about 13 months. IBM's forecasts show that in the near future, human knowledge will double every 12 hours, which calls into question the ability of humans to adapt to such a rapid pace of change [1].

New knowledge is one of the prerequisites for the emergence of innovations, which leads to an increase in the relationship between information, technology, and learning and economic performance [9, p. 63]. However, in the modern world, education often lags behind business in realizing the potential of new technologies. However, there are several technological trends that can immediately have a positive impact on education.

In modern industries, the use of digital avatars, which are virtual models of processes, goods, or services, is becoming more widespread. These models allow for a wide range of analyses without the need to interact with physical objects. The results obtained can provide a deeper understanding of real objects and indicate the expediency of corrective actions. In this context, digital avatars act as an innovative tool for educational purposes: learning takes place not on a real object, but on its digital representation. Additionally, augmented reality (AR), mixed reality (MR), and virtual reality (VR) technologies significantly expand the possibilities of interacting with digital models, contributing to a more effective perception and understanding of complex processes in learning. The technology of digital avatars significantly expands the possibilities compared to traditional training on virtual objects.

In the modern world, each person owns numerous fragments of their own digital avatar, which are stored in various digital ecosystems, such as social networks, e-government platforms, healthcare systems, and loyalty programs. In addition, the organizations with which a person has interacted throughout their life store data on their professional achievements, knowledge, and skills. In the future, this disparate data can be integrated into a single digital profile that more accurately reflects the individual characteristics of the person. Given the rapid growth of personal information volumes, the creation of such integrated profiles can become the basis for more accurate and personalized analysis.

Moreover, search engines such as Google also have a fairly clear picture of our interests. Therefore, thanks to symbiotic relationships, our digital avatar can form a very accurate understanding of who we are and reflect both our knowledge and our skills [10; 11]. It can also be supplemented with applications that take into account the processes of knowledge loss (what we forget) and skills loss (what we lose due to lack of practice). This information about the degradation of our knowledge and skills can be the starting point for creating an active educational program.

By integrating such disparate data into a single digital profile, particularly in the context of educational activities, it is possible to create new approaches to analyzing and adapting knowledge that will be useful for both students and teachers. For example, a digital teacher can use data about their professional activities to create adaptive educational programs focused on the individual needs of students. The use of a digital teacher's avatar will allow to track and analyze teaching methods, develop personalized approaches to the presentation of material, and automatically update and supplement the learning content according to changes in the field of knowledge. This model will help to create more effective interaction between the teacher and students, providing flexibility and individualization of the learning process.

Another reason for using digital avatars is the existence of a half-life of knowledge, i.e. the time during which knowledge loses half its relevance. In his book "Future Shock" [12], A. Tofifler stated that the uneducated in the XXI century will not be those who cannot read and write, but those who are unable to learn, relearn and forget in order to learn again. The knowledge and skills acquired in schools, universities and workplaces throughout life are reducing in value and require constant updating.

The relevance of knowledge over time depends on the "half-life of knowledge," a term used to describe the reduction in value in various fields. For many disciplines, especially technical ones, this period has significantly decreased, which leads to the growing need for digital avatars to maintain relevance to modern challenges.

In a symbiotic autonomous system, knowledge and skills are distributed among its constituent elements.

The digital avatar of a symbiotic system integrates the digital avatars of its components. In complex systems, the whole is not always the simple sum of its parts. There is a so-called "emergent" (superstructure) effect of the system that cannot be inherent in any of its components separately. Intelligent applications can balance knowledge and education, as well as provide an exchange between different components of the system.

In the context of the Internet of Things (IoT) integration, digital avatars are connected to real-world objects, provide information about the status of their counterparties, respond to changes, improve operations, and increase overall value [13, p. 805].

One of the most promising applications of this concept in the educational process is the development of a "model of the student" - a digital analog capable of modeling the cognitive processes of the student with a high level of detail [14, p. 62]. Such a model includes data not only on the level of competencies mastered, but also on potential misconceptions that may hinder learning progress, as well as on the necessary practices to achieve the appropriate level of competence. Using this model allows teachers to more effectively plan educational strategies and adapt technological means of interactive learning to the individual needs of students.

A digital avatar can be presented in three main parts:
– content creation;
– maintenance and management;
– needs and realization.

Each of these parts, in turn, is divided into several subgroups based on different criteria. For example, in the first part, there are three basic content creators: organizations that create strategies and standards, groups that develop innovative ideas and often launch disruptive technologies, and individuals who conduct research, write scientific papers and make unique discoveries.

The main areas of content creation include:
– academic research and education;
– applied research and development;
– business modeling and analysis;
– technical and scientific organizations.

The maintenance and management component of the digital avatar includes several key components that ensure the system's efficient operation. The first element is a knowledge repository used to store and organize information. The second component is a taxonomy analyzer and generator that classifies new knowledge, assesses its relevance, and predicts possible obsolescence of existing information. The third element is the external interaction component integrated with the real world, which allows the digital avatar to respond to external changes and adapt its functions to current conditions. Using modern machine learning algorithms, the system processes a significant amount of data, providing knowledge and experience that meets the individual needs of the user.

The needs determination and content implementation function focuses on identifying individual requirements and meeting them with personalized approaches. Needs can arise in a variety of contexts, including personal or professional interests, interactions with organizations, business, or society. These needs are formed depending on a specific time, situation, or expected outcome and are met through adaptive content delivery mechanisms.

To achieve the full functionality of a symbiotic autonomous system in education, there are a number of challenges. First, it is necessary to create an intelligent digital avatar capable of integrating and analyzing large amounts of data. Second, it is important to ensure symbiotic relationships between the system components for effective interaction. Thirdly, accurate modeling of educational processes is required, taking into account the complexity and multidimensionality of the modern learning environment.

Despite the widespread use of the concept of digital avatars in various fields, their use for human modeling is a relatively new approach. Currently, active research and development of adaptive and autonomous systems with elements of cognition and consciousness are underway. However, these systems do not yet have all the necessary characteristics to ensure the full functioning of a digital human avatar.

Conclusions from the problems and prospects for further research in this area. The rapid growth of information and the increase in the pace of knowledge updating pose new challenges to educational systems, including the need to adapt to the conditions of information overload. Traditional didactic models demonstrate a decrease in efficiency, which requires the development of innovative approaches to learning that take into account the cognitive capabilities of a person. Digital avatars, as virtual models for modeling cognitive processes and personalizing learning content, are a promising solution in this context. They can not only ensure effective knowledge management, but also contribute to improving the quality of education through the integration of modern digital technologies.

Despite considerable scientific interest in this issue, research on the use of digital avatars in the educational process is still at an early stage. The main challenges are the need to create integrated digital profiles of students that will take into account their individual needs, as well as the development of algorithms for adapting learning content to the level of competencies and cognitive capabilities. It is especially relevant to study the potential of such technologies in building symbiotic autonomous systems that will allow for effective knowledge management in complex multidimensional educational environments.

Further research should be aimed at developing the concept of a digital avatar, including improving mechanisms for integrating and processing large amounts of data, as well as studying the impact of such systems on the effectiveness of the learning process. Particular attention should be paid to the development of technologies that will ensure symbiotic interaction between digital avatars, teachers and students, creating personalized and adaptive learning models. This will improve the quality of educational services and ensure compliance with the modern challenges of the information society.

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Бобро Н.С., *Приватний вищий навчальний заклад «Європейський університет».* ***Цифрові аватари в системах навчання та управління знаннями.***

Анотація. Метою статті *є дослідження концепції цифрових аватарів та їхнього потенціалу для оптимізації процесів навчання та управління знаннями в умовах стрімкого зростання обсягів інформації.* ***Методика дослідження.*** *У дослідженні використано методи логічного узагальнення, структурного аналізу та порівняльної оцінки для вивчення ролі цифрових аватарів у вирішенні проблеми когнітивного перевантаження та покращення персоналізованих освітніх процесів.* ***Результати.*** *У статті акцентовано увагу на викликах, які постають перед традиційними освітніми моделями через швидкий розвиток знань, та визначено перспективи використання цифрових аватарів як віртуальних когнітивних моделей. Зазначено, що цифрові аватари здатні обробляти великі обсяги даних, моделювати когнітивні процеси здобувачів освіти та адаптувати навчальний контент до їхніх індивідуальних потреб. Досліджено інтеграцію цифрових профілів із різних екосистем для створення персоналізованих навчальних систем. Наведено практичні приклади використання цифрових аватарів для розробки адаптивних освітніх програм і покращення взаємодії між викладачами та студентами. Визначено ключові компоненти цифрових аватарів, включаючи створення контенту, управління та реалізацію індивідуальних потреб. Розроблено рекомендації щодо використання цифрових аватарів для моделювання когнітивних процесів здобувачів освіти. Встановлено, що застосування цифрових аватарів дозволяє підвищити ефективність освітнього процесу та сприяє гнучкості навчальних моделей.* ***Практична значущість.*** *Застосування цифрових аватарів в освіті сприяє підвищенню ефективності управління знаннями, зменшенню когнітивного перевантаження та підвищенню якості освітніх послуг. Завдяки інтеграції великих даних, алгоритмів машинного навчання та адаптивному підходу до контенту, розроблені моделі дозволяють ефективно реагувати на виклики інформаційного суспільства. У статті наведено рекомендації щодо створення симбіотичних освітніх систем, які забезпечують персоналізований підхід до навчання та відповідають сучасним вимогам.*

Ключові слова: *цифрові аватари, діджиталізація, персоналізоване навчання, цифровізація освіти, адаптивна освіта.*