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Emergent properties of modern education

Емерджентні властивості сучасної освіти

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Abstract


The article reveals the essence, content, and advantages of emergence and shows the possibilities and situations of using the word "emergence" and its derivatives. Analyzing the ways of development of an emergent society, the integrity and emergence of synergistic education, and the importance of an emergent educational modern innovative system in a higher education institution are shown. Augmented reality (AR), considered a technology that is necessary in the educational sector today, emergent properties of the educational space are highlighted – informatization, virtualization, and digitalization. An experiment was conducted to identify the expediency of using AR technology in the educational process in general and the higher school, in particular, to ensure the emergence of the educational space as a final result. We were asked to assess the level of training of each respondent, in particular, the ability to use AR technologies. The obtained


Анотація


У статті розкрито сутність, зміст, переваги емерджентності та показано можливості та ситуації використання слова «емерджентність», його похідні. Аналізуючи шляхи розвитку емерджентного суспільства, показано цілісність і емерджентність синергетичної освіти, важливість емерджентної освітньої сучасної інноваційної системи у закладі вищої освіти. Доповнена реальність (AR), розглянута як технологія, яка необхідна в освітньому секторі сьогодення, виділено емерджентні властивості освітнього простору – інформатизація, віртуалізація, діджиталізація. Проведено експеримент з метою виявлення доцільності використання технології AR в освітньому процесі взагалі і вищої школи, зокрема, з метою забезпечення у кінцевому результаті емерджентності освітнього простору. Нами було запропоновано завдання оцінити рівень сформованості кожного респондента, зокрема, уміння використовувати

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results showed that the majority of teachers and future specialists assess their own level of formation of the use of AR technologies as low and average – 78% of respondents and 22% – as sufficient and high. This indicates the expediency of using AR technology in the educational process in general and higher education, in particular, to ensure the emergence of the educational space as a final result.

Keywords: emergence, institution of higher education, augmented reality, informatization, virtualization, digitalization.

Introduction

The modern world has resolutely shifted the epicenter of human existence to the pole of self-organization and "non-linearity" when the universe appears through multidimensionality. In the modern scientific discourse, in search of the fundamental foundations of existence, there is an increasing trend of methodological reorientation from a stable state to a state of constant formation, from a single to a multifaceted one, from identity to differences, which is connected with the emergence of a new post-nonclassical, non-linear type of thinking (Fedoryshyn & Tkach, 2023).

The modern system of higher education is constantly being modernized, actualizing the search for new educational strategies for the development of higher education in the conditions of a global pandemic, which involves the revision of existing forms, the optimization of meaningful components of the organization of the educational process by the new, in the educational space, communication conditions. In the educational process of the higher education system, special emergent properties appear successively, which help the system to update itself without losing its quality indicators. "Today, the emergence of something new in the education system is perceived as reality, and only the unpredictable threat of viral infection from COVID-19 reveals elements with emergent properties in the system" (Puchkov & Uvarkina, 2021). Each person has unique knowledge that makes him stronger and benefits the group during training and professional activities, and emergent systems help achieve a positive result. Knowledge exchange occurs when the team receives new facts and uses them in the process of discussing ideas and projects for the implementation of innovations. Therefore, the

AR технології. Отримані результати засвідчили, що більшість викладачів та майбутніх фахівців оцінюють власний рівень сформованості використання AR технологій як: низький та середній – 78% респондентів та 22% – як достатній та високий. Це говорить про доцільність використання технології AR в освітньому процесі взагалі і вищої школи, зокрема, з метою забезпечення у кінцевому результаті емерджентність освітнього простору.

Ключові слова: емерджентність, заклад вищої освіти, доповнена реальність, інформатизація, віртуалізація, діджиталізація.

study of emergent properties of modern education is important and necessary today.

Literature Review

Studies of the emergent properties of modern education, and their impact on the professional activity of an individual are the subject of scientific research in psychology, philosophy, and pedagogy. Let's analyze such studies. N. Heseleva and N. Zaritska (2013) provided the basics of the emergent properties of the education system, defined and considered approaches to the meaning of the concept of "emergence", and clarified the emergent strategies of enterprise management. Similar studies were conducted by O. Puchkov, & O. Uvarkina (2021) in particular, emergent properties were analyzed in modern education. The actualization of the search for new educational strategies that contribute to the development of higher education in the conditions of a global pandemic is shown. Integral components of modern education are singled out. It has been proven that digitalization, virtualization, and informatization are becoming essential in the educational sector, and the concept of nomadism can become the conceptual basis for the formation of modern educational strategies. It is clear that "special emergent properties consistently appear in the educational process, which helps the system to update without losing its quality indicators".

G. Woolcott, S. Leonard, A. Scott, R. Keast & D. Chamberlain (2021) respond to a growing literature arguing that change in higher education institutions might be better understood and managed if such institutions are understood as complex systems with emergent properties. The study finds evidence of subsystem variations on the initial partnership priorities, including

substantial boundary crossing, leading to emergence and co-evolution, indicating that a macroscopic view of emergent variation rather than 'micromanaging' may be an essential factor in scaling and sustaining collaborative partnerships.

V. Fedoryshyn, & M. Tkach (2023) examines in the context of the convergence of scientific research polyparadigm principles and strategies of knowledge the interdisciplinary nature of scientific research in the field of higher education, shows the ways of using modern innovative approaches in the content of education with prominent signs of non-linearity: emergentness, reflexivity, irreversibility, multidimensionality, etc. In the studies, the problem of the formation of a non-linear new post-non-classical type of personality thinking was considered, which led to a deepening of methodological reflection in the field of humanitarian knowledge. In this regard, it was determined that "transitional orientations of professional training of students require the implementation of several non-linear approaches, the defining features of which are an interdisciplinary synthesis of knowledge, methodological pluralism, polyvariance of search vectors, interdisciplinary connections, strengthening of integration interaction, etc." It is proved that the problem of "explication of the modern non-linear paradigm, its systematicity, multifacetedness, and complexity requires the synthesis of the entire complex of sciences, represented by synergy, and humanitarian knowledge, represented by the philosophy of postmodernism".

A. Stepanyuk, L. Mironets, T. Olendr, & I. Tsidylo (2022) conducted experiments to prove the effectiveness of the proposed methodical system. It has been established that in the conditions of the information society when implemented in the educational process of a higher school, it contributes to the improvement of the quality of training of future specialists for educational activities. A list of educational disciplines has been defined: "Innovative learning technologies", "Digital technologies in professional activity", "Digital technologies in education and science", and "Theory and teaching methods", which are expedient to form a person's professional skills in different ways. Despite the existing scientific works on the systematic analysis of the educational sector, the issues of emergent properties of the educational system remain insufficiently studied.

The purpose of the article: the study of emergent properties of modern education.

Methodology

To ensure the achievement of the goal, a set of methods was used in the research process:

- theoretical: analysis of scientific research aimed at the researched problem, with the aim of systematic comparison of different views, regarding the organization of the educational process and the study of professional experience;
- empirical: use of interviews, surveys, observation methods, questionnaires. Conducting conversations with teachers and students of higher education institutions about the ways of using augmented reality in the educational process, clarifying the difficulties and advantages of specialists that exist when using augmented reality in the educational process, the sufficiency of access to technologies to be able to use augmented reality, etc., to ensure in the end the emergence of the educational space; conducting a pedagogical experiment;
- statistical: registration and processing of experiment results using computer programs, in particular MS Excel and SPSS, for statistical processing of the obtained data.
- The experiment was conducted on the expediency of using AR technology in the educational process in general and higher education, in particular, to ensure the emergence of the educational space as a final result.

To study the state of implementation of the problem in teaching practice, a questionnaire was conducted to find out the use of augmented reality in the educational process, what difficulties and advantages specialists have when using augmented reality in the educational process, whether access to technologies is sufficient to be able to use augmented reality, whether the use of augmented reality improves academic achievement of students, or whether augmented reality should become an important component of the educational process.

The experimental research took place according to the following stages: organizational-methodical, educational-processual, and reflective-analytical.

The organizational and methodological stage involved the study of the research problem and

substantiation of theoretical questions, the determination of priority research and methodology, with the help of which the methodology of familiarization with AR applications is developed, the special training of specialists in the use of AR technologies and the use of modern forms and methods of learning to achieve the set goal.

The educational and procedural stage provided for two academic years in which 86 students of master's level education participated, who were included in the experimental group (EG). The obtained results were compared with the control group (CG), which included 98 respondents.

The reflective-analytical stage of the research included the analysis of the results of experimental training according to objective indicators – the activity of using AR technologies in pedagogical practice, adaptability to the requirements of the information society, and subjective indicators – self-analysis of the level of readiness to use AR. Students were asked to answer the questions of the questionnaire after the experimental training.

We conducted a study of teachers and students of higher education institutions to determine the level of their ability to use AR in their professional activities. It was proposed to assess the level of education of each respondent, in particular, the ability to use AR technologies. The obtained results showed that the majority of teachers and future specialists assess their own level of formation of the use of AR technologies as low and average – 78% of respondents and 22% – as sufficient and high. This indicates the expediency of using AR technology in the educational process in general and higher school, in particular, to ensure the emergence of the educational space as a final result.

Results and Discussion

The essence, content, and advantages of emergence.

Outside the mode of self-development, education is an externally controlled process of "processing human material."

The situation does not change radically even when educational material is processed based on the best ideals. The educational space, despite all ideals, cultivates power relations within which everything innovative and new is "caused by the old". Moreover, the latter leaves a mark on anything innovative and new and thus enables its

existence to be only an imitation of self-organization in the educational process. After all, self-organization and self-development cannot be "generated" by causes that are external to these processes. It is important to consider that creativity is a concentration of the sphere of self-development. From this follows the conclusion that the "constitution of educational space as an "emergent" system is impossible without creative activity" (Kremen, 2014). The readiness to choose from alternatives to the emergence of a new one enables creativity, and non-linear thinking as the ability to ensure further self-development, to reorient to new dimensions. Creativity is a kind of technology for generating everything new.

Creativity is capable of systematically organizing the present through a controlled expansion of perception of reality and transformation as the future.

As a result of fluctuations, something new emerges as unpredictable, emergent, in the form of a multidimensional spectrum of possible paths. Emergence is the presence in any system of special properties, the appearance, the emergence of something new in the theory of systems that is not characteristic of its blocks and subsystems, as well as the sum of elements that are not connected by system-forming ties. Emergence is such processes that occur in the process of discovering the properties of small parts that, through a simple process of choosing between several simple options, exist beyond the capacity of a single individual.

Emergence directs the creativity of the individual, its creative construction in the mode of self-organization of the thinking process. "In this sense, creativity differs from creativity, as the generation of new knowledge, by the ability to use already existing relevant properties, connections, relationships, albeit hidden ones. Creativity involves the creation and design of such properties from already existing elements" (Landau et al., 2021).

The ideals of the educational process developed in the past should be critically reconsidered for the self-organization of the individual in the context of their adequacy. For this, it is necessary to take as a basis the elements of the "emergent" system of all participants of pedagogical activity – the interaction between such elements generates a qualitatively new result, unexpected and unique to human existence. In this case, education is the ability of a person to independently realize various personal ways of

existence in his own life, it serves as a gift for all its participants (Kremen, 2014).

So, the emergence and appearance of a new emergent in the theory of systems contribute to the creation of an innovative system of special human properties that are not inherent in the blocks of subsystems, the sum of elements that are not connected by system-forming ties.

The advantages of emergent systems are that they:

- change the attitude towards information, and its values;
- do not replace the government,
- innovatively change the preferences of the wishes of the majority over the wishes and prescriptions of the minority.

In these processes, the Internet plays a key role, because it provides an opportunity for individuals to participate in discussions, in discussions that until recently were only possible for individuals, not for all of humanity, and could not be heard by society (Maraví, 2021).

Possibilities and situations of using the word "emergence" and its derivatives.

We will reveal the possibilities and situations of using the word "emergence" and its derivatives.

Emergence is such processes that take place outside the capacity of a single individual, when many small parts reveal precisely such properties that create actions through a simple process of the individual and allow a choice to be made between several simple options.

Thanks to the Internet, the birth of emergent democracy became possible – a kind of collective intelligence, a new political phenomenon. Humanity got the opportunity to challenge the authority of respectable institutions through amateur blogs. Emergence allows this system to significantly exceed the capabilities of each individual (Chuc & Riveroll., 2022).

The human brain is the most amazing example of emergence. Out of 20 thousand genes, a third of them are in the human brain. Each neuron is not conscious by itself, but when connected, all neurons form a network, and this exceeds the sum of their parts and gives a person the ability to be so conscious that one can reflect on the thought process itself (Conejo & Carmiol, 2017).

Development of an emergent society.

Emergence systems include:

- each individual possesses knowledge that is useful and unique for the entire group;
- human knowledge makes a person stronger;
- in the process of discussing projects and ideas, there is an exchange of personal knowledge, which is formed in the process of studying at a higher education institution;
- during education, a team of higher education students receives new facts, which they use in their professional activities to implement innovations;
- creation of an educational platform for involvement in the development of an emergent society.

The spread of cheap or free online education is one of the important stages of emergence. This includes practical classes in various workshops, educational websites, and informal exchange of information with peers to combine parts into a whole and to create something qualitatively new in the educational process, without which there simply could not be an association. This property is called a certain resource of the system, i.e. emergence. That is, when we all gather together and work as a team, we achieve a more significant result than when we act individually.

"The theory of emergent evolution, the purpose of which is the recognition and interpretation of "jumpy" development and the emergence of something new, is relevant in our time. From the standpoint of the dialectical approach, emergentism leads to the denial of natural and historical patterns and the role of the quantitative stage of change in the development process (Fedoryshyn & Tkach, 2023).

Emergent educational modern innovative system in a higher education institution.

Considering the emergent educational modern innovative system in the institution of higher education as large, complex, dynamic, and open, the organization of which is determined by the tasks of professional training and the goals of education, improving the qualifications of branch specialists of education, management workers, the following integrative features are highlighted:

- manageability and purposefulness (the presence of a general purpose, a general goal that is adjusted and set by society);
- innovativeness of the emergent system (the

presence of properties that are integrative and cannot be deduced from the known properties of individual elements of the system);

- the structure of the organization is hierarchical and complex (presupposes coordination with the autonomy of elements, subsystems, and centralized management);
- multi-criteria;
- multi-connectedness of system elements (the connection between levels of the hierarchy and at the same level);
- the complexity of relationships between variable, and dynamic parameters;
- multidisciplinary specialists;
- the presence of external information connections and multiple internal connections between system elements and their subsystems;
- multiple changes in composition and transition from one state to another;
- probability of conflict situations;
- the presence of internal disturbing factors of competing parties and external ones.

The signs listed above make it possible to conclude that this emergent educational modern innovative system in a higher education institution is differentiated into separate systems and subsystems of different levels of complexity and orderliness. At the same time, the subsystems are interconnected, their components interact with each other and are coordinated, which causes radical changes in the professional development of a person in the conditions of optimization and intensification of the educational process (Puhach et al., 2021).

Emergent properties of educational space – informatization, virtualization, digitalization.

In the educational process of a higher school, special emergent properties appear successively, which help the emergent system to update itself without losing its quality indicators. Virtualization, digitalization, and informatization transform educational processes towards the latest technologies, contribute to the development of the modern personality of the 21st century, become integral components of world educational systems, and form new mobile forms of thinking in the space of education (Thorne et al., 2021).

Today, in the education system, the emergence of something new is perceived as a reality. Only the threat of viral infection from COVID-19, which is unpredictable, or military conflicts in the world manifest themselves more and more and

accelerate the pace of development in the system, providing an opportunity for the development of elements with emergent properties.

Global informatization is one of such properties that influenced the development of education and covered all spheres of society. Today, the informatization of education acts as a communication and defining information base of the educational space, which ensures the harmonious development of the modern personality (Bida et al., 2022). The exponential nature of global informatization constantly reveals new properties of its own information system, affects the updating of technologies in education by the requirements of digitalization, and forms new social communication relations for all participants of the educational process in higher education. It is known that the systems of personality consciousness and communication systems are evolutionarily tuned to each other, thus unprecedented autonomization and formation of personality occur through informagenesis (Nazar, 2018).

The educational space contributes to increasing the effectiveness of information, unites the subjects of information genesis in our time, and creates conditions for the formation of an informational cultural field where personality is improved and developed.

Nowadays, the virtualization of a person as an emergent property of modern educational processes gives birth to a virtual personality that realizes real reality through information networks and becomes a full participant at all levels and forms of the educational process. The student of education is actively involved in intercultural communication, evolving towards the development of potential virtual opportunities, improves and studies English as the language of communication in global networks, self-realizes in virtual space and introduces new rules of virtual communication into information technologies, meaningful knowledge (emojis, abbreviations, etc). This virtualization of a modern student contributes to learning to overcome a stressful state, for example, during a pandemic, or to protect scientific work and creates the most favorable psychological and pedagogical interaction with the already formed virtual personality of the student of education (Uvarkina, 2020). In conditions of rapid growth of the role of information technologies, the digitalization of society is taking place, which leaves no choice to the educational system, in all spheres of social life, the network principle of organizing the

world community is emerging on the surface of global transformation. Quarantine restrictions and martial law, for example, in Ukraine, have formed a new virtual personality, a modern informational and educational space, which is related to the so-called "digital nomads", a special category of people. A feature of educational "digital nomads" was their mobility, which made it possible to transfer and receive professional skills, abilities, and knowledge remotely from various geo-locations with the availability of the Internet and modern means of communication. The majority of educators belong to a large social group of people who talk about the presence of "digital inequality". These are individuals who widely use and know computer systems in everyday life and professional activities because the digitalization of the entire society leaves no choice to the educational system. Teachers become subjects of education with emergent properties of modernity, become "digital nomad" or "digital literati" (Puchkov & Uvarkina, 2021).

Integrity and emergence of synergistic education.

Significant changes in the existence of national cultures and interactions led to globalization processes as a necessary attribute in the modern world.

A cultural gap occurs, under such conditions, the loss of traditional supports, and the transition to a polystylistic culture from a monostylistic culture, the main characteristics of which are emergence, dynamism, openness, non-linearity, etc. The formation of a new type of society (post-industrial, technotronic, informational) actualizes the role of a creative, creative personality.

The principle of emergence "characterizes complex open self-organized systems in terms of the emergence in them of new, integrative qualities that appear due to the combination of individual components of the system, which were not characteristic of neoplasms."

The emergence of integrative qualities determines the emergence of a system that appears not due to a simple rearrangement or addition, but the unification of some of them and a lower level of organization. This explains the emergence in modern society of qualities essential for the functioning of the individual, which appear:

- due to the combination of individual skills and knowledge – qualities of a lower level;
- formation of competencies – qualities of the highest level.

Therefore, in the coordinates of modern science, the personality should be considered by pedagogy and philosophy of education as a synergistic system – emergent, complex, capable of self-organization, self-development, coherent, open, and dissipative.

As a constant movement from one state of the system to another, from the point of view of synergy, the development of the individual appears, in which randomness, chaos, passage of bifurcation points, destruction, creation, etc. are natural states of the system, which build a continuous chain of transformations, successively change each other. It is impossible to predict and perceive personality development as a dependence on "pedagogical pressure" – the organization of the educational environment, educational influences, the amount of involved efforts and means, etc. The possibility of personality development is embedded in the structure of the personality itself – it is a potential that can be spontaneously realized in one of many options.

In the process of its development, the personality is constantly in a state where it acts as a component of another coherent system. It is necessary to take into account the laws of the phenomenon of "excessive influence on the system, which can lead to a change in its structure, which is explained by the occurrence of resonance, in which a small fluctuation (deviation, oscillation) can change the state of the entire system."

Therefore, mastering the definitions of synergetics and understanding concepts is natural from the point of view of pedagogical theory and philosophical-educational theory. The scientific thesaurus includes the following units:

- personality as a synergistic system;
- principles of personality organization as a synergistic system – emergence and dissipativeness, non-linearity of development, openness, coherence, imbalance; bifurcation points; fluctuations; too little impact; catastrophe.

The emergence and integrity of synergistic education in the developed countries of the world are manifested in the predominantly endogenous nature of the formation of mechanisms, factors,

conditions of activity of the subjects of the educational process, and intellectual and cognitive growth of the individual (Kremen, 2014).

Emergence is an important feature of the educational environment that determines its quality as a system.

Emergence is an important feature of the educational environment that determines its quality as a system. Emergence in the educational environment indicates that the designed model of the educational space is more complex than the sum of its constituent elements (Sajoza Juric, 2019).

Speaking about the structure of the educational environment of the light space, it is worth paying attention to the coherence of its parameters, as the ability, in the process of carrying out its educational functions, to the mutual coordination of the actions of various microenvironments. The educational environment as a system:

- is in dynamics and constant movement;
- needs modeling;
- requires monitoring and adjustment.

Therefore, we conclude that the positions of scientists regarding the definition of the concept of emergence, integrity, and emergence of synergistic education, emergent properties of the educational space, and structural elements of the educational environment differ significantly, which confirms its characterization of emergence as a complex, integral formation that includes certain components with multiple relationships languages of the socio-pedagogical system.

In the process of structuring an educational environment or an educational environment, researchers single out the material-spatial (visual, spatial-semantic, object-spatial, etc.) component as important and necessary for transformations in all periods of a person's life. The subject-spatial factor of educational situations determines the dependence on material factors, such as classrooms, provision of the educational process with computers, auxiliary literature, and textbooks, the building of the educational institution, recreational facilities, research area, etc. (Demchenko, 2014).

Augmented reality (AR) is a technology that is necessary in the education sector today.

The study of any subject of knowledge, which is a system formation, is connected with the

selection of the basic features characteristic of any system in general, including a plurality of components, subsystems, components, interaction, communication, system, system-forming, regular connections, structure, organization, hierarchy, integrity, and emergency (Stepanyuk et al., 2022).

Considering the emergent educational modern innovative system in the institution of higher education as a large, complex, dynamic, and open, the organization of which is determined by the tasks of professional training and the goals of education, improving the qualifications of industry specialists in education, management workers, the emergent properties of the educational space are highlighted – informatization, virtualization, digitalization, integrity is shown and the emergence of synergistic education.

Emergence directs the creativity of the individual, its creative construction in the mode of self-organization of the thinking process. In this sense, creativity differs from creativity, as the generation of new knowledge, through the ability to use already existing relevant properties, connections, and relationships (Hashim et al., 2022).

Global informatization is one of the main properties that influenced the development of education and covered all spheres of society. Scientists consider augmented reality (AR) as a technology that, with the help of computer applications, allows you to identify and create a virtual layer of information with a favorite object or marker that is in the physical real world. A graphic visual object can act as a marker that will be added to virtual objects of various formats using special software tools. AR technology allows you to superimpose text, images, video, and audio components on space and an existing image. The aura (received information) can be read from the marker using all kinds of digital devices, such as tablets, smartphones, AR helmets, AR glasses, etc. (Shetelya et al., 2023). Scientists define augmented reality (AR) by its characteristics or features. Stepanyuk et al. (2022) interpret augmented reality as a system that meets three characteristics, such as real-time interaction, a combination of real and virtual worlds, and accurate 3D registration of real and virtual objects. C. Lytridis, & A. Tsinakos (2018) offer the following definition: AR is "the technology of augmenting the physical world with the help of digital data provided by computer devices (smartphones, tablets, smart lenses, and AR glasses) in real time". The

features of AR are that "real and computer information are combined in the physical world, interactively in real-time, and the display of the virtual object corresponds to the orientation in the real world".

An experiment on the expediency of using AR technology in the educational process in general and in higher education, in particular, to ensure the emergence of the educational space as a final result.

To study the state of implementation of the problem in teaching practice, a questionnaire was conducted to find out the use of augmented reality in the educational process, what difficulties and advantages specialists have when using augmented reality in the educational process, whether access to technologies is sufficient to be able to use augmented reality, whether the use of augmented reality improves the academic achievements of students, whether augmented reality should become an important component of the educational process.

The experimental research took place according to the following stages: organizational-methodical, educational-processual, and reflective-analytical.

The organizational and methodological stage involved the study of the research problem and substantiation of theoretical questions, the determination of priority research and methodology, with the help of which the methodology of familiarization with AR applications is developed, the special training of specialists in the use of AR technologies and the use of modern forms and methods of learning to achieve the set goal.

The educational and procedural stage provided for two academic years in which 86 students of master's level education participated, who were included in the experimental group (EG). The obtained results were compared with the control group (CG), which included 98 respondents.

The reflective-analytical stage of the research included the analysis of the results of experimental training according to objective indicators – the activity of using AR technologies in pedagogical practice, adaptability to the requirements of the information society, and subjective indicators – self-analysis of the level of readiness to use AR. Students were asked to answer the questions of the questionnaire after the experimental training.

The study is based on the research scheme of Ukrainian scientists (Stepanyuk et al., 2022), the results of which show that:

- To the question "Do you use augmented reality in the educational process?" respondents answered: "Yes" – 72.8%, "No" – 24.1%, "If possible" – 0.7%, "Sometimes" – 0.9%; "Rarely" – 1.5% of respondents.
- To the question "Name at which stages of the lesson you use augmented reality?" 27.2% of respondents answered, "I don't use it at all." The received data in digital format fully corresponds to the results of the answers to the previous question. AR is used by 15.2% of respondents at the stage of the lesson, when previously submitted tasks are being checked, in the process of updating basic knowledge – 17.9% of respondents use AR when motivating educational activities – 39.9%, while at the stage of learning new material they use AR has the most respondents: clarification and expansion of information – 48.9%, perception of information – 47.9%, generalization, systematization of knowledge – 36.7%." Therefore, AR is used by most teachers and students to expand, clarify information, and motivate educational activities and their perceptions.
- To the question "What difficulties did you see when using augmented reality in the educational process?" the respondents had the following answers: the need for additional training – 71.9%; technical problems – 69.7%; limited availability – 38.9%; high cost – 22.5%; distraction of education seekers – 11.8%; futuristic – 6.9%; a large number of education seekers in groups – 0.9%; no – 0.7%.
- To the question "When using augmented reality in the educational process, choose which advantages do you consider to be the most important?" The answers were divided as follows: the development of an emergent educational modern innovative system in a higher education institution as a large, complex, dynamic, open organization, which is determined by the tasks of professional training and the goals of education – 61.8%, the development of creative thinking, informatization, virtualization, digitization of education, modeling, and simulation of educational processes – 60.9%, visualization of complex and abstract concepts – 46.9%, development of problem thinking – 28.9%, active participation of students and their interaction

- 27.8%, growth in the process of learning cognitive interest – 0.9%.
- To the question "Is access to technology sufficient to be able to use augmented reality?" teachers and future specialists gave the following answers: Yes – 40.8%; No – 62.2%. However, 99.7% of respondents expressed a desire to receive additional support or advanced training in the use of augmented reality.
- To the question for teachers and future specialists "Does the use of augmented reality improve the academic achievements of students?" they gave the following answers: "Yes" – 89.1%, "No" – 5.7%, "It is difficult to give an unequivocal answer" – 4.3%.
- To the question "What positive changes have you noticed in students during classes using augmented reality?" the answers were distributed as follows: motivation for the educational process increases ("Yes" – 96.7%, "No" – 3.3%); the student's cognitive interest increases ("Yes" is considered by 90.8% of respondents, "No" by 0.2%); the level of educational achievements of students increases ("Yes" – 95.0%, "No" – 0.5%).
- To the question "Do you think that augmented reality is or should become an important component of the educational process?", teachers and future specialists said: Yes – 94.1%; No – 5.9%.

To study the state of implementation of the problem in teaching practice, a questionnaire was conducted to find out the use of augmented reality in the educational process, what difficulties and advantages specialists have when using augmented reality in the educational process, whether access to technologies is sufficient to be able to use augmented reality, whether the use of augmented reality improves the academic achievements of students, whether augmented reality should become an important component of the educational process.

The experimental research took place according to the following stages: organizational-methodical, educational-processual, and reflective-analytical.

The organizational and methodological stage involved the study of the research problem and substantiation of theoretical questions, the determination of priority research and methodology, with the help of which the methodology of familiarization with AR

applications is developed, the special training of specialists in the use of AR technologies and the use of modern forms and methods of learning to achieve the set goal.

The educational and procedural stage provided for two academic years in which 86 students of master's level education participated, who were included in the experimental group (EG). The obtained results were compared with the control group (CG), which included 98 respondents.

The reflective-analytical stage of the research included the analysis of the results of experimental training according to objective indicators – the activity of using AR technologies in pedagogical practice, adaptability to the requirements of the information society, and subjective indicators – self-analysis of the level of readiness to use AR. Students were asked to answer the questions of the questionnaire after the experimental training.

We conducted a study of teachers and students of higher education institutions to determine the level of their ability to use AR in their professional activities. We were asked to assess the level of education of each respondent, in particular, the ability to use AR technologies. The obtained results showed that the majority of teachers and future specialists assess their own level of formation of the use of AR technologies as low and average – 78% of respondents and 22% – as sufficient and high. This indicates the expediency of using AR technology in the educational process in general and higher education, in particular, to ensure the emergence of the educational space as a final result.

Conclusions

We revealed the essence, content, and advantages of emergence and showed the possibilities and situations of using the word "emergence", and its derivatives. Analyzing the ways of development of an emergent society, the importance of an emergent educational modern innovative system in a higher education institution is shown. Augmented Reality (AR) is seen as a must-have technology in today's education sector.

Considering the emergent educational modern innovative system in the institution of higher education as a large, complex, dynamic, and open, the organization of which is determined by the tasks of professional training and the goals of education, improving the

qualifications of industry specialists in education, management workers, the emergent properties of the educational space are highlighted – informatization, virtualization, digitalization, integrity is shown and the emergence of synergistic education.

Global informatization is one of such properties that influenced the development of education and covered all spheres of society. Nowadays, the virtualization of a person as an emergent property of modern educational processes gives birth to a virtual personality that realizes real reality through information networks and becomes a full participant at all levels and forms of the educational process. In conditions of rapid growth in the role of information technologies, society is being digitized.

An experiment was conducted to identify the expediency of using AR technology in the educational process in general and higher school, in particular, to ensure the emergence of the educational space as a final result.

To study the state of implementation of the problem in teaching practice, a questionnaire was conducted to clarify the use of augmented reality in the educational process, the difficulties and advantages of specialists that exist when using augmented reality in the educational process, and to clarify the questions: is access to technology sufficient, to be able to use augmented reality; whether the use of augmented reality improves academic achievement of students; whether augmented reality should become an important part of the educational process, etc.

The experimental research took place according to the following stages: organizational-methodical, educational-processual, and reflective-analytical.

We conducted a study of teachers and students of higher education institutions to determine their level of formation of AR skills in professional activities. We were asked to assess the level of training of each respondent, in particular, the ability to use AR technologies. The obtained results showed that the majority of teachers and future specialists assess their own level of formation of the use of AR technologies as low and average – 78% of respondents and 22% – as sufficient and high. This indicates the expediency of using AR technology in the educational process in general and higher education, in particular, to

ensure the emergence of the educational space as a final result.

Consideration of innovative ways of digitalization of society requires further research.

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