Zhytomyr Ivan Franko State University Journal.
Pedagogical Sciences. Vol. 3 (118)

Вісник Житомирського державного
університету імені Івана Франка.
Педагогічні науки. Вип. 3 (118)

ISSN (Print): 2663-6387
ISSN (Online): 2664-0155

UDC 378.147:001.8:004.8
DOI 10.35433/pedagogy.3(118).2024.2

METHODOLOGICAL BASIS AND PRACTICAL ASPECTS OF DIGITALIZATION OF EDUCATIONAL SPACE

O. V. Voznyuk*, O. A. Dubaseyuk, O. I. Shuryn*****

The article presents theoretical and practical aspects of digitalization of educational space. The negative and positive consequences of the mentioned process are analyzed in their dialectical unity using an interdisciplinary approach. Artificial intelligence technologies are considered in relation to the digitalization of the educational space of Ukraine, and the problem of academic integrity in the context of the mentioned process is also analyzed. One of the most important problems of the use of artificial intelligence and other intelligent digital systems in the educational branch is actualized, which is related to the possibility of replacing the teacher with artificial intelligence.

The theoretical foundations of the research are the principles and ideas that can be found in the 2021 National Report of the National Academy of Sciences of Ukraine on the state and prospects for the development of education in Ukraine, as well as in the "Beijing Consensus" of UNESCO, within the framework of which the papers on "International Conference on Artificial Intelligence and Education" (2019) were published. Both the concept of functional asymmetry of the cerebral hemispheres and the information theory in some of its modifications have been also used to solve the problems actualized in the article.

It has been found that the risks associated with the use of artificial intelligence are becoming important, related to the possible loss of jobs due to automation, the spread of deep fakes, privacy violations, algorithmic bias, socio-economic inequality, volatility, i.e. the instability of the market, the uncontrolled process of the possible formation of artificial self-awareness of the artificial intelligence.

The solutions of the mentioned problems require an integral effort of legal professionals, policymakers, technology experts, and educators, who are to work together to create lucid artificial intelligence rules and policies that balance innovations and protect the rights of stakeholders.

In the context of the problem of academic integrity, the development of the proposed software related to the algorithms for analyzing the uniqueness of texts can be considered as a prospect for solving the problem.

* Doctor of Sciences (Pedagogy), Professor
(Zhytomyr Ivan Franko State University)
alexvoz@ukr.net
ORCID: 0000-0002-4458-2386

** Doctor of Sciences (Pedagogy), Professor
(Zhytomyr Ivan Franko State University)
dubasenyuk @ukr.net
ORCID: 0000-0002-9447-4527

*** Candidate of Pedagogical Sciences (PhD in Pedagogy), Docent
(Rivne State Humanitarian University)
olena.shuryn@rshu.edu.ua
ORCID: 0000-0002-8804-7860

Keywords: *methodology of scientific research, information boom, artificial intelligence, telecommunications technologies, digital generation, digitalization of educational space, "4K" skills, academic integrity, media education, information theory.*

МЕТОДОЛОГІЧНІ ОСНОВИ ТА ПРАКТИЧНІ АСПЕКТИ ЦИФРОВІЗАЦІЇ ОСВІТНЬОГО ПРОСТОРУ

О. В. Вознюк, О. А. Дубасенюк, О. І. Шурин

У статті представлені теоретичні та практичні аспекти цифровізації освітнього простору. Аналізуються негативні та позитивні наслідки зазначеного процесу у їх діалектичній єдності з використанням міждисциплінарного підходу. Розглядаються технології штучного інтелекту щодо цифровізації освітнього простору України, а також здійснюється аналіз проблеми академічної доброчесності у контексті зазначеного процесу. Актуалізується одна з найбільш важливих проблем використання штучного інтелекту та інших інтелектуальних цифрових систем в освітній сфері, яка пов'язана із можливістю заміни вчителя штучним інтелектом.

Теоретичними основами дослідження постають принципи та ідеї, що їх можна знайти у Національній доповіді НАПН України 2021 року щодо стану і перспектив розвитку освіти в Україні, у "Пекінському консенсусі" ЮНЕСКО, у рамках якого було надруковано матеріал стосовно "Міжнародної конференції зі штучного інтелекту та освіти" (2019 рік). Для розв'язання проблем, актуалізованих у статті, також використовувалися як концепція функціональної асиметрії півкуль головного мозку, так і теорія інформації у деяких її модифікаціях.

З'ясовано, що важливими постають небезпеки щодо використання штучного інтелекту, пов'язані з можливою втратою робочих місць через автоматизацію, розповсюдженням діпфейків, порушення конфіденційності, алгоритмічну упередженість, соціально-економічну нерівність, волатильність, тобто непостійність ринку, неконтрольований процес можливого формування самосвідомості штучного інтелекту.

Вирішення зазначених проблем вимагає поєднання спеціалістів з права, політиків і експертів з технологій, освітян, які мають працювати спільно, щоб створити чіткі правила та політику застосування штучного інтелекту, які збалансують інновації та захистять права зацікавлених сторін.

У контексті проблеми академічної доброчесності перспективою вирішення зазначеної проблеми постає розробка програмного забезпечення, що стосується запропонованих у статті алгоритмів аналізу унікальності текстів.

Ключові слова: *методологія наукового дослідження, інформаційний бум, штучний інтелект, телекомунікаційні технології, цифрове покоління, цифровізація освітнього простору, навички "4K", академічна доброчесність, медіаосвіта, теорія інформації.*

Introduction of the issue. The urgency of the problem stems from one of the main trends of the modern world in general and educational sphere in particular related with the exponential growth of information, as well as with the significant increase of the social role of human personality and intellectualization of its activity in the context of extremely dynamic change of equipment and technologies. At the same time, the analysis of the current socio-cultural situation, as well as the study of the main trends in the development of socio-pedagogical systems in Ukraine and the world, allows us to come to the conclusion that the futuristic forecast for the emergence of the "digital generation" in the XXI century presupposes taking into account the relevant modern conditions – the rapid development of telecommunication technologies, the computerization and digitization of productive processes, the use of telecommunications with feedback, etc. These changes should lead to a fundamental transformation of the style of people's social and individual life, to the increase of its intensity, as well as to enhancing people's social responsibility and creativity in labor, study and scientific research. Under such

conditions, modern society will need a comprehensively developed mobile personality capable of self-education, self-improvement and self-development.

The relevant laws of Ukraine in the field of education indicate a strategy for solving the problem connected with providing information needs and information support for all spheres of activity of a modern specialist through digitalization of education. In addition to the digitalization of educational space, the so-called "cyber socialization" turns out to be relevant now, which reveals itself as a process of qualitative change in the structure of personality's self-awareness and its need-motivational sphere taking place under the influence of the use/dissemination of contemporary digital technologies.

Current state of the issue. At large, one can analyze such aspects of the digitalization of the educational space as generally pedagogical, didactic, methodical ones (V.Yu. Bykov, I.E. Bulak, M.I. Zhaldak and others), as well as the implementation of the principles of digitalization in the process of teaching different disciplines (M.M. Kozyar, Yu.V. Lukyanenko, O.M. Spirin and others). Digitization of educational systems is the subject of the research of a large number of foreign scientists [8; 11; 13; 17].

It can also be said that the use of modern information technologies in the context of artificial intelligence (AI) technologies in the educational process of Ukraine (V.Yu. Bykov, I.E. Bulak, O.M. Spirin, O.P. Pinchuk and others), as well as in foreign countries [7; 9; 12; 14; 21], is extremely relevant.

Therefore, the intensive implementation of digital technologies in all spheres of socio-economic, educational life of many countries, including the dynamic development of AI, reveal an urgent need to analyze the positive and negative aspects of the mentioned process using interdisciplinary research.

The aim of the research. Accordingly, we can study the negative and positive consequences of the digitalization of the educational process in their dialectical unity being the objective of our research. In this regard, it is important to analyze the implementation of AI technologies in the context of digitalization of the educational space of Ukraine, as well as to focus on the problem of academic integrity in the context of the mentioned process.

Research methods. The methodological and theoretical foundations of our research, having an interdisciplinary character, are the principles and ideas that can be found: 1) in the 2021 National Report of the National Academy of Sciences of Ukraine (where the content of digitalization of education as a modern imperative in the context of the development of the information and digital educational environment of the Ukrainian school is outlined), 2) in the "Beijing Consensus" of UNESCO, within the framework of which the papers on "International Conference on Artificial Intelligence and Education" (2019) were published, where such aspects were outlined: 1) the increasing of the readiness of those responsible for the development of policy in the field of education for the use of AI, 2) the formation of a general understanding of the opportunities and problems that AI opens up for education, 3) the positive and negative consequences of the development of AI technologies for participants in the educational process [12]. To this end, to solve the problems actualized in the article, the concept of functional asymmetry of the cerebral hemispheres, as well as some modifications of the information theory have been used [19; 20].

Results and discussion.

1. Positive consequences of digitization of educational space

The process of formation of the *digital generation* of young people which is going on in the world is connected with the development of AI revealing significant potential for solving current problems that the education brunch faces with. Under these conditions,

UNESCO aims to support countries around the world in using the potential of AI technologies, while ensuring the basic *principles of inclusiveness and equity.* Thus, UNESCO's mandate inherently requires such an approach to AI that focuses on the interests of all participants in the educational process in the context of equal access to knowledge, diversity of forms of cultural expression, when everyone can take advantage of the *technological revolution* and gain access to its achievements, especially in the context of *innovative knowledge*.

The technological field of AI is currently developing by leaps and bounds. The essence of AI (the functional basis of which was developed by John McCarthy in 1950) lies in the ability of computer devices/programs to learn, think, and reason like the human brain. The AI systems receive data and instructions, on the basis of which the AI systems draw conclusions, perform certain functions, and also learn, revealing at the same time huge opportunities for analyzing a large array of information.

Let us illustrate this fact: 1) recently, the Harvard scientists have developed AI software (after studying more than 131,000 earthquakes and aftershocks, the scientists tested the neural network of 30,000 events) that can predict the location of underground tremors. Compared to traditional methods, AI has demonstrated great accuracy in determining the locations of aftershocks. 2) The OpenAI company represented a new model of artificial intelligence GPT-4o, which is much more mobile than the old one and has a wider set of functions. It reacts to the user's voice in real time, can pick up nuances in the voice, generating a response in "different emotional styles", including the musical sphere. This model is supported in more than 50 languages. Professional media and bloggers, who call this version "crazy", "sensational", "revolutionary", claim that the developers for the first time are able to bring the program closer to the communication model of real people. GPT-4o can sing, change the intonation of the voice, recognize the user's emotions and analyze visual information. In addition, GPT-4o has greatly improved foreign language skills and can be used as a real-time translator. The developers admit that they still do not fully know how to use all the functions of GPT-4o, but there are already fears that the new version of the chat can fundamentally change the market of translation services and learning foreign languages.

First of all, *the positive consequences of digitization of educational space* are connected with a rapid increase in the amount of information being transmitted. Accessibility information saves the participants in the educational process from the need to spend a large amount of time on search for the necessary data

We can also mention the new sources of income for business, since the digitization of education is the means and stimulus for development of new products on market of educational services.

In addition, the digitization of educational space provides the possibility of 24-hour access for educational and information resources, because digitization of education allows to choose for training any convenient period of day and night

At the same time, education becomes more accessible, the online learning tools overcome barriers, making education accessible to all concerned persons throughout the world.

Thanks to digital tools and automation of the studying process the teachers are not loaded with routine work since with the help of the software the teachers have the possibility to track the academic attendance, to create pertinent records, and send automated responses and reminders to students.

In the USA, two-thirds of educators implement information technologies among students. Almost 20% of students at Stanford University reported using ChatGPT for practice assignments.

In 2023, a nationwide survey of the prospects of AI implementation in national education was conducted in Ukraine. It turned out that in the international ranking of the use of AI, Ukraine has entered the group of countries with the lowest indicators (among them Guatemala, Paraguay, Venezuela, El Salvador, and others) [6].

1,747 teachers and 1,443 students of grades 8-11 from all over the country took part in the All-Ukrainian study of the prospects of using AI in the educational process of Ukraine. 7 out of 10 interviewed teachers used at least one of the AI tools. In general, 76% of teachers have used artificial intelligence at least once, half of the teachers have a positive experience of digital interaction. Every second teacher believes that AI has the prospect of replacing the educational process in the future. At the same time, the participants in the educational process are aware of such AI tools as ChatGPT (68% of teachers, 76% of students), the educational project "On Lesson" (69% of teachers, 35% of students). Both teachers and students are much less aware of such well-known international AI services as Grammarly, Bard Google, Midjourney, Notion AI and Stable Diffusion (from 4 to 15 percent).

Teachers of the natural sciences (informatics, physics, mathematics) and the humanities (English, foreign literature, history, Ukrainian language) actively use AI during the teaching process. At the same time, the dependence has been revealed: the shorter the teacher's work experience, the more active the use of such a tool as ChatGPT is.

Most Ukrainian pupils and students are aware of the benefits of using AI in education. 6 out of 10 surveyed students have already used AI services when preparing their homework. 85% of students have used AI tools at least once, and a third of them do so at least weekly. Also, about 40% say that they use AI during classes.

The feedback from teachers indicates that it is currently difficult to separate the AI and student's contribution to solving the creative tasks, so it is not clear how to distinguish the work of the computer from the work of the student [6].

2. Negative consequences of digitization of educational space including the media education

As any social entity is characterized by positive and negative characteristics, it is appropriate to talk about not only positive but also negative consequences of digitalization of the educational space [1].

Nowadays, scientists and educators are beginning to understand that television and computer in a certain way limit the richness of bodily/sensual perception of reality, canceling functional equality between image and sound perception, since music or speech coming from an invisible announcer often comes from a completely different realm of reality than the image on screen. Moreover, a child's impressions from what is heard and seen are separated from the child's physical activity, who while watching the television or computer programs, remains in a state of physical immobility. M. Shlitzer notes that television, video and computer inflict a destructive effect on child's health, even if we have the best children's program including educational one. Using the computer for educational purposes in primary school or even in preschool establishment is also unproductive and in some cases even detrimental: the results of the study of 200 Israeli schools, of which 122 were equipped with computers, testified that even a computerized lesson in mathematics did not give significant improvements in academics success, rather even revealed the trend for its deterioration [4].

In 2003, T. Oppenheimer's book *"Flickering Mind"* was published, where the author ponders about negative consequences of digitization of educational process. Alongside with obvious advantages, the use of information technologies in the field of education leads to occurrence of "wrong goals", because a great number of

computers is considered a comfortable indicator of "quality" of educational process, and if the computer is connected to the Internet, then the ultimate goal of investment in education seems to have been achieved. T. Oppenheimer claims that information technologies in the form they were developed at the beginning of the 21st century are not able in principle to perform the tasks of automation of intellectual activity. Hence, T. Oppenheimer convincingly shows malignancy of modern computerization of educational process and reaches conclusion that teaching process is to be saved by returning to traditional non-computer methods [15: 13].

The analysis of various negative factors of introduction of computer technologies in educational sphere allows to concretize some rather harmful consequences of the specified process.

1) Computers teach a person to act on the environment in a *manipulative, directive, instrumental manner.* This can lead to violent acts, which is vividly illustrated by hacking technologies and the avalanche of computer viruses as well as computer games (so called "shooting games") being mostly of violent character.

2) Computers are harmful because of the *digital logic of information processing* adopted in them, which contributes to the formation of unambiguous, "black and white", "yes or no" anti-creative, *bipolar thinking* in a person. If a child does not develop an ambivalent (dialectical, multifaceted, paradoxical) attitude towards the object/environment, and all objects seem to the child to be either good or bad without any smooth transitional phase between these polar indications, and if this perception of the surrounding world is fixed at the level of emotional intellect, then this circumstance serves as a prerequisite for further child's development in the direction of the *schizoid type,* characterized by ***atomic-discrete, aggressive, anti-creative*** perception and mastering of the world. It is significant that ambivalence as a "balance of opposites" (P. Weinzweig) is a nurturing and psychological basis for the development of a creative personality (creative personalities are paradoxical beings characterized by ambivalent, mutually exclusive psychological and behavioral features) [3].

3) The implementation of the computer aids as the main conductor of modern visual technologies significantly inhibits the need and process of reading as the essential educational activity: in the age of electronic mass media, the periods of childhood and adulthood have lost their distinction. The advent of television transformed culture into "emotional consumption" of television frames that change on the screen every three seconds. It is estimated that in the first fifteen years a teenager spends 16 hours in front of the TV, and in each program he/she sees at least three scenes of violence. The modern youth pay more attention to "aggressive forms of culture", which are spreading with the speed of an epidemic thanks to the spread of mass media messages. And the book as a source of spiritual development recedes into the background [5].

According to neuropsychologists, this has an excessive effect on the right hemisphere, which is associated with visual perception of the world, whereto the child's activity is attracted, whereas the left hemisphere, where the centers of thinking and speech are located, is being lessened [5].

Under such conditions, the elements of spectacular culture are becoming increasingly active, when due to the development of relevant electronic means of mass media the informational (audio-visual) signals that reach young people increased many times.

Simultaneously the factor of book-verbal information has weakened. The latter circumstance is manifested in the fact that today's children and young people read very few books, in particular fiction. This leads to the primitivization of the artistic and aesthetic sphere of a person; the functional connection between the hemispheres of his/her

brain is distorted due to weakening the interhemispheric transformation processes. Such interhemispheric transformation needs attracting young people to the artistic treasury of human civilization, which develops a persons' ability to generate figurative information in the sphere of their own artistic and aesthetic representation, and this, in turn, is a cornerstone of the development of creative thinking and implements the main mechanism of thinking as such – ***diplasty*** – person's ability to combine in one logical and psycho-emotional context the opposite and mutually exclusive concepts, images, objects, states, stimuli.

Thus, the mechanisms of the reproductive imagination remain undeveloped, and its highest level of development allows the reader not only to reproduce the images of literary works as the writer sees them, but also to fully subordinate his/her imaginative processes to a deep and accurate analysis of the text [1-5].

If ***psychophysiological purpose of human being's development*** can be considered to be the reaching of the state of functional synthesis of the hemispheres (when symbolic and verbal information being perceived mainly on the level of the left hemispheric processes, can be easily transformed into imaginative and emotional sphere of the right hemispheres, and vice versa), then nowadays the interhemispheric transformational processes are sharply decreasing alongside with the decreasing in person's ability for verbalization and deverbalization of information. And this process means, ***on the one hand,*** "dressing up" in the symbolic-verbal "attire" the emotional and imaginative information, and ***on the other hand***, – the reverse transformation of a sign into an image, and words into emotions. Such a transformation takes place precisely in the process of young person's plunging into artistic treasury of human civilization, which develops person's skills to generate visual information in the field of his/her own artistic and aesthetic perception, and this, in its turn, is the corner condition of the development of creative thinking [1; 3].

3. The problem of using artificial intelligence in social and educational space

The process of formation of the digital generation takes place in the context of not only sociocultural and psychomental aspects, but also leads to psychophysiological changes of the subjects in the educational process. One of the significant challenges of the digitization process, including the development of AI technologies, is connected with the use of digital devices that can change the structure of the human brain. Researchers from the University of Sussex (Great Britain) have found out that if a person uses several electronic devices at the same time, it changes the structure of the brain, and, unfortunately, not for the better [14].

There is also a problem of control of AI, when AI should be useful to people, being controlled by people, not vice versa. Under such conditions, we can talk about some advantages and disadvantages of AI, including in the educational field.

Among ***the important advantages of AI*** is the minimization of different errors stemming from a human factor. However, this minimization depends on the AI programming algorithms.

We can also talk about the zero risk factor of using AI, since AI can be used to solve tasks that can pose a danger to humans.

AI is characterized by round-the-clock availability, since computer devices can work endlessly, without interruptions.

The AI doesn't express human emotion when customers can send any number of strange requests, and the chatbot can produce pre-prepared responses with the help of which it can react.

In addition, AI in the context of its software can quickly make decisions [14; 21].

Among ***the disadvantages of AI,*** one can mention that its operation involves large material costs (for the development

and maintenance *of software* and *hardware*).

According to some of its developers, AI does not show signs of creativity because it functions according to certain rigid algorithms lacking in spontaneity.

In addition, AI is capable of replacing many people who work in certain sectors of economy and in education.

Working roles such as simple data entry or communicating with customers at the beginning of the interaction, i.e. chat support, are now handled by bots that can do this more efficiently and round-the-clock. Being one of the key advantages of AI, it is also its disadvantage, as machines lack intuition and empathy and cannot fully establish relationships with the humans, which is the case with the educational process.

Another human peculiarity that is difficult to integrate into a computer machine is connected with the phenomenon of ethics, since the moral and ethical aspects of human interaction are extremely difficult (and maybe impossible) to algorithmize. The situation of the biased use of AI can be illustrated by examples of hiring procedures, loan approvals, and unequal and inadequate criminal sentencing. Mitigating such AI's characteristics requires a thoughtful approach to data selection, preprocessing methods, and algorithm development.

The legal issues concerning AI cover a wide spectrum: responsibility, intellectual property rights, regulatory compliance. Legal issues related to copyright arise from ownership of AI-generated content and its algorithms.

AI transparency is connected with the algorithms and decision-making processes. Such transparency is essential for building authority, accountability, and user's trust in AI systems [14; 21].

Another important problem of using AI (and other intelligent digital systems) in the educational field is related to ***the possibility of replacing teachers with artificial intelligence.*** Thus, in one of the schools in Finland, a technological experiment was conducted: during the school year, the teachers there were replaced by robots. Elias, a new foreign language teacher at a Tampere school, never gets tired of repeating the same things. Elias is ready to answer many questions, being a universal teacher who speaks 23 languages. The robot can assess students' knowledge and select appropriate questions and exercises. At the same time, its behavior is programmed to interest children, encouraging them to study. The mathematics lessons are taught by another "teacher" – a robot that was made and programmed in Finland. The technological experiment designed for elementary school lasted a year. Similar experiments have already been conducted in the United States, the Middle East, and China [18].

It is important to note that the essential basis of the educational process (in the context of its participants), which consists in the interaction of teachers with pupils/students, is revealed at the level of the ***neural organization of the human brain***.

As researches have shown, the educational process is fundamentally resonant, when the interaction of the participants in this process can be analyzed in the context of resonance processes.

At the level of the neural organization of the human brain, the principle of resonance is actualized in the phenomenon of "mirror neurons" discovered by Giacomo Rizzolatti with his colleagues [16: 10], who revealed the *"mirror effect"*, according to which the actions (as well as the behavior) of a person, accompanied by the activation of the corresponding structure of neurons in his/her brain, activate the same structure of the neurons in the brain of another person who observes these actions or participates in them.

This mirror effect is also realized in those ideomotor reactions, when a thought, a created image can cause a certain muscular reaction, when the movement imagined by a person is realized reflexively.

Taking into consideration the mentioned phenomenon, we can conclude that the robotization of the educational process is quite problematic.

4. The problem of academic integrity associated with digitalization of the educational and scientific space

The phenomenon/paradigm of academic integrity has always occupied an important place in the scientific and educational spheres, but in the last 15-20 years this phenomenon has becoming ever more problematic. One of the main reasons for this circumstance is related to the so-called *information boom*, due to which the information generated by modern civilization doubles every six months. And 100-150 years ago, the process of doubling information on our planet took place every half century. At the same time, nowadays the mentioned process has, to a large extent, acquired the character of multiplication of generated information, which reduces the level of production of objectively new information.

The values of academic integrity face such an important challenge as AI, which as a software product can generate absolutely unique/original texts on a certain order (although, it should be said, that there are some AI programs allowing to determine to a certain extent the level of originality of the texts created by AI). We can also mention the computer programs enabling to paraphrase texts (for example, https://neuralwriter.com/uk/#progress=96). There are also other software methods for increasing the uniqueness of texts, which require separate research.

To solve the problem under consideration, we have used both the theory of information in its various modifications and the concept of functional asymmetry of the hemispheres of the human brain.

The question arises of how to radically approach the solution of the above-mentioned problem. We believe that one of the ways to solve the problem of academic integrity is related to informational analysis of texts in the context of *information theory*.

C. Shannon defined information as a measure of diversity, R. Ashby – as a measure of structural diversity. Other researchers suggest considering information as a measure of structural-semantic diversity as well as the freedom of person's choice of this or that information. Information is also understood as a degree of heterogeneity of the distribution of matter and energy in space and time: while energy can be understood as a measure of the intensity of objects' motion, the information characterizes its structural properties. There is also a probabilistic approach to determining the amount of information about a specific event, according to which the more rare and non-trivial this event is, the more information it contains.

These facts enable to specify the two aspects of text analysis in the context of academic integrity, which correspond to the information processing strategies of the hemispheres of the human brain – the right (emotional and imaginative) and the left (abstract and logical):

1) the analysis of the level of informational non-triviality of the text, which is investigated due to the analysis of the frequency of the use of lexical units in the text, as well as the uniqueness of their combinations (such an approach can hardly be used in the context of the analysis of texts containing an experimental data received by mathematical operations);

2) the analysis of the degree of structural diversity of the text, which involves the analysis of the structural complexity of the text including certain number of its elements, as well as the number of connections of these elements, i.e. here we analyze the amount of contexts in which a certain text element is used/occurs; this amount which can compare with the number of connections (synapses) of a certain neuron in the brain.

Conclusions and research perspectives. The conducted interdisciplinary research has enabled us

to come to the conclusion that the digitalization of educational space has a colossal benefit for all of us. On the other hand, our analysis casts doubt on the absolute beneficence of computerized learning, based on digital devices. Due to this conclusion, the prospective development of the educational field in the context of the introduction of a new educational paradigm presupposing the preventive measures regarding the threats of cybersocialization: age restriction of children's access to the Internet and their presence in social networks; teaching children and young people how to spend time on the basis of the healthy lifestyle; appropriate legislative measures to limit the activities of the mass media as for the propaganda of cruelty, violence, immoral behavior, etc.

Nowadays, the field of AI faces major challenges – such as privacy and protection of personal data, the ethics of its use, which reveals the possible bias of algorithms and transparency, as well as the socio-economic consequences of changing patterns of employment of people. The proliferation of AI also raises concerns about how AI will affect cybersecurity. Furthermore, when implementing AI in sensitive areas, such as health care and criminal justice, a more focused approach is needed that requires greater attention to the ethical principles necessary to achieve fair outcomes. It is also important to keep a balance between technological development and moral considerations, essential to harnessing AI for the benefit of society, avoiding risks and encouraging *ethical innovation*.

The educators note that they use AI services in their extracurricular work and the activities to prepare for classes, create tests for homework, during lessons, as well as to test students' knowledge. In most cases, AI helps students quickly search and systematize information, take notes, generate ideas for creative works concerning titles, illustrations, theses for a report, etc. At the same time, in separate questionnaires, children anonymously admitted that they use AI tools for creating the texts, for example, during the preparation of tasks in humanitarian disciplines. At the same time, according to experts, AI cannot yet replace a person in conscious decision-making or in the creative process, and AI is also unable in full to reflect/understand the context of the task being offered to solve. Disadvantages of AI technologies, particularly their use for educational needs, are also obvious to educators. In particular, AI sometimes makes blunders (it makes basic logical errors), or the data it relies on may contain inaccuracies or be obsolete. Also, AI reveals the problem of ascertaining the original source of information, and for scientific research it is very important to check and correctly refer to the original source. According to some experts in the domain of education, the influence of AI on the formation of students' "4K" skills *(communication, collaboration, critical thinking, creativity*) is limited; this fact requires additional research.

In general, some disadvantages and even risks of AI implementation into social and educational sphere are connected with the possible loss of jobs due to automation, as well as deep fakes, privacy violations, algorithmic bias caused by incorrect data, socio-economic inequality, market volatility, automation of weapons, uncontrolled process of possible formation of AI's self-awareness, etc. [7; 14; 21].

Addressing these challenges requires concerted efforts of legal professionals, policymakers, technology experts, educators, who are to cooperate in creating clear rules and policies for the application of AI thus balancing the innovation and protecting the rights of all concerned parties.

In the context of the problem of academic integrity, the prospect of solving this problem presupposes the development of software related to the proposed algorithms for analyzing the uniqueness of texts.

REFERENCES (TRANSLATED & TRANSLITERATED)

1. Vozniuk, O.V. (2023). Nehatyvni ta pozytyvni naslidky tsyfrovizatsii osvitnoho protsesu [Negative and positive consequences of digitalization of the educational process]. *Tsyfrova transformatsiia ta dydzhytal tekhnolohii dlia staloho rozvytku vsikh haluzei suchasnoi osvity, nauky i praktyky – Digital transformation and digital technologies for the sustainable development of all branches of modern education, science and practice:* materialy mizhnar. nauk.-prakt. konf. Mizhnarodna Akademiia Prykladnykh Nauk (Respublika Polshcha) – Derzhavnyi biotekhnolohichnyi universytet (Ukraina). Lomzha, Polshcha, ch. 1, 196-200 [in Ukrainian].

2. Vozniuk, O.V., & Dubaseniuk, O.A. (2024). Suchasni vyklyky tsyfrovizatsii osvitnoho prostoru u konteksti vykorystannia shtuchnoho intelektu [Modern challenges of digitalization of the educational space in the context of the use of artificial intelligence]. *Teoriia i praktyka tsyfrovoho navchannia v suchasnykh zakladakh osvity – Theory and practice of digital learning in modern educational institutions:* zb. nauk. prats. Vinnytskyi derzhavnyi pedahohichnyi universytet imeni Mykhaila Kotsiubynskoho. Vinnytsia: TOV firma "Druk plius", vyp. 3, 29-34 [in Ukrainian].

3. Vozniuk, O.V., & Horobets, S.M. (2019). Vykorystannia kontseptsii funktsionalnoi asymetrii pivkul holovnoho mozku u pobudovi informatsiino-tsyfrovoi tekhnolohii roboty z obdarovanymy ditmy ta moloddiu [Using the concept of functional asymmetry of the cerebral hemispheres in the construction of information and digital technology for working with gifted children and youth]. *Informatsiino-tsyfrovyi osvitnii prostir Ukrainy: transformatsiini protsesy i perspektyvy rozvytku – Information and digital education space of Ukraine: transformation processes and development prospects:* materialy metodolohichnoho seminaru NAPN Ukrainy, 4 kvitnia 2019 r. / za red. V.H. Kremenia, O.I. Liashenka; ukl. A.V. Yatsyshyn, O.M. Sokoliuk. Kyiv, 312-321 [in Ukrainian].

4. Vozniuk, O.V. (2013). Kibersotsializatsiini naslidky kompiuteryzatsii yak suttievoho chynnyka pobudovy suchasnoho informatsiinoho prostoru [Cyber-socialization consequences of computerization as a significant factor in building a modern information space]. *Naukovi zapysky Maloi akademii nauk Ukrainy. Seriia: Pedahohichni nauky – Scientific notes of the Small Academy of Sciences of Ukraine. Series: Pedagogical Sciences:* zb. nauk. prats, vyp. 4, 23-35 [in Ukrainian].

5. Vozniuk, O.V. (2013). *Reformuvannia osvity u konteksti suchasnykh osvitnikh mifiv. Osvitni reformy: misiia, diisnist, refleksiia [Reforming education in the context of modern educational myths. Educational reforms: mission, reality, reflection]:* monohrafiia / za red. V. Kremenia, T. Levovytskoho. Kyiv: TOV "Vydavnyche pidpryiemstvo EDELVEIS", 239-250 [in Ukrainian].

6. *Rezultaty vseukrainskoho doslidzhennia pro perspektyvy ShI v zahalnii serednii osviti [The results of the all-Ukrainian study on the prospects of AI in general secondary education].* Retrieved from: https://mon.gov.ua/ua/news/rezultati-vseukrayinskogo-doslidzhennya-pro-perspektivi-shi-v-zagalnij-serednij-osviti [in Ukrainian].

7. Allen, C., Smit, I., & Wallach, W. (2005). Artificial morality: Top-down, bottom-up, and hybrid approaches. *Ethics and Information Technology,* 7(3), 149-155 [in English].

8. Bucăța, G., Popescu, F., & Tileagă, C. (2022). Digital Transformation of Higher Education System. *Proceedings of the 28th International Scientific Conference Knowledge-Based Organization*, vol. 28, issue 1. Retrieved from: https://doi.org/10.2478/kbo-2022-0025 [in English].

9. Gabriel, Iason. (2020). Artificial Intelligence, Values, and Alignment. *Minds and Machines,* 30 (3), 411-437. Retrieved from: https://doi.org/10.1007/s11023-020-09539-2 [in English].

10. Gentilucci, M., Dalla, Volta, R. (2008). Spoken language and arm gestures are controlled by the same motor control system. *The Quarterly Journal of Experimental Psychology,* 61(6), 944-957. Retrieved from: https://doi.org/10.1080/17470210701625683 [in English].

11. Goulart, V.G., Liboni, L.B., & Cezarino, L.O. (2021). Balancing skills in the digital transformation era: The future of jobs and the role of higher education. *Industry and Higher Education,* vol. 36, issue 4, 118-127. Retrieved from: https://doi.org/10.1177/09504222211029796 [in English].

12. *International Conference on Artificial Intelligence and Education, Planning Education in the AI Era: Lead the Leap*. (2019). Beijing. Retrieved from: https://unesdoc.unesco.org/ark:/48223/pf0000368303 [in English].

13. Ljungqvist, M., & Sonesson, A. (2021). Selling out Education in the Name of Digitalization: A Critical Analysis of Swedish Policy. *Nordic Journal of Studies in Educational Policy,* 8(2), 89-102. Retrieved from: https://doi.org/10.1080/20020317.2021.2004665 [in English].

14. Loh, K., & Kanai, R. (2014). Higher media multi-tasking activity is associated with smaller gray-matter density in the anterior cingulate cortex. *PLoS One,* 9(9), e106698. Retrieved from: https://doi.org/10.1371/journal.pone.0106698 [in English].

15. Oppenheimer, Todd. (2003). *The Flickering Mind: Saving Education from the False Promise of Technology.* New York: Random House, Trade Paperback, 528 [in English].

16. Rizzolatti, G., & Arbib, M. (1998). Language within our grasp. *Trends in Neurosciences,* 21, 188-194. Retrieved from: https://doi.org/10.1016/s0166-2236(98)01260-0 [in English].

17. Santos, H., Batista, J., & Marques, R.P. (2019). Digital transformation in higher education: the use of communication technologies by students. *Procedia Computer Science,* 164, 123-130. Retrieved from: https://doi.org/10.1016/j.procs.2019.12.163 [in English].

18. Seppinen, Nina. (2022). *The Possibilities of use of Robotics in Finnish Early Childhood Education – benefits and challenges. A functional thesis.* Retrieved from: https://www.theseus.fi/bitstream/handle/10024/782416/Seppinen_Nina.pdf?sequence=2 [in English].

19. Voznyuk, A. et al. (2021). Interdisciplinary Educational Technology based on the Concept of Human Brain Functional Asymmetry. *Postmodern Openings,* 12(2), 433-449. Retrieved from: https://doi.org/10.18662/po/12.2/316 [in English].

20. Voznyuk, O. (2023). Deepening The Principles Of Media Education Based On The General Systems Theory. *Zhytomyr Ivan Franko State University Journal. Pedagogical Sciences,* 1(112), 29-38. Retrieved from: https://doi.org/10.35433/pedagogy.1(112).2023.29-38 [in English].

21. Yudkowsky, Eliezer. (2011). Complex Value Systems in Friendly AI. *Artificial General Intelligence,* 6830, 388-393. Retrieved from: https://doi.org/10.1007/978-3-642-22887-2_48 [in English].

Received: July 26, 2024
Accepted: August 20, 2024