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Digital competence of specialists in socio-economic, physics, and mathematics specialties, company managers in professional activities

Цифрова компетентність фахівців соціономічних спеціальностей, фізико-математичного спрямування, керівників фірм у професійній діяльності

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Abstract


This article explores the role of digitalization in enhancing personal and societal well-being. The role of digital competence, virtual and augmented reality tools, cloud technologies, robotics, 3D technologies, MOOC, e-learning, m-learning, flipped learning, Internet of Things (IoT), intermediate interval training, hybrid, mixed reality (MR), Machine Learning (ML), Artificial Intelligence (AI) in a person's professional life. The most effective principles of digitization are outlined, the services in demand for self-study and professional activities are identified, digital educational products and the most popular services, as well as free Web applications for joint professional work on the Internet, are identified, a matrix of their services, tools, and opportunities is compiled; the necessity of using messengers and cloud services has been proven. To form and develop the digital competence of specialists, the author's


Анотація


У статті розкрито зміст, головна мета, основні напрями цифровізації для вдосконалення життєдіяльності людини і суспільства. Показано роль цифрової компетентності, інструментів віртуальної та доповненої реальності, хмарних технологій, робототехніки, 3D-технологій, MOOC, e-learning, m-learning, flipped learning, Internet of Things (IoT), проміжного інтервального навчання, гібридної, змішаної реальності (MR), Machine Learning (ML), Artificial Intelligence (AI) у професійному житті людини. Виокреслено найдієвіші принципи цифровізації, затребувані сервіси для самонавчання та фахової діяльності, виявлені цифрові освітні продукти та найпопулярніші сервіси, а також безкоштовні Web-додатки для спільної фахової роботи в Інтернеті, складено матрицю їхніх послуг, інструментів та

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methodology was developed and introduced to the experimental group using digital applications, services, digital tools, etc. in human life. The qualitative analysis of the effectiveness of the development of the digital competence of specialists was confirmed by the quantitative analysis of positive changes in all blocks. Methodological recommendations have been developed for the development of the digital competence of specialists and the optimal practical use of digital technologies in a person's professional activity.

Keywords: digitalization, digital competence of a specialist, digital skills, career advancement, digital tools.

Introduction

The realities of the modern world demand a review of personality formation and set new requirements for human competencies. High technologies play an important role in all spheres of human activity and are the basis of the economic growth of all world countries.

Most professions require knowledge of computer technology and the use of various possibilities of digitalization because the appearance of the Internet in the modern world has significantly changed the format of human life, which has stimulated the development of new innovative technologies.

Not only the educational process has changed in the modern world, but also the model of the person himself. Therefore, the main task of modernity appeared on a global scale – to form a new way of thinking in a person, to raise the qualification level, and to teach how to use information for self-education with the help of the latest technologies.

In the process of increasing the efficiency of professional activity, one of the main factors of a person is the active introduction of new forms and methods into his professional life and to promote the general computerization of life positions in all spheres of life.

In professional activity, we consider the active use of digital tools to be a methodical basis, which forms skills, develops a person's creative abilities, and provides a person with modern personal characteristics necessary for research activities, professional activities, project activities, etc. Therefore, digital education around the world is an important tool for building a digital society and ensuring the sustainable development of every country. The transition to a high-quality digital education level requires the joint efforts of educational institutions, industry, the government, and all people of civilized society to "ensure the readiness of the young generation for the challenges and opportunities of the digital world".

Digitization for humanity is the introduction of the latest information and digital technologies into the life and profession of each individual to form the skills of the 21st century in a person: critical thinking, analysis of the reliability of information received, and maximum use for professional purposes (Kan, 2021).

The advantages of digital transformation in the life of humanity are: finding the most valuable materials for professional activity and personal development; independent learning throughout life with the help of digitalization, increasing motivation for self-development, and self-education; promoting the development of skills; the ability to quickly adapt to unpredictable and rapidly changing conditions; the opportunity to work at a comfortable pace, in the most convenient conditions. Therefore, digitalization is necessary for the development of personality in modern society. We believe that digital technologies, which are actively developing in the world, will change our imagination about the possibilities of IT.

можливостей; доведено необхідність використання месенджерів, хмарних сервісів. З метою формування та розвитку цифрової компетентності фахівців розроблено та введено авторську методику в експериментальну групу з використанням цифрових додатків, сервісів, цифрових інструментів тощо у життєдіяльності людини. Якісний аналіз ефективності розвитку цифрової компетентності фахівців підтверджено кількісним аналізом позитивних змін у всіх блоках. Розроблено методичні рекомендації щодо розвитку цифрової компетентності фахівців та оптимального практичного використання цифрових технологій у професійній діяльності людини.

Ключові слова: цифровізація, цифрова компетентність фахівця, цифрові навички, кар'єрний розвиток, цифрові інструменти.

Literature Review

Nowadays, the use of digital technologies for a person's life and work is one of the stable, most important trends in the development of the global process of an individual's life. Therefore, scientists, in their research, raise consideration of this issue to the highest level.

N. Nychkalo, N. Lazarenko, & R. Hurevych (2021) at the beginning of the 21st century considered the processes of digitalization of world education and the processes of informatization related to the informatization and digitalization of social processes. Digitization of society has acquired a global character, so the research of scientists covered many developing countries, not only developed countries of the world community. It is a proven position that in the information society, the results of work and the objects of the majority of the employed population are information resources and human knowledge, the growing role of intellectual work, oriented on a global scale to the use of information; the need for constant updating of rapidly aging knowledge. The goal of digitization of the world is to prepare a person for effective and full participation in social, household, and professional activities in the conditions of the information society. The meaningful content of the phrase "digital transformation" is shown, the possibility of using all these technologies due to their synergy in the aggregate.

To clarify digitalization as a means of personality development in modern society, O. Stoika (2023) developed recommendations taking into account the experience of the Republic of Poland and Hungary. She examined the content of the educational levels of the program "Google Digital Tools for Education", proved the importance of digitalization of education, which is taking place at a fast pace, found that a significant indicator of the achievement of digitalization of the world is the modernization of the Unified World Electronic Database on Education and Science, the professional activities of all spheres of humanity. Taking into account the experience of Hungary and Poland, she showed the ways of digitalization of specialist training, and highlighted the need for intensive development of such technologies: virtual and augmented reality; Artificial Intelligence; blockchain; internet of things; robotics; media education; gamification; cloud-based environments; interdisciplinarity. Presented useful online services for the individual. Scientists M. Marienko, & A. Sukhikh (2022) also showed the peculiarities of the organization of the process of obtaining information with the help of digital technologies. They showed the ways of digitization and highlighted the need for intensive development of the following technologies: blockchain; internet of things; Artificial Intelligence; virtual and augmented reality; robotics; media education; cloud-based environments; gamification; interdisciplinarity. N. Hrechanyk, D. Koval, I. Kovalchuk, O. Slovik, & L. Zinchenko (2023) devoted their research to this problem. Scientists show the ways of digitalization of specialist training in connection with the digital transformation of education, scientists show the main ways of applying the technology of mixed learning by scientists. The main components of blended learning, which can be implemented in the digitalization of the information and educational environment, are highlighted. The author's methodological concept has been developed, which provides for the digitization of the training of specialists, including in the modern professional training of specialists a categorical and component analysis of the technology of mixed learning in the following dimensions: philosophical, cultural, psychological, social, and pedagogical.

L. Kharitonenko (2022) analyzed the main models, approaches, and methods of learning during the life of an individual and singled out the most effective of them, which can be used for a person's readiness for positive activity in the conditions of information culture and dynamic society in the future. Innovative methods are presented, which are aimed at improving intellectual skills, developing personal creativity, decision-making, independent problem-solving, improving cognitive activity; and innovative methods of planning the assimilation of professional material.

Internet services used for professional activities in modern society were clearly described by A. Kulichenko & Y. Polezhaev (2020). Scientists at the time of digitization showed the importance and necessity of a person's use of the information contained in a smartphone and computer; and developed recommendations on the possibility of turning smartphones and computers into human assistants in updating and acquiring knowledge. The learning process was based on a CLIL approach, using the Lumowell channel on the YouTube platform. Scientists offered various tasks using free online educational platforms: Quizlet and Zoom scientists.

The urgent need for digitization occupies a key place in society, in all spheres of life, and requires an increase in the number of educational resources that make life easier, more accessible, and more efficient.

Due to the realities of the modern educational process, N. Ivanenko, M. Deneka, & O. Sydorenko (2023) outlined the main most used digital applications, platforms, online resources, tools, etc., which are currently used in the life of every individual and briefly characterized each position; the concept of digitization of education was studied.

The analysis of the scientific works of specialists from different countries suggests that the digitalization of society and digital technologies help people in the implementation of practical activities and research work; are the basis of training of modern future specialists, contribute to the process of personality development, formation of digital competence, increase the level of professional maturity, professional thinking. Therefore, the importance of the use of digital tools in human work is undeniable.

Accordingly, the *purpose of this article* is to prove the importance of digitalization as a means of personal development in modern society; conduct an analysis of effective digital applications, and digital tools used in the process of human life, justify their influence and experimentally verify the effectiveness of the system of formation of digital competence of specialists on the formation and development of their digital competence.

Methodology

The modern methodology of psychological and pedagogical research was used to conduct an experimental test of the formation of the digital competence of specialists and to analyze the role of effective digital applications, services, and digital tools in human life.

In particular, the following methods were used: analysis of the sources of the literary and bibliographic review; terminological and retrospective analysis, statistical and formal-logical analysis, the study of the products of individual activity, questionnaire survey, and monitoring.

By level of education – adult education.

Time of the experiment: 2023–2024.

Audience of experimental work: specialists in various fields.

The purpose of the experimental work: experimental verification of the formation of the digital competence of specialists and the role of effective digital applications, services, and digital tools in human life.

We have developed a system for the formation of digital competence of specialists and developed methodological recommendations for the development of digital competence of specialists.

Control and experimental groups were determined (experimental group (EG) – 131 respondents, control group (CG) – 129 respondents), where constant sections were conducted to determine the levels of development of digital competence of specialists and the role of effective digital applications, services, digital tools in everyday life a person.

At the formative stage of the experiment, an author's methodology using digital applications, services, and digital tools in human life was introduced in the experimental group to form and develop the digital competence of specialists. The author's technique was not used in the control group.

The control group was provided with informational materials, methodological recommendations for the development of digital competence of specialists, and the role of effective digital applications, services, and digital tools in human life.

Positive dynamics were obtained at the end of the experimental work in both groups – in the experimental group and the control group. However, in the experimental group that underwent training, a significantly higher level of development of the digital competence of specialists and the respondents' use of effective digital applications, services, and digital tools in their professional activities was noted. This is evidenced by the results at the end of the formative experiment. The results indicate the need for the formation and consistent development of the digital competence of specialists.

A qualitative analysis of the effectiveness of the development of digital competence of specialists is confirmed by a quantitative analysis of positive changes in all blocks.

Results and Discussion

1. Content, main goal, main directions of digitization for improvement of human life, society, and the state.

The modern world pays more and more attention to methodical techniques that develop the cognitive and creative activity of an individual. For the development of personal creativity and successful solutions to modern professional tasks, new technologies are used in the life process of every person, which makes this process more relevant to the requirements of modern life and effective.

With the help of digitalization, the present makes it possible to form informational, intellectual, creative, and general cultural competence in a specialist. Without the use of information and communication technologies, it is impossible to apply innovations that include, with the help of interactive equipment, the process of preparing and transmitting information in modern society. It is digital technologies that provide the possibility of visual perception of information, and contribute to increasing motivation and transparency of knowledge acquisition. They supplement information that is important for a specialist in a certain field: personal experience, photo and video materials, organization of virtual exhibitions, use of 3D technologies, informative virtual sightseeing trips, etc. At the same time, every person actively uses a tablet, smartphone, and desktop computer, which occupy an important place in the life of an individual.

Definitions of "digitalization", and "digitalization of education" are the subject of scientific research by scientists. According to M. Rudenko (2021), we are talking about "digitalization" as "a means of obtaining the expected result, which meets the requirements and needs of society and suits manufacturers and business owners about the possibility of obtaining high profits" and we support the opinions of A. Vasylyk & A. Kushnir (2018), emphasize in their scientific works that "the digital format represents information more accurately, ensuring its free circulation, placement, processing, and use in computer networks. The digital education system includes information resources, telecommunications, and management system".

V. Kuibida, O. Karpenko, & V. Namestnik (2018) emphasize in scientific research that "digitalization in the broadest sense should be considered as the process of introducing digital technologies to improve the life of a person, society and the state". So, we see that the process of digitalization of the world is aimed at ensuring the continuity of the learning process and human life, that is, lifelong learning – life-long learning, its personification based on advanced learning technologies – advanced learning technologies.

The main goal of digitalization in human life involves ensuring the continuity of the learning process, i.e. life-long learning, and at the same time its individualization based on advanced learning technologies; inclusion of the use in the training of significant data on the process of assimilation of the personality of professional components and automatic adaptation to the profession; the use of technologies of augmented reality of virtualization, cloud computing and many other technologies (Karpluk, 2017).

Let's consider the main directions of digitization for improving the life of a person, society, and the state:

- 1) Creation of digital platforms and professional resources with support for multimedia and interactive content for general access of the individual, in particular, tools for automating the main processes of human work;
- 2) Introduction of innovative computer-based, computer-oriented multimedia learning tools and equipment to create a digital professional learning environment (multimedia centers, STEM research laboratories, etc.);
- 3) Organization of broadband access to the Internet for each person;
- 4) Development of remote form using multimedia and cognitive technologies.

2. The role of digital competence, virtual and augmented reality tools, cloud technologies, robotics, 3D technologies, MOOCs, e-learning, m-learning, flipped learning, Internet of Things (IoT), intermediate interval learning, hybrid, mixed reality (MR), Machine Learning (ML), Artificial Intelligence (AI) in a person's professional life.

One of the key problems of a person's professional activity is the development of a person's digital competence, which is a consequence of combining the virtual and real worlds for visualizations and the creation of new spaces where digital and physical objects interact and coexist in real-time. A modern person should be able to use the latest digital tools in their professional activities, be in the trend of modern technologies, create a suitable environment for their activities, be able to protect personal information in the digital space and know ways and ways of safe behavior on the Internet. Therefore, for a teacher of a higher school, the formation of digital competence in both the future specialist and himself is an urgent need (Stoika, 2022).

The development of personality in modern society is facilitated by cloud technologies, which facilitate the use of video and audio files, and provide free access to informational educational materials. There is a practice of active use of online webinars, integrated practical classes, etc. Cloud technologies provide new opportunities for conducting training, scientific work, collective, group, research, interactive project activities, online communication with colleagues and employers, etc. (Verbovetskyi & Oleksyuk, 2022).

The introduction of digitization of education in the global space is aimed at creating a system of training specialists closely related to IT companies, creating a system that will determine professional standards in a certain field.

The basis of digital education is information, new information that changes the traditional education system and contributes to the formation of its new quality. Training future specialists in various fields only with the help of "dry" classes and banal didactic materials can discourage the desire to work and will be fruitless. Therefore, the training of a modern specialist involves the formation of a digital culture in the teacher, to competently use the opportunities of the information society. The professional thinking of the teacher is formed and develops in the conditions of the information space. The teacher's thinking generates new ideas, understanding the needs of modern education with the use of digital technologies, and understanding the problems in one's own professional activity. The digital environment requires a different way and forms of work from the teacher, a different formulated picture of the world, and a different mentality because digitalization in modern society is a creative product, a means of personal development, gives an impetus to the development of the professional thinking of the future specialist, who is created as a person under his leadership.

To increase the level of implementation of digital technologies by future specialists, to develop professional thinking, developing a digital educational environment, and improving the level of literacy, we propose to implement and develop multimedia and digital learning tools and equipment, including augmented and virtual reality tools, cloud technologies, mixed and distance learning, educational robotics, MOOC, 3D technology training tools.

The task of digital means, in the context of the development of the professional thinking of the future specialist of today, is to activate the process of the working day, and free up time for personal direct communication (Rozputnia et al., 2023).

For this purpose, we recommend using mobile learning, e-learning, "inverted" learning, and blended learning at the workplace.

E-learning at the workplace is: based on the use of new multimedia technologies of the Internet, a promising model for improving the quality of work through joint work at a distance, facilitating access to services and resources, their exchange, a system that offers the use of electronic libraries, Internet technologies, multimedia materials, workshops, virtual laboratories, etc. It would be appropriate to develop a specialist's website for a purposeful, independent search for information.

M-learning – transfer of knowledge using WAP and GPRS technologies to mobile devices to make the professional process accessible, flexible, and personalized, which implements the principle: work at a convenient time and in any place. We offer the use of mobile applications – WhatsApp and Viber, which allow you to send text messages, communicate with colleagues, and make audio and video materials necessary for work.

Flipped learning is a form of cooperation that allows you to actively "flip" the usual work process in such a way that it has a positive effect on the results of work, independent work, and the actualization of already-known knowledge when discussing and performing practical tasks.

If a professional is willing to spend time customizing Minecraft and setting up a script, then the professional potential is endless. You can work in a team by giving such a task, the performance of which requires the combined efforts of the entire team.

The acquisition of practical skills by specialists in working with multimedia means of computer technologies creates a professional basis that allows to establishment of optimal proportions between traditional and computer technologies in human activity. In this way, the combination of traditional and innovative technologies helps eliminate stereotypes in the workplace, creates an interesting aura at work, and ensures a high level of personal productivity.

An important place in the process of improving a person's professional qualities is occupied by intermediate interval work. This technology is effective in programming, linguistics, and other fields, and contributes to the long-term consolidation of the studied material. Success in retaining acquired skills and memorizing knowledge occurs with constant repetition of the material and systematic practical application. Such cyclicity in practice is successfully updated after the development of a mobile application.

Internet of Things (IoT) is one of the main technologies on which digital information is based. The modern system of worldwide digitalization allows for remote management and collection of information on digital objects of the physical world that connect to the Internet (control of industrial or home alarm systems). A virtual copy of a physical object appears on the Internet, allowing the object to be controlled over the Internet and containing various parameters of the outside world and the object. An example of IoT is a preceptor in a cinema, which sends a signal about a detected malfunction to the technical support service and offers a list of spare parts that must be replaced as part of unscheduled repairs.

Immersive technologies, which include Virtual Reality and Augmented Reality technologies, are invaluable in a person's professional life and are actively being implemented in the professional practice of their fields. The principle of immersiveness offers specialist immersion in virtual space. The design of virtual interactive models is relevant now in the professional sphere and the educational space. Virtual reality technology has become an important technology in modern society because it can effectively supplement traditional didactic tools. It attracts users with the possibility of active participation of each person in the process of professional activity, interesting for its interactivity. Virtuality becomes an effective tool for a person's life, because, at the moment of immersion, a person takes an active part in the process, is interested in this process, and works successfully. A product designed by technical means is perceived by a person using visual, auditory, discrete, and kinesthetic channels. To enhance the perception and enrich the knowledge of the research material (AR), sensory information is provided. "Since the brain does not distinguish between real events and a high-quality simulation, there is a high probability that VR and AR technologies will solve the problem of "live" communication in online education. The created "presence effect" contributes to experiencing an incredible experience in real reality (VR)" (Karpluk, 2019).

Technical devices allow a person to be in virtual reality. The appearance of such devices has made this technology in demand in the entertainment industry. Virtual reality suits and helmets, movie theaters, auditoriums, and specialized rooms allow a person to enter an unknown world, which is programmed in such a way that allows one to fully immerse himself in the proposed world and all human actions cause a reaction-response of the virtual world.

Currently, VR technologies are not so often used in business. 3D modeling technologies are in great demand here. To optimize the processes of making management decisions, with the possibility of connecting the means of designing products with the means of their production – within the framework of 3D modeling, it is possible to claim the construction of models of objects, their filling with data (Shumilova et al., 2023).

The result of merging virtual and real worlds is hybrid, mixed reality (MR), which is essential for creating visualizations and new spaces where digital and physical objects interact and coexist in real-time.

Machine Learning (ML) and Artificial Intelligence (AI) are on the rise in modern society. Machine learning, which refers to the methods of artificial intelligence, teaches the computer to find solutions to various problems on its own. With the help of pre-loaded special algorithms and data, computers perform analytical work and identify patterns faster than humans (Morze et al., 2020).

Robotics. Robots are already coming into our reality in all spheres of production, medicine, education, etc. The presence of robots in human life allows to reduce the number of errors created by the human factor, contributes to the substitution of functions performed by people in production, and also accelerates the performance of tasks set by the enterprise. Many industrial companies actively use robotics in logistics, on industrial lines, which allows them to get by with minimal involvement of people and reduce the human factor. In Germany, there is the term "Industry 4.0", which involves the construction of fully automated logistics networks and production networks, where machines interact with each other within the framework of production processes.

An important technology that can change the engineering and construction industries is 3D printing. The creation of a significant number of 3D printers that can print products from metals and even gold, concrete, and polymers changes the very understanding of the production cycle, since, having only a 3D model and a 3D printer, many of the products can be obtained at home. There are examples: a fully 3D-printed bus, a printer that can print itself, entire houses built using specialized 3D printers, and bridge printing in development. Designers of clothes and shoes, and mechanical engineering, who also print their products, have already actively participated in the development of 3D printing. Builders, jewelers, and doctors are increasingly actively using 3D printing in their professional activities.

The so-called synergy of technologies – the joint use of innovative digital technologies, about which scientists from different countries have recently expressed many opinions, is exciting for the whole world. This allows you to restructure a completely relevant industry, bringing to it a product that did not exist before, and not just to change a certain process. The best thing about digital transformation is the possibility of using all the technologies described above.

So, the Internet of Things allows you to form conclusions and decisions; will be able to combine the virtual world with the real world; based on huge arrays of data, and apply artificial intelligence obtained from IoT. Virtual and augmented reality will make the new world richer for people. And 3D printing and robotics will allow most routine operations to be automated. Information systems have entered all spheres of life. The development of digital technologies opens up a huge range of possibilities. Progress in all fields and industry. Personal websites of specialists can be called multi-functional, informative, comprehensive tools, the usability of which helps to find the necessary information and guides the user through numerous pages (Nychkalo et al., 2021).

Today, the combination of robotics, artificial intelligence, the Internet of Things, and 3D printing makes it possible to build fully mechanized productions from the production of products, starting, for example, with sneakers and ending with cars.

Gamification in human life and the application of its elements in pedagogical practice is a trend of the future. Game models and educational games (for example, "Stalkers", "Classcraft", "Alpha Planet", etc.) become a component of a person's professional strategy. Motivation and interest in work and professional training of a person increases, with the help of the implementation of a game approach, the attention of the individual is maintained, and his involvement in quasi-professional activities occurs.

The didactic potential of gamification directly affects a person's life path: both in life and in a professional direction, which provides opportunities to increase a person's digital competence, to update information about new implementations of digital technologies, to be aware of new trends, etc. The introduction of a gamification environment into a person's life contributes to the development of spatial imagination, lifelong learning, and the continuous development of mental skills, encourages work in an innovative modern environment, promotes self-organization, and allows the formation of practical work skills in a group. Gamification develops the professional competence and digital competence of a person, which is a

component of his professional culture as an integrated, complex formation in the integral structure of a specialist (Verbovetskyi & Oleksyuk, 2022).

Digital science art technology is a technology of creative direction of the individual, which arose at the border of science and creativity from the fusion of "numbers" and art. It is possible to preserve cultural values and improve their quality in a digital environment using computer technologies. Objects of decorative and applied art can be modeled using 3D printing. "The works of "scientific art" have a serious research base, based on the achievements of scientists, but also appeal to emotions, allowing both to understand and to feel science" (Kucherak, 2020).

3. Principles of digitization.

Let's name the basic principles of digitalization, which are necessary in the process of online work of a person in any field of knowledge:

- The principle of creating advantages in life and professional aspects of a person's everyday life directs digitalization to create advantages;
- The principle of accessibility through the use of information and communication technologies provides every individual with equal access to information knowledge and services, ease of use and access, relevance and constant updating;
- The principle of information society. Digitization contributes to the development of the creative market, creative environment, information society, etc.;
- The principle of efficiency and competitiveness of digitalization contributes (thanks to the increase in productivity and the increase in efficiency from the use of digital technologies) to the mechanism of economic growth of the entire enterprise and the person, in particular. Note that such an increase is possible when the initiative, actions, ideas, and digitalization programs are fully integrated into regional, national, and global development programs and strategies.
- The principle of standardization is the basis of digitalization, a key factor in its successful implementation;
- The principle of integration provides an opportunity for digitalization to focus on global cooperation to develop the global market of electronic services and electronic commerce; integration with global systems, to spread innovative modern technologies;
- The principle of public administration makes digitalization an object of complex and focused public administration, where politicians and public administration play the main role in the implementation, promotion, and development of national comprehensive digital strategies of society;
- The principle of confidentiality, trust and security of digitalization when using ICT is accompanied by increased security and trust (cyber security, information security, inviolability of a person's personal life, trust, confidentiality of personal information, protection of the rights of ICT users) and is a simultaneous prerequisite for security and development of digitalization; facilitates control of operations, protection of personal data, provides the ability to prohibit or limit information, warns of hacks, protects information from distortion or interference and controls its capabilities;
- The principle of expediency –to achieve professional goals and fulfill set tasks during digitization, it is mandatory to use the necessary technologies or digital methods;
- The principle of individualization involves obtaining the necessary information and access to the digital space, improving professional skills and personal skills, creating an individual strategy of professional activity, using communication in social networks, adaptive methods, individual forms of presentation, etc.;
- The principle of flexibility – following the special needs of a person and the age, and individual, interests of each individual allows the use of digital content taking into account the professional tasks of the individual, his preferences, convenient place or time, etc.;
- The principle of development – through digitalization, in solving life problems, the advantages of the digital environment are used, ensuring the realization of personal qualities of a person, the development of creative abilities, the desire to improve, adaptation to modern working and living conditions;
- The principle of innovativeness makes it possible to use the possibilities of the digital space and the latest technologies in it, modern innovative, remote, interactive, methods and forms of work in professional activity (Kremen et al., 2022).

4. In-demand services for self-study and professional activities.

As a result of the analysis of digital educational platforms and their review, digital educational products and the most popular services, as well as free web applications for joint professional work on the Internet, were identified, and a matrix of their services, tools, and capabilities was compiled.

In the conditions of e-learning and self-learning, the integration of MOOCs into a person's life allows for enriching the content of professional activity, introducing the skills of the world's best specialists into the process of self-education, and giving every person free access to knowledge and professional activity.

Massive open online courses (MOOC) for self-study are popular services that offer courses by well-known world-class specialists (Plakhotnik et al., 2023).

For professional activities, we successfully used messengers: Skype, Viber, WhatsApp, etc.; communication services of social networks Facebook, Telegram, etc.; cloud services Google Mail.

We note the efficiency and convenience of the modular dynamic personal-oriented professional environment (Moodle), where all resources are located in a single database; professional process is continuous and mobile, place and time are independent, information resources are available; modern methods of interaction are available: workshops, chats, blogs, forums, wikis, etc.; for professional activities, there is an opportunity to work in the system asynchronously and synchronously; ways and methods of communication in a group of employees deserve attention: sending information, comments, discussions, evaluation, etc.; the ability to manage and monitor the specialist's activities; possibility of evaluation and analysis of activity results.

The formation and development of the digital competence of specialists is important for a specialist in any field, as well as for positive digitalization – the use of independent and corporate micro- and macro-educational professional space formats. Sites in the macro-educational professional space: Coursera, EdX, Udacity, General Assembly, Udemy, BigThink, CrossKnowledge, SkillSoft, Pluralsight, Lynda.com, etc. The micro-educational specialist space was implemented in a short period, while the macro-educational specialist space was of a long-term nature. Sites of micro-educational professional space: Grovo, YouTube, Twitter, Pathgather, Axonify, Edcast, Qstream, etc. (Marienko & Sukhikh, 2022).

So, all of the above speaks of the importance and necessity of introducing digitalization into modern society, which is a necessary condition for its introduction in the educational and professional activities of a person and is a means of increasing motivation, interest, and personality development.

5. Experiment.

The purpose of the experimental work: experimental verification of the formation of the digital competence of specialists and the role of effective digital applications, services, and digital tools in human life.

Research methods. The modern methodology of psychological and pedagogical research was used to conduct an experimental test of the formation of the digital competence of specialists and to analyze the role of effective digital applications, services, and digital tools in human life.

In particular, the following methods were used: analysis of the sources of the literary and bibliographic review; terminological and retrospective analysis, statistical and formal-logical analysis, study of the products of individual activity, questionnaire survey, and monitoring.
By level of education – adult education.

Time of the experiment: 2023–2024.

Audience of experimental work: specialists in various fields.

We made an approbation and experimental verification of the effectiveness of the formation of digital competence of specialists and the role of effective digital applications, services, and digital tools in human life.

We have developed a system for the formation of digital competence of specialists and developed methodological recommendations for the development of digital competence of specialists.

Control and experimental groups were determined (experimental group (EG) – 131 respondents, control group (CG) – 129 respondents), where constant sections were conducted to determine the levels of development of digital competence of specialists and the role of effective digital applications, services, digital tools in everyday life a person.

The confirmatory experiment showed the following results.

As a result of the ascertainment experiment, it was found that the level of digital competence of specialists in the conditions of the information environment is insufficient.

The formation of the content component of the digital competence of specialists at the beginning of the experiment in EG and CG had practically no difference.

In the experimental group and the control group, according to the content block, the average relative value of the formation of digital competence of specialists was equal to:

- CG – 35.8%;
- EG – 36.2%.

Moreover, the respondents fully agreed with the statement that the invaluable role of digital applications, services, and digital tools is important in the process of formation and development of the digital competence of specialists.

In the experimental group and the control group by organizational block, the average relative value of the formation of digital competence of specialists was equal to:

- CG – 21.7%;
- EG – 23.5%.

In the experimental group and the control group by technological block, the average relative value of the formation of digital competence of specialists was equal to:

- CG – 22.9%;
- EG 22.2%.

Such results indicate the homogeneity (at the beginning of the experiment) of the preparedness of the respondents and the need to develop the digital competence of specialists.

At the formative stage of the experiment, an author's methodology using digital applications, services, and digital tools in human life was introduced in the experimental group to form and develop the digital competence of specialists. The author's technique was not used in the control group.

In particular, the EG respondents were informed about the content, the main goal, and the main directions of digitalization for the improvement of human life, society, and the state. The role of digital competence, virtual and augmented reality tools, cloud technologies, robotics, 3D technologies, MOOC, e-learning, m-learning, flipped learning, Internet of Things (IoT), intermediate interval training, hybrid, mixed reality (MR), Machine Learning, ML, Artificial Intelligence, AI in a person's professional life.

The most effective principles of digitization, popular services for self-study, and professional activities are outlined. As a result of the analysis of digital educational platforms and their review, digital educational products and the most popular services, as well as free web applications for joint professional work on the Internet, were identified, and a matrix of their services, tools, and capabilities was compiled. In the conditions of e-learning and self-learning in practice, the integration of MOOCs into human life is shown, which allows for enriching the content of professional activity, introducing into the process of self-education the skills of the best specialists in the world, giving every person free access to knowledge and

professional activity; used the Massive open online course (MOOC) for self-education, which are popular services that offer courses by well-known world-class specialists.

For professional activities, we successfully used messengers: Skype, Viber, WhatsApp, etc.; communication services of social networks Facebook, Telegram, etc.; cloud services Google, and Mail.

Respondents note the efficiency and convenience of a modular dynamic personal-oriented professional environment (Moodle), where all resources are located in a single database; the professional process is continuous and mobile, place and time are independent, information resources are available; modern methods of interaction are available: workshops, chats, blogs, forums, wikis, etc.; for professional activities, there is an opportunity to work in the system asynchronously and synchronously; ways and methods of communication in a group of employees deserve attention: sending information, comments, discussions, evaluation, etc.; the ability to manage and monitor the specialist's activities; the possibility of evaluation and analysis of activity results.

We used the formats of independent and corporate micro- and macro-educational professional space (according to M. Marienko, & A. Sukhikh (2022)). Sites in the macro-educational professional space: Coursera, EdX, Udacity, General Assembly, Udemy, BigThink, CrossKnowledge, SkillSoft, Pluralsight, Lynda.com, etc. The micro-educational specialist space was implemented in a short period, while the macro-educational specialist space was of a long-term nature. Sites of micro-educational professional space: Grovo, YouTube, Twitter, Pathgather, Axonify, Edcast, Qstream, etc.

All of the above speaks of the importance and necessity of introducing digitalization into modern society, which is a necessary condition in the educational process and professional activity of a person, is a means of increasing motivation, interest, personality development, and the formation of digital competence in a specialist.

At the formative stage of the experiment, 131 respondents of the experimental group were involved (specialists in socioeconomic specialties, physical and mathematical specialists, managers, directors, and deputies of companies), who directly carried out digitalization measures in their professional activities.

In the control group, informational materials and methodological recommendations were provided for self-examination regarding the development of digital competence of specialists and the role of effective digital applications, services, and digital tools in human life.

Positive dynamics were obtained at the end of the experimental work in both groups – in the experimental group and the control group. However, in the experimental group that underwent training, a significantly higher level of development of the digital competence of specialists and the respondents' use of effective digital applications, services, and digital tools in their professional activities was noted.

This is evidenced by the results at the end of the formative experiment.

In the experimental group and the control group, according to the content block, the average relative value of the formation of digital competence of specialists was equal to:

- CG – 57.8%;
- EG – 97.4%.

Moreover, EG respondents used digital applications, services, and digital tools constantly in the process of forming and developing digital competence, while CG respondents did it sporadically.

In the experimental group and the control group by organizational block, the average relative value of the formation of digital competence of specialists was equal to:

- CG – 38.5%;
- EG – 87.3%.

In the experimental group and the control group by technological block, the average relative value of the formation of digital competence of specialists was equal to:

- CG – 49.9%;
- EG 83.7%.

Such results indicate the need for the formation and consistent development of digital competence of specialists.

The qualitative analysis of the effectiveness of the development of the digital competence of specialists was confirmed by the quantitative analysis of positive changes in all blocks.

We provide methodological recommendations for the development of the digital competence of specialists and the optimal practical use of digital technologies in a person's professional activity:

- constantly increase the digital competence of specialists;
- in professional activity and human life, use tools of virtual and augmented reality, cloud technologies, robotics, 3D technologies, MOOC, e-learning, m-learning, flipped learning, Internet of Things (IoT), intermediate interval training, hybrid, mixed reality (MR), Machine Learning, ML, Artificial Intelligence, AI;
- to develop digital tools that contribute to the individualization of personality at the workplace;
- use effective digital applications, services, and digital tools in daily life and professional activities;
- use digital technologies in everyday life and professional activities for cooperation, interaction, providing feedback on professional results, increasing motivation, interest in work, personal development, and formation of digital competence in a specialist;
- to ensure the availability of digital applications, services, digital tools, and digital technologies for all employees in the professional space, in everyday life, and especially for those with special needs, and limited physical capabilities.
- to implement projects that involve the use of services, effective digital applications, digital technologies, and digital tools in a person's professional activity and life.

Conclusions

The content, the main goal, and the main directions of digitalization for improving the life of a person, society, and the state have been formed.

The role of digital competence, virtual and augmented reality tools, cloud technologies, robotics, 3D technologies, MOOC, e-learning, m-learning, flipped learning, Internet of Things (IoT), intermediate interval training, hybrid, mixed reality (MR), Machine Learning (ML), Artificial Intelligence (AI) in a person's professional life.

The most effective principles of digitization, popular services for self-study, and professional activities are outlined.

As a result of the analysis of digital educational platforms and their review, digital educational products and the most popular services, as well as free web applications for joint professional work on the Internet, were identified, and a matrix of their services, tools, and capabilities was compiled.

In the conditions of e-learning and self-learning in practice, the integration of MOOCs into human life is shown, which allows for enriching the content of professional activity, introducing into the process of self-education the skills of the best specialists in the world, giving every person free access to knowledge and professional activity; used the Massive open online course (MOOC) for self-education, which are popular services that offer courses by well-known world-class specialists.

Messengers were successfully used for professional activities: Skype, Viber, WhatsApp, etc.; communication services of social networks Facebook, Telegram, etc.; cloud services Google, and Mail.

We used the formats of independent and corporate micro- and macro-educational professional space.

To form and develop the digital competence of specialists, the author's methodology was developed and introduced to the experimental group using digital applications, services, and digital tools in human life. The author's technique was not used in the control group.

The results obtained during the experimental study indicate the need for the formation and consistent development of the digital competence of specialists.

The qualitative analysis of the effectiveness of the development of the digital competence of specialists was confirmed by the quantitative analysis of positive changes in all blocks.

Methodological recommendations have been developed for the development of the digital competence of specialists and the optimal practical use of digital technologies in a person's professional activity.

Further research is needed to investigate the role of digitalization principles in the self-learning of a person during his life.

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