

Установлено, що практична реалізація багатопредметного підходу сприяла підвищенню ефективності підготовки майбутніх учителів у закладах вищої педагогічної освіти до роботи в умовах інклюзивної освіти. Здійснене дослідження не вичерпує всіх аспектів окресленої проблеми. Перспективу подальших досліджень вбачаємо у розв'язанні проблеми підготовки психологічних кадрів до роботи в умовах інклюзивного навчання дітей з особливими освітніми потребами.

Ключові слова: діти з особливими освітніми потребами, інклюзивна освіта, зміст навчання; технології навчання; підготовка майбутніх учителів для інклюзивної освіти, багатопредметний підхід, компетентнісний підхід, інтеграція, компаративний аналіз.

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Oleh Malyshevskiy

Pavlo Tychyna Uman State Pedagogical University

ORCID ID 0000-0002-7653-7862

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INFORMATION AND COMMUNICATION TECHNOLOGY APPLICATION IN ENGINEERING EDUCATORS' FUTURE PROFESSIONAL ACTIVITIES

The article substantiates the relevance of the use of information and communication technology in future engineering educators' professional activity. The "information and communication technology" definition has been clarified from the educational perspective of its interpretation. It is revealed the specific features of information and communication technology as a modern scientific and technical branch manifested in the dynamic improvement of ICT means, constant influence on the development of productive forces, and a high potential of production processes and relations. It is determined that intrinsic motivation is a catalyst for professional self-improvement and self-development. An empirical analysis of a motivation level in masters (graduates of engineering and pedagogical specialties) for information and communication technology use is carried out. The development trajectories of the investigated quality in engineering educators are offered.

Key words: informatization, professional education, engineer-teacher, information and communication technology (ICT), information environment, professional training, information training, pedagogical conditions, motivation for ICT use, masters in engineering and pedagogical specialties.

Introduction. In the era of globalization, education is becoming a significant factor in a country's social stability, its economic well-being, competitiveness, and national security. At the same time, the 21st century lays down new demands on education creating opportunities for educational activity diversification. First of all, it is connected with finding ways to update it improving educational process efficiency and quality, in particular, through the development of information technology, computer equipment, and distance learning.

The UNESCO report "Learning: the treasure within" (*The main provisions*, 1996) emphasizes the urgent need to impart ever-increasing knowledge and skills as they are the basis of professional activity. The report also stated that the relationships between the subjects of the educational process, the study of

the environment, the proper use of modern communication means can generally contribute to the personal and intellectual development of every individual.

In the information society where information is the main value, the pooling of educational information resources is an overriding need. Modern information and communication tools, with their powerful potential, make it possible to overcome heterogeneity and fragmentation inherent in the traditional education system. They contribute to the creation and development of a common education space at different levels, from international education communities to university methodological associations.

In recent years, the main state legislative and regulatory documents set forth the general principles of education informatization, further prospects for this process development as well as the tendencies of updating the content, organizational forms and methods of educators' professional training based on information and communication technology (ICT). The fierce competition prevailing in the educational and manufacturing markets today is raising the level of training requirements for higher education graduates, including computer majors. Future engineering educators, because of the specifics of their profession, have to constantly acquire modern knowledge in the field of ICT and be ready to fulfill professional responsibilities in the social and production sphere as well as to realize their own psychological and pedagogical potential at the institutions of professional (vocational) education.

Analysis of relevant research. Some aspects of the ICT introduction into different educational activity fields are covered in the works by V. Bykov, R. Hurevych, Yu. Doroshenko, M. Zhaldak, Yu. Zhuk, T. Koval, N. Morze, S. Rakov, S. Semerikov, O. Spivakovskiy, O. Spirin, S. Yashanov, and others. They point out that introduction of methodological systems developed on the basis of the pedagogically balanced and appropriate use of information and communication technology in existing traditional education systems is one of the most important issues of modern pedagogy.

R. Hurevych, M. Kademia, I. Shakhina, and others proved that the modern higher education institution cannot function without the widespread use of information and communication technology in all its activity directions (Kademiia & Shakhina, 2011). At the same time, the introduction of modern education ICT makes it possible to optimize traditional training forms and methods, to realize the ideas of intensive learning, to form technical and information literacy, and to prepare the adult generation for life in the information society (Hurevich & Kademiia, 2002).

M. Zhaldak (2011) points out that ICT improvement and development have both a direct impact on education content connected with the level of scientific and technological achievements and an indirect one implying the formation of new professional skills. At the same time, the scientist emphasizes the need to develop fundamentally new computer-based learning systems based on the use of the appropriate activity environment and its pedagogically sound combination with traditional methodological training systems.

The analysis of recent studies on the development of ICT in education shows different points of view on the interpretation of the studied definition. Thus, ICT is considered as information technology, that is, a set of information processes using computer technology means that provide a fast search for information, access to information sources (Busel, 2009, p. 504).

C. Blurton (1999) interprets ICT as a variety of technological tools and resources used to communicate, create, disseminate, store and manage information. At the same time, ICT is also interpreted as a computer technology based on the use of a certain formalized content model in the form of pedagogical software and telecommunication network capabilities (Kremen, 2008, p. 364).

V. Bykov (2008) and Yu. Tryus (2012) interpret ICT as a computer-based component of pedagogical technology. Thus, Yu. Tryus (2012) defines it as an original technology of the creation, transmission, and storage of training materials, other information resources of an educational nature, as well as the organization and support of the educational process through telecommunication connection and computer systems and networks purposefully, systematically and consistently implemented in pedagogical practice to improve the quality of education. At the same time, V. Bykov describes ICT as some formalized model of a certain training content component and its presentation in the educational process in the form of pedagogical software. It involves the use of a computer, computer-oriented training tools, and computer communication networks for carrying out didactic tasks or their fragments (Bykov, 2008, p. 141).

O. Spirin (2010) considers ICT as a didactic technology that ensures the achievement of learning goals only if it is used compulsorily.

In the context of our study, it is reasonable to address the issue of development in engineering and pedagogical specialty graduates of the need to use ICT in future professional activities.

Aim of the study. The purpose of the article is to study the motivational aspect of the ICT use by future engineering educators.

Research methods. In our study we used the following methods: theoretical analysis of scientific papers to determine the essence of the studied

definitions; empirical methods – surveys, observations, questionnaires and interviews.

Results. The current stage of social development is characterized by a number of features including the following:

- the increasing importance of intellectual work focused on the use of information resources on a global scale;
- the need for accessible and prompt communication between individual professionals, creative teams and organizations to solve common problems;
- the integrative nature of processes encompassing science, technology, and education.

Society is now dominated by information and communication technology ideas and products. Technological knowledge and other artifacts related to information processing technology are penetrating all spheres of life in our modern society: daily routine, social and professional activities are increasingly dependent on constantly updated technology. Nowadays, computer knowledge and skills are crucial to most of our actions and decisions. The problem of effective ICT use is being updated on the agenda of all professional fields. It is expected that there is a societal need for professionals who have an appropriate mindset, as well as the growing importance of education (including professional) in their preparation.

These features of a modern society are characterized by the informatization process the essence of which is to continuously increase the level of each specialist's professional and information competence. The main characteristics of ICT as a new scientific and technical field are the following: dynamics of hardware and software improvement; the need for information system developers and users' continuous professional development due to the ever-increasing level of the technical and technological complexity of computer system components; the impact of the use of modern ICT on the development of productive forces and a significant change in industrial relations; the high potential efficiency of modern ICT opportunity realization in the processes of information activity automation and information interaction in various social and industrial fields.

At the same time, one of the priority areas of society informatization is the process of higher (including professional) education informatization involving the use of ICT for the intensification of all educational process levels, its efficiency, and quality improvement, preparation of the young generation for successful professional activity in the modern information society.

According to L. Lukianova (2014), in its broad sense, education informatization is a complex of socio-pedagogical transformations related to the provision of education systems with information products, tools, and technology, and defined narrowly, it is the introduction into education institutions of information tools running on microprocessor technology, as well as pedagogical technology information products based on these tools (p. 45).

T. Gunn and M. Hollingsworth (2013) believe that traditional educational patterns are giving way to more innovative modes and methods of learning, primarily due to radical technological changes that have increased the availability of information and improved communication.

In light of the above, the issue of preparing engineering and pedagogical specialty graduates for the use of information and communication technology in future professional activity is urgent.

At present, the complexity of production processes, the active use of ICT in all spheres of life determines the vital need to systematically boost the level of vocational education specialists' professional training. In the context of the informatization of all professional activity types, the spiritual and intellectual interconnections of the individual and society are becoming dominant. Human intelligence, the level of their spiritual, information culture and professional competence currently start to play a major role in personality socialization.

The main factor in its formation is the information environment with its cognitive mechanisms and structures, the latest technological advances, modern media, and communication. Such an information environment can be considered as a verbal and information component of an integrated information field (Malyshevskiy, 2007, p. 18). According to E. Kastrubin (1995), the information field is a living system, capable of receiving information, storing it, learning from previously received data, creation of new ones within itself, and voluntarily add orders regarding material movement and actions (p. 50).

Humanization of modern society as the most essential factor in the formation of information civilization helps to optimize all parameters of a person's information field in order to ensure their comprehensive, harmonious, and holistic development. In the process of individual professional competence development, in the system of society humanization, there should be made a distinction between the direct and indirect influence of social communication and the modern information environment on a person. An integral part of this process is personal development taking place throughout life. It is characterized as an active activity beginning, its focus on socialization. Self-development is also treated as

the beginning and continuation of the process of future engineering educators' professional development management and their socialization.

In order to train a modern engineering educator capable of fulfilling their professional responsibilities in the information society, in our opinion, it is recommended to develop and implement such technology that would allow:

- implementation of didactic teaching principles aimed at students mastering the subject content of field-specific subjects, as well as future engineering educators' equipment with a system of psychological and pedagogical techniques, teaching modes and methods;

- realization of engineering educators' professional training goals and objectives in accordance with the specific field of professional education;

- revealing the content of engineering educators' professional training aimed at the implementation of the basic provisions of higher education according to the state standards and qualification requirements for specialists in a specific field of professional education.

The realization of this requirement is possible with the active use of modern information technology in education aimed at forming an educated, harmonious, and creative personality, capable of continuous scientific knowledge development, characterized by professional mobility and rapid adaptation to changes in educational and socio-cultural spheres, a management system and labor organization under market economy conditions, to provide such pedagogical conditions that would allow a young professional to form a stable system of professional competences most effectively.

We believe that it is necessary to distinguish between internal and external components of pedagogical conditions for engineering educators' training for them to be ready to use ICT: intrinsic motivation encouraging self-development, self-realization, and the self-affirmation of the individual's internal driving forces, their abilities, and talents; purposeful formation of internal professional activity. In our opinion, it will ensure formation of a set of adequate professional and psychological-pedagogical patterns that will lead to personally directed educational activity; the development of communication skills in different systems of interaction (student – teacher, student – student, student – educational environment, etc.).

Future engineering educators' information training implies realization of the technological adaptability learning principle (not only subject content acquisition but also mastering pedagogical techniques, forms and methods of teaching, training technology in general); personally and vocationally oriented context- and subject-based training within industry-specific preparation; performing

methodological tasks in the study of special disciplines (content analysis, drafting of its thesaurus and logical structure, planning of its study, etc.); introduction to students of the system of research, scientific and methodological work of departments starting with the first year of study; engaging students into a professionally oriented system outside the classroom; constant monitoring of the quality of education at different stages of educational activity. Thus, engineering educators' training in higher education institutions should be closely linked to the promotion of their future professional activity, an important part of which will be the use of information technology. Mastering such technology should not only be a training goal, but also an educational tool.

Given the purpose of the proposed publication, we were interested in the motivational aspect of ICT use by future engineering educators.

Our survey was conducted during 2019–2020 using questionnaires, interviews, and conversations. Masters studying at Pavlo Tychyna Uman State Pedagogical University participated in the survey. The sample of respondents was 45 students. Their participation was voluntary. The data collected were anonymous and used for research purposes only.

A questionnaire containing 15 questions was used to examine the level of motivation for ICT use. The survey was aimed at determining the level of need for the investigated quality formation in graduate students.

The questionnaires included statements such as:

– I believe that the ability to use modern innovative information technology contributes to future engineering educators' professional development.

– I have a desire to gain the systematic knowledge of how to develop and use ICT tools.

– I want to increase my professional competence, it will allow me to be more mobile.

– I want to master the skills of combining traditional and modern learning tools.

– Future engineering educators need a high level of ICT competency.

– The use of information educational environment and ICT tools have a positive effect on motivation and interest in future engineering and pedagogical activities.

– Systematic self-improvement in the field of ICT affects the level of the future engineering educator's professional adaptation.

The questionnaire evaluation system was based on the incomparable method of the Likert scale. The choice of the specified scale is made due to the

fact that this methodology allows determining patterns, the degree of the respondent's attitude to a particular object of research. This method is based on the assumption that every statement is a perfect pattern. The procedure for measuring the respondent's attitude involves evaluation of the extent of agreement or disagreement with the set of proposed patterns. Our questionnaire uses a semantic series that can be easily replaced with a numerical equivalent in the following way: «strongly disagree» – 0 points, «disagree» – 1 point, «agree» – 2 points, «strongly agree» – 3 points. The total score made it possible to determine the level of motivation for ICT use.

According to the survey conducted in the first year of the Master's program (2019), it is noted that the overwhelming majority of respondents has a high level of motivation to use ICT in their future professional activities. It was considered such responses as "I strongly agree" and "I agree". Thus, 95.6 % of future engineering educators seek to increase their professional competence. 82.2 % of students recognized the positive impact of the information education environment and ICT on their professional development. At the same time, only 26.6 % of respondents expressed a desire to acquire the systematic knowledge of the methods of how to develop and use ICT tools, and 48.8 % consider it promising for professional adaptation and self-improvement in the field of ICT.

A series of thematic training courses and debates were held in terms of the Master's program (2019/20 academic year and semester 1 in 2020) aimed at increasing the motivation and stimulation of students' interest in the development and implementation of ICT tools in lifelong learning, future pedagogical and engineering activities, leisure, and lifestyle. At the end of the experimental work, a second diagnostics was made. An illustrative presentation of the analysis of the initial and final results for individual statements in the questionnaire is shown in the figures below.

Thus, Figure 1 shows an increase in the desire to obtain the systematic knowledge of ICT development techniques and its use by almost 2.5 times as compared to the initial data.

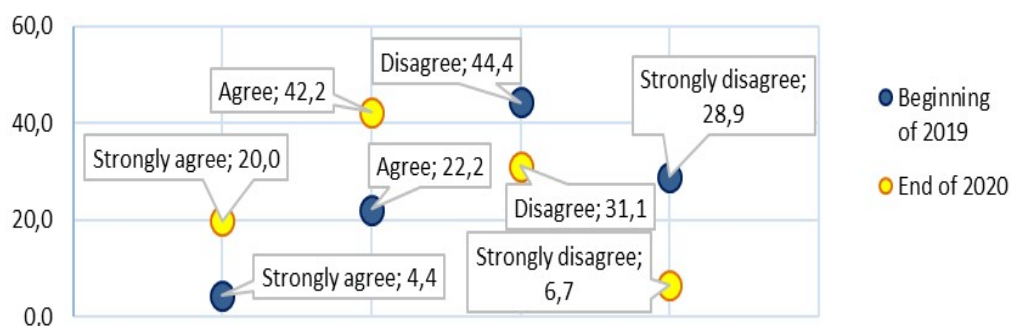


Fig. 1. Results of the comparison of answers to the statement “I have a desire to acquire the systematic knowledge of the development methodology and use of ICT tools”, %

As can be seen in Figure 2, all masters-graduates (100 %) feel the need to boost their competences to increase their professional mobility.

97.8 % (as compared to 82.2 % in 2019) believe that the information education environment and ICT have a positive effect on the motivation and interest in the future profession (Fig. 3).

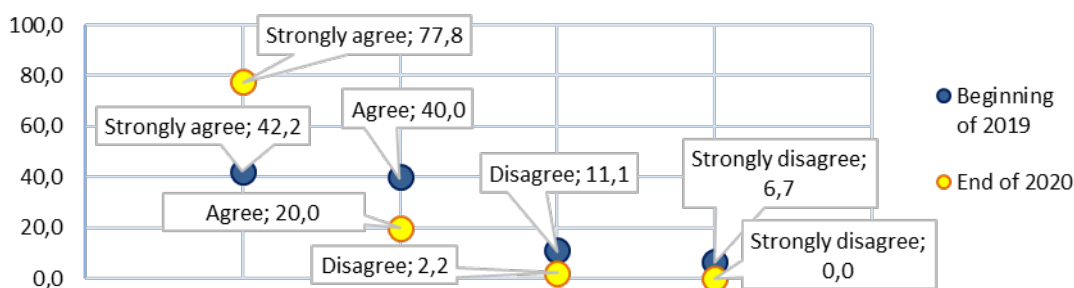


Fig. 3. Results of the comparison of answers to the statement “The use of information education environment and ICT tools has a positive influence on motivation and interest in future engineering and pedagogical activities”, %

Interestingly, the vast majority of future engineering educators (77.7 %) consider self-improvement in the field of ICT as an effective tool for professional adaptation and growth (Fig. 4). This figure is almost 1.5 times higher than the original data.

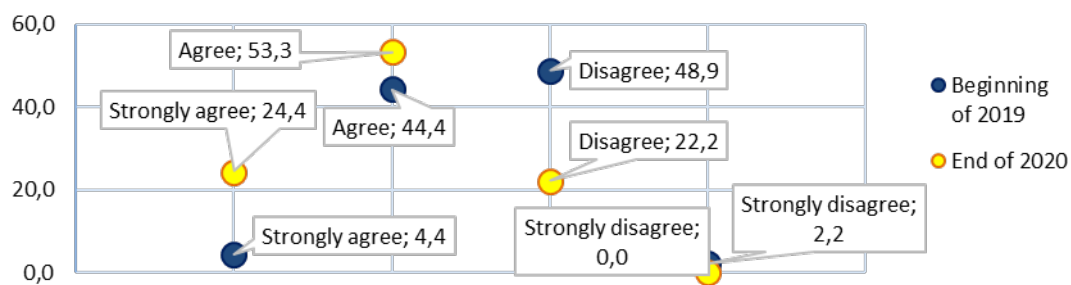


Fig. 4. Results of the comparison of answers to the statement “Systematic self-improvement in ICT is affecting future engineering educators’ professional adaptation level”, %

In general, the final results of the questionnaire showed a positive dynamic of “I strongly agree” and “I agree” answers. At the same time, the number of negative responses has decreased, and in some cases answers there were no “strongly disagree” answers at all.

While processing the obtained data, we have determined the following motivation levels in future engineering educators for ICT use: low, sufficient, and high. According to the scales of answers given above, the respondents’ assessment was carried out as follows: low level – 0–15 points, sufficient – 16–30 points, and high – 31–45 points.

A high motivation level to use ICT is characterized by a consistent pattern for mastering systematic knowledge in the field of ICT, interest in future professional activity, and life-long self-improvement.

A sufficient level is characterized by a desire for professional growth and ICT use in general. However, there was no interest in professional competence enhancement and self-improvement in the future.

A low motivation level for ICT use is characterized by the lack of an active positive attitude to future professional issues in general and no interest in ICT and their implementation in particular.

The generalized results at the beginning and the end of the Master’s program are shown in Fig. 5.

Thus, according to the analysis, the use of a series of thematic discussions, debates, and training courses in computer engineering educators’ training has a positive effect on the growth of masters’ motivation to use ICT. The high level of the investigated quality increased by 31.1 %, the sufficient level halved, and there were no students with a low motivation level at all.

Conclusions. The study of scientific works has made it possible to clarify the key aspects of the “information and communication technology” definition central to our research. Out of the variety of the concept interpretations, the

most relevant are those connected with this technology educational aspect, in particular, as a computer-based pedagogical technology component; a modern technology improving educational process organization and support using computer systems, networks, and telecommunication; a specific formalized model of training content and its presentation through the implementation of computer-aided learning.

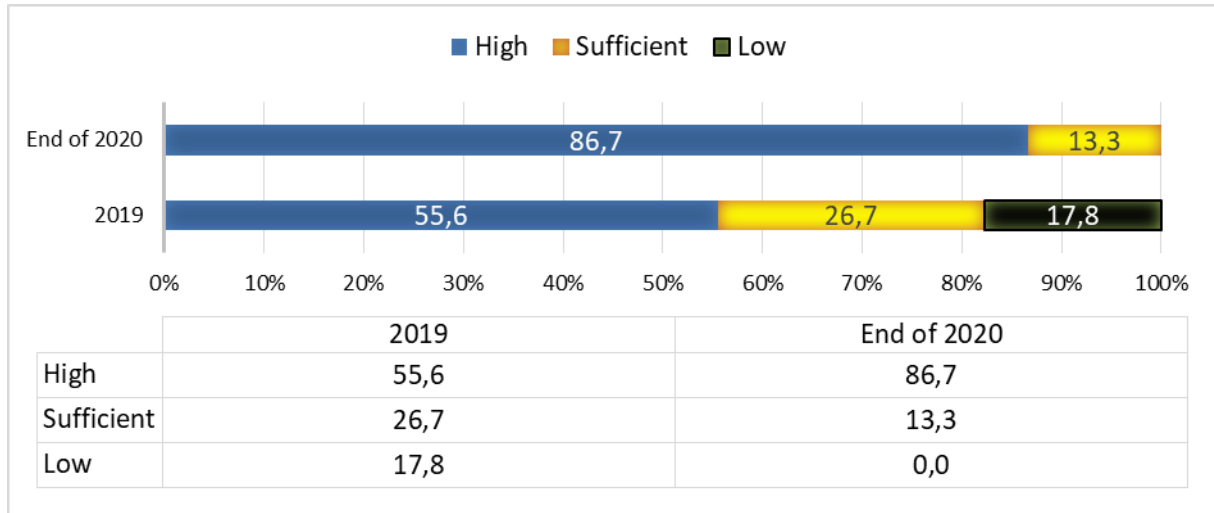


Fig. 5. Generalized questionnaire results, %

Given the relevance of preparing engineering and pedagogical major graduates for the use of ICT tools in professional activities, the research outlines the essential characteristics of ICT as a modern scientific and technical field and defines the internal components of pedagogical conditions for engineering educators' preparation to use ICT. The latter includes internal motivation as a catalyst for self-development, self-realization and professional self-affirmation, as well as development of the future specialist's internal activity and communication skills.

In this context, we identify motivation as a particularly significant component of engineering educators' professional development. The empirical study of the motivation level to use ICT has been conducted among masters majoring in engineering and pedagogy studying at Pavlo Tychyna Uman State Pedagogical University. The conducted diagnostics of the investigated quality level has revealed that the overwhelming majority (86.7 %) of respondents has a high motivation level to use ICT in future professional activities. However, some students did not show interest in the systematic acquisition of knowledge about ICT development and implementation and the desire for professional self-development. Thus, it has been empirically confirmed that a purposeful

pedagogical influence contributes to an increase in the masters' motivation level to use ICT.

Engineering educators' professional training at a higher education institution should be closely linked to their introduction to future professional activities. At the same time, ICT use will play a leading role in the profession of an engineering educator as a prerequisite for their professional growth. Therefore, at the present stage of higher professional education development in Ukraine, the development of positive motivation for the use of ICT is a prerequisite for engineering educators' qualitative preparation for professional activity. In turn, it is not only a powerful tool for social demand fulfillment – it is becoming an integral component realizing future engineering educators' inner potential and stimulating their self-education, and creative professional self-development.

This problem is rather relevant and determines directions for further research, in particular the impact of ICT on the development of engineering educators' professional mobility.

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РЕЗЮМЕ

Малышевский Олег. Использование информационно-коммуникационных технологий в будущей профессиональной деятельности инженеров-педагогов.

В статье обоснована актуальность использования информационно-коммуникационных технологий в будущей профессиональной деятельности инженеров-педагогов. Уточнено значение дефиниции «информационно-коммуникационные технологии» в контексте образовательного аспекта ее толкования. Определены характерные признаки информационно-коммуникационных технологий как современной научно-технической сферы, проявляющиеся в ее динамичности совершенствования ИКТ, постоянном воздействии на развитие производительных сил, высоком потенциале производственных процессов и отношений. Определено, что внутренняя мотивация выступает катализатором профессионального самосовершенствования и саморазвития. Осуществлен эмпирический анализ сформированности мотивации выпускников инженерно-педагогических специальностей к использованию информационно-коммуникационных технологий. Предложены пути развития исследуемого качества инженеров-педагогов.

Ключевые слова: *информатизация, профессиональное образование, инженер-педагог, информационно-коммуникационные технологии, информационная среда, профессиональная подготовка, информационная подготовка, мотивация к использованию ИКТ, магистры инженерно-педагогических специальностей.*

АНОТАЦІЯ

Малишевський Олег. Використання інформаційно-комунікаційних технологій у майбутній професійній діяльності інженерів-педагогів.

У статті обґрунтовано актуальність використання інформаційно-комунікаційних технологій у майбутній професійній діяльності інженерів-педагогів. Установлено, що завдяки розвитку інформаційно-комунікаційних технологій в Україні створено необхідні умови для формування єдиного освітнього простору. Наголошено, що інформатизація вищої професійної освіти забезпечує активне використання інформаційно-комунікаційних технологій у процесі інженерно-педагогічної підготовки майбутніх фахівців. Доведено, що особливого значення в умовах інформаційного суспільства набуває інформаційна складова професійної освіти, реалізацію якої вбачаємо в цілеспрямованому організованому системному освітньому процесі забезпечення майбутніх інженерів-педагогів методологією, технологією і практикою оптимального використання можливостей інформаційних і комунікаційних технологій для вирішення професійних завдань. Уточнено значення дефініції «інформаційно-комунікаційні технології» в контексті освітнього аспекту її тлумачення. Визначено характерні ознаки інформаційно-комунікаційних технологій як сучасної науково-технічної галузі, що проявляються в динамічності вдосконалення засобів ІКТ, постійному впливові на розвиток продуктивних сил, високому потенціалі виробничих процесів і відносин. Основними сутнісними характеристиками цих технологій є спрямованість на підвищення ефективності освітнього процесу шляхом запровадження комп'ютерних систем, мереж і засобів телекомунікаційного зв'язку. Окреслено внутрішні компоненти (внутрішня мотивація, внутрішня професійна активність, комунікативні здібності) педагогічних умов ефективної підготовки інженерів-педагогів до використання інформаційно-комунікаційних технологій. Визначено, що внутрішня мотивація виступає каталізатором професійного самовдосконалення й саморозвитку. Здійснено емпіричний аналіз стану сформованості мотивації магистрів – випускників інженерно-педагогічних спеціальностей – до використання інформаційно-комунікаційних технологій. Запропоновано шляхи розвитку досліджуваної якості інженерів-педагогів.

Ключові слова: *інформатизація, професійна освіта, інженер-педагог, інформаційно-комунікаційні технології, інформаційне середовище, професійна підготовка, інформаційна підготовка, педагогічні умови, мотивація до використання ІКТ, магистри інженерно-педагогічних спеціальностей.*