DEVELOPMENT OF STUDENTS' INFORMATIONAL AND COMMUNICATIVE COMPETENCE BASED ON THE INTRODUCTION OF DIGITAL LEARNING TOOLS

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ABSTRACT

The open information and educational environment, whose priority is person-centered learning, is based on a combination of the competence-based, activity-based and person-centered approaches. The higher education digitalization educational process should ensure the development of researched competence on the basis of scientificity, consistency, accessibility, unity of theory and practice, individualization of learning, ensuring creative activity and independence, etc. as well as andragogic principles. Digitization of education depends on the objective conditions and modern trends in the development of the information society, the main of which are the development of artificial intelligence, "machine learning", ensuring the mobility of users' information and communication activities in the information space, further development of mobile-oriented means and ICT access to electronic data; communication between subjects of educational activity. The higher education informatization process is determined by the students' information and communication competence level. Therefore, the application of new information technologies is a primary task for future specialists training. The scientific research theoretically substantiates the students' information and communication competence development process by means of digital learning tools, and provides the results of experimental verification of its implementation in the higher education system. Scientific sources on the researched problem have been analyzed, the notion of "information and communication competence" has been clarified. The experimental method of forming students' information and communication competence has been successfully tested and a toolkit for determining its levels

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of formation has been developed. Forms and methods of using digital learning tools have been improved. The main task of the experiment was to implement an individual program of choice for the students' information and communication competence development. The task was aimed at providing the respondents with theoretical knowledge regarding the understanding of the ICT role in education and their use; development of ICT, abilities and skills for use in educational and research activities as well as use of monitoring studies. The importance of using a differentiated approach in the students training has been outlined. It involves taking into account the individual data of students, their subjective experience as well as the course and level of training in Ukrainian universities in order to create optimal conditions for the digital education principles implementation. The organization of free access to the educational content of students, formation of readiness for educational activities by means of digital learning tools as well as orienting the content of educational activities to the informational and communicative educational needs and requests of students have proved the stimulation of creative, research and team work in a computer-oriented educational environment. A students' information and communication competence development model as well as its formation diagnosing tools have been developed.

The basis for achieving educational goals was the use of interactive forms and methods of educational activity (seminars, trainings, lectures, individual and group consultations; independent work; individual and joint work in the LMS Moodle distance learning system), the use of information assessment tools with feedback; assessment of knowledge, abilities and skills using testing and questionnaires. It was established that the development of students' information and communication competence involves ensuring the quality of higher education system based on effective management and a productive educational process; creating a computer-oriented educational environment of a higher education institution, providing it with high-quality content (development of pedagogical workers' skills and abilities to correctly and creatively use data in order to solve problems and jointly create educational content).

The cognitive, operational and research criteria in the students' information and communication competence development structure have been identified.

Therefore, the experimental verification of the program by choice proved its effectiveness and contributed to the higher education institution informational and educational environment design.

Key words: higher education, information and communication competence, information environment, innovative technologies, interactive tools, Internet resources, educational tools.

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INTRODUCTION

Higher education is one of the most important systems in society. On the one hand, the state of this system depends on the development of society and on the other hand, it determines it. According to the generally accepted international standards, one of the important factors in the higher education system development is the applicants' information competence level. Nowadays, it is a necessary condition for successful educational activities in educational institutions and application of information and communication technologies in professional activities. Therefore, the students' information and communication competence development problem is relevant because informatization of education causes urgent necessity to be able to use digital means of educa-

tion, which relates to the information environment formation of educational institution (Halfdan Farstad Competencies for Life, 2004). The information and communication technologies development as well as their integration into all areas of human activity are affecting the nature of production, research, education, culture, social relations and other communicative interaction processes. Information saturation of social development is taking place, digitalization of education is the imperative of educational sector reform, the primary goal of effective information society development in Ukraine. The main goal of this process is the high quality of future specialists training at all levels (Baidenko, Oskarsson, 2002).

The Law of Ukraine "On National Informatization Program" (1998) emphasizes the role of modern communication and information technologies in all spheres of activity at the present stage of integration formation, which justified the need for changes in education.

The Concept of the Digital Competencies Development and Approval of the Measures Plan for its Implementation () identifies the digitalization of education as one of the state policy priorities, which involves filling the educational environment with electronic digital devices, tools, systems and cyber-physical educational space. This transformation is aimed at overcoming isolation and stagnation in scientific research, creating demands for high-quality training of researchers in various fields of science as well as integrating Ukrainian education and science into the global research space.

The aim of the article is to justify the students' information and communication competence development by means of digital learning tools and to present the results of experimental testing of its implementation in higher education.

LITERATURE REVIEW

The International Department of Standards for Training, Achievement and Education in its documents defines the concept of competence as the ability to perform activities, tasks or any work effectively. "The structure of competence should include certain knowledge, skills, attitudes that are the basis for performing professional functions, achieving standards in the professional field. The competence assessment criteria can be certain knowledge, skills as well as learning achievements" (Spector, J. Michael de la Teja, Ileana, 2002). During the existing problems analysis, it should be noted that a number of research works are devoted to the outlined problem – the work of S. Vitvitska (2006), V. Baidenko, B. Oskarsson (2002), V. Bykov (2019), S. Konyushenko (2004), etc. Changes in the interpretation of the "competence" concept are due to the introduction of the competency-based approach in the European countries educational systems. The use of the given approach solves a pressing problem: learners master a set of theoretical knowledge well, but experience significant difficulties in activities that involve using this knowledge to solve specific tasks or problematic situations. This has led to the human resources concept replacement by the human competence concept (Krisiuk, 1996). The introduction of this approach would update the education and learning technologies content as well as align them with contemporary educational formation problems (Competency-Based Approach in Contemporary Education, 2004); replacing the ZKU paradigm which has been leading education for the past few decades (Spirin, 2003). The problems associated with the emergence of the competency-based education are being studied by various international organizations: UNESCO, UNICEF, the UN Formation Program, the Council of Europe, the International Standards Department, the Organization for European Cooperation and Formation, etc. Kocharian (2016), J. Raven (2002), I. Radigina (2005), A. Khutorski (2003), S. Shishov (1999), etc.

However, the relevant psychoeducational literature interprets the essence of the key concepts of this approach differently. In particular, the experts of the Council of Europe believe that everyone should have competences and those of them that contribute to success in life and correspond to various spheres of life, as well as allow tolerating other worldview positions, resolving conflicts. They distinguish several groups of them: intercultural – allow living in a multicultural society and respecting other peoples and their traditions; communicative – allow a person to communicate with other people; self-educational competences – allow a person to educate himself/herself; self-educational competences – allow a person to work in a multicultural society and respect other peoples and their traditions. Our work is based on the theoretical positions of pedagogical research organization, reflected in the scientific works of Ukrainian and foreign scientists.

At the UNESCO international conference (2004) "competence" was defined as "the ability to apply effectively and creatively knowledge and skills in interpersonal relations – situations involving interaction with other

people in a social context, as in professional situations".

Consequently, the interpretation of 'competence' by different international organizations focuses on people's interpersonal interactions in the process of dealing with a particular problem situation, and 'competence' is not only a person's ability to interact effectively, but also the result of that interaction (Hornby, 2005).

Scholars' interpretation of the competence concept. In particular, in the scientific literature the term "competence" was originally used only in the field of language teaching (communicative competence, foreign language communicative competence), while the term "competence" focuses more on vocational education (Chemeris, 2006). At the same time, according to S. Lesova (2011), among a number of this terms' definitions we can find common ground, which gives us grounds to consider this concept as a unity of theoretical knowledge and practical activities as the most universal language to describe educational outcomes.

Among the Ukrainian scientists considering the issues related to competence methods, O. Pometun (2005) defines the term "competence" as a complex attribute of personality, which is understood as a set of knowledge, abilities, skills, attitudes, as well as experience, which together allow performing activities or performing certain functions effectively to ensure problem solving and meeting certain standards in professions or type of activity (Dubrovina, Obolonnik, 2021). A similar interpretation is proposed by O. Ovcharuk (2019): "competence is an integrated characteristic of personality quality, a performance unit formed through experience, knowledge, skills, attitudes, behavioral reactions". At the same time I. Rodygina (2005) notes that "competence is not specific subject skills and abilities, not even abstract general subject thinking actions or logical operations (although, of course, it is based on the latter), but specific life skills necessary for a person in any profession, age or marital status".

Therefore, we agree with the statement that it is important not to confront competence with knowledge or skills. The concept under study is more general than those mentioned. Since "competence contains both content (knowledge) and process (skill) criteria, therefore a competent specialist should not only understand the essence of the problem, but also be able to practically solve it, depending on specific conditions apply a certain method of problem solving" (Vorobets, 2014). At the same time, it should be noted the opinion of foreign scholar J. Raven (2002) that "competence" is a specific ability of an individual, necessary for effective implementation of a particular action in a particular subject area. In addition, according to the scholar, it encompasses highly specialized knowledge, specific subject skills, and ways of thinking. In addition, the scientist identifies "higher competencies" that imply a high level of initiative, the ability to organize other people to achieve their goals, the willingness to assess and analyze the social consequences of their actions. J. Raven (2002) constructed a competency model that combines one hundred and forty-three elements, which makes its application problematic. Therefore, today scholars and experts in international organizations (UNESCO, UNICEF, UNDP, Council of Europe, International Standards Department, Organization for European Cooperation and Formation, etc.) consider the so-called "key competences" that allow an individual to participate in many social spheres and contribute to the quality of society and promote personal success (according to the Organization for European Cooperation and Formation) (Kluzer S., Priego L.P. (2018); multidimensional structure containing emotional, cognitive, motivational and value elements (The Oxford Russian Dictionary, 1977); the most common ways of acting that enable a person to understand situations and achieve results in personal and professional life. Key competences integrate the personal and the social in education, reflect the complex mastery of a set of activities, they do not appear in general but in specific cases or situations.

Key competences should be favorable to all members of society, i.e. appropriate for all, regardless of gender, class, race, culture, marital status and language. Furthermore, the key competences should be aligned not only with the ethnic, economic and cultural values and conventions of the concerned society, but also in line with educational priorities and goals and be person-centered. The scientific literature notes that "key competences are multifunctional, supra-subjective, involve significant intellectual development, and rely on different cognitive processes" (Colin, 2001).

The scientific and pedagogical literature provides a large number of key competencies classifications proposed by different authors. At the same time, Baidenko, Oskarsson (2002) consider the notion of "basic skills" as personal and interpersonal qualities, skills and knowledge expressed in different forms in work and social life situations, which include communication skills and abilities, creativity, creative ability to adapt to unpredictable changes, teamwork and independent work; self-awareness as well as self-esteem skills development.

At the same time, domestic and foreign scientists as well as experts from relevant international organizations note that key competences are variable, depend on the priorities of society, have variable structure, educational goals, characteristics and opportunities of self-determination of the individual in the society (Grinko, 2019).

Based on the scientific literature and documents analysis, we note that a common feature for the key competences list is the mandatory inclusion of information competence, which is due to the intensive development and use of information and communication technologies in various spheres of society (Trishina, 2005). The main development trend of the modern information society is its globalization. As a result, the movement towards international integration in higher education is intensifying. Innovative methods and technologies of role-playing game training are important for the development of the educational, scientific, and innovative international activity of higher educational establishments (Hrebeniuk etc., 2022). The key competences list identified by Ukrainian scientists also contains competences in the field of information and communication technologies, including personal ability to navigate in the information space and to possess and operate information in accordance with the labor market demands. They are related to the qualities of a technically educated individual prepared for life and active work in a modern high-tech information society and the possession of digital learning tools (Order of the Ministry of Education and Science Youth and Sports of Ukraine, 2012).

A number of definitions are widely used in scientific literature: "information and communication competence", "information and technological competence"; "information and computer competence", "information" or "informational" competence; "information culture". Usually, these concepts are often not distinguished from each other. A study needs to clarify them. The "information culture" concept is considered by many scholars: the information culture formation in co-educators of education – V. Bykov (2019), I. Dubrovina, D. Obolonnik (2021), Vorobei (2014), Ovcharuk (2019), etc.; information culture development of the teacher – V. Baidenko, B. Oskarsson (2002), Koliada M. (2003). (Grinko, 2019), Rodygina (2005), Chemeris (2006) and others.

METODOLOGY

The methodological basis of the research is the use of analysis and synthesis method, empirical data comparison and results evaluation method; study and analysis of scientific and methodological literature on the problem of research, interview, questioning, testing, ranking forms of methodological work of educators in the educational team.

Hypothesis: the students' information and communication competence formation in higher education will increase if the following factors are introduced into the professional training process: creating a computer-oriented higher education educational environment, filling it with quality content; preparing students for educational activities in a computer-oriented educational environment; ensuring a quality of higher education system based on effective management and organization of productive interaction with teachers. An important condition for designing a students' information and communication competence development program in higher education is to build forms, methods, tools, technologies to ensure the information and communication competence development. We consider the development and adoption of the corporate standard of students' information and communication competence to be an important stage in the students' information and communication competence gradual development program implementation. Modern requirements of labor market in Ukraine predetermine the changes in the higher education system, shifting the emphasis on the educational process organization on the achievement of the final result, ensuring the quality of education. The necessary conditions for the high-quality information and educational environment development in higher education are the presence of developed and approved corporate standard of the faculty's information and communication competence, the development of indicators to ensure internal standards of educational activities quality. A future pedagogue who fills the information and education environment with content should have an appropriate information and communication competence level, which is a type of professional competence of future employees. However, so far no such standard has been approved at the national level, therefore educational institutions develop and adopt their own internal (corporate) standard to ensure the various students' professional competencies development methods to meet labor market requirements and be competitive.

Among the corporate higher education standards, the following were used: standards for quality management system; standards for use of ICT and information environment; standards for e-learning documentation; standards for scientific-methodical materials and tests; standards for organization of teaching activities; standards for applicants' information and communication competence; standards for e-content, information and education environment; standards for pedagogical activity.

The main tasks in this case were to create an appropriate individual program of choice for the students' information and communication competence development, to determine the levels of their development and

appropriate tools for monitoring their formation. Studying the European experience of building an open informational and educational environment, the priority of which is personalized learning based on the combination of competence, activity and personality-oriented approaches (Vitvitska, 2006).

The higher education information and education environment content includes electronic educational resources: content of educational portal of higher education, official distance learning website, electronic professional publications, higher education information system, institutional repository, electronic educational software, virtual. Quality educational content should ensure effective communication and effective cooperation (as one of the quality criteria) between education applicants, teachers, administration. Given the above, it should be argued that the educational environment criteria development in accordance with the quality and openness requirements, the application of specific indicators and tools for its measurement will allow a higher education institution to reach the level of the European quality standard. We believe that the quality of creation and subsequent constant updating of the content criterion (quality of teaching, research, methodological, controlling and reference resources), the level of use of technological criterion (IT infrastructure and services) and compliance with organizational criterion requirements (introduction and observance of the post-graduate education corporate standard) of information and education environment of a modern institution depends on the pedagogical workers' information and communication competence formation level.

Given the above, during the experimental research the students' information and communication competence development program has been elaborated, tested, and implemented in the educational process.

The key tools for measuring the respondents' information and communication competence formation have been defined: the development and substantive content of electronic teaching and learning packages in the distance learning system; analysis of the systematic use of electronic teaching and learning packages; level of use of Web 2.0 services (blogs, wikis, social networks, etc.); availability of individual and joint work in Moodle distance learning system; the use of formative assessment tools with ICT-supported feedback; analysis of participation in seminars and conferences at regional, national and international levels using e-conference systems; analysis of students' creative work on the research problem; analysis of distance learning system reports on the quality of the educational services provided by teachers; testing of applicants to determine the results of their educational activities; analysis of the e-portfolio of graduates.

Material and technical equipment is one of the conditions providing for the students' information and communication competence development with material and technical facilities: personal computers, network equipment, high-speed Internet access, digital cameras, speakers, microphones, multimedia complexes, whiteboards with interactive surface, servers, software, 3D printer.

Given the above, the main approaches to directly organizing the students' information and communication competence development process have been outlined: activity-based, competence-based, andragogic as well as personality-centered.

The activity-based approach implementation is an important factor that guides future teachers to develop information and communication competence, apply the obtained knowledge and skills directly in professional activities. According to the general theory, activity is considered as "a specifically human form of active attitude towards the surrounding world, the content of which consists of its expedient change and transformation" (Raven J., 2002).

In the activity-based approach context the educational activity of higher education applicants combines several elements: motivation, purpose, objectives, content, methods, forms, result, reflection, forming a complete cycle of activity. The cycle is repeated at the new students' information and communication competence development program content and operational (technical) criteria implementation stage.

When specifying pedagogical conditions of students' information and communication competence development, we considered that they have their own pace of competence development or do not have pedagogical experience yet, and acquisition of new skills occurs in everyone.

In the activity-based approach of students' information and communication competence development program implementation process the main ways of organizing educational activities are practical methods, namely, trainings, bar-camps, practical tasks of creating electronic educational and methodological complexes and (or) its content criteria.

The competence approach implementation implies the unity of the process of acquiring knowledge, skills, experience, attitude, critical thinking, ability to develop information and communication competence during industrial professional practice, readiness to use information and communication technologies in the educational

process. The basis of competence-based and activity-based approaches is the idea of activity-based, active higher education content orientation. A specific feature of the competency-based approach is the focus of educational activities on achieving certain results by means of ICT platforms, providing transfer of awareness, their ability to use acquired information to solve practical problems; students' professional competencies formation level assessment as a result of the educational process quality; program orientation on the choice of future professionals' educational needs, modelling and etc.

In the students' information and communication competence development program process we proceeded from the understanding of andragogy as the science of adult learning in accordance with their age, educational and life needs, identified capabilities and internal resources, abilities, individual personality traits, acquired experience of professional activity, psychology, and physiology (Pedagogical Mastery, 1997). The andragogic approach implementation is an important factor in the students' information and communication competence development based on a set of andragogic approaches: priority of independent learning, principle of joint activities, principle of reliance on colleagues' experience, individualization and systematization of learning, principle of awareness and actualization of learning (Gromkova, 200).

The students' information and communication competence development based on andragogic approach contributes to the creation of necessary conditions for self-realization; formation of internal motivation for active participation in educational activities; informal communication in the learning process, which is manifested in mutual respect, partner interaction, independence, responsibility for achieving educational results.

One of the conditions for successful students' information and communication competence development is the lifelong learning principle implementation, which implies the need and opportunity to acquire new knowledge at different life stages, development of different types of professional competence (Bykov, Spirin, Pinchuk (2017) based on the integration of different learning technologies (formal, informal, informational).

Subject-subject interaction in higher education assumes acquisition, search and assimilation of new knowledge, development of different types of professional competence, ability to apply ICT tools in future professional activity, which determines the need to search for modern forms, methods and innovative respondents' information and communication competence development technologies. The use of traditional teaching tools (manuals, monographs, methodological recommendations) does not provide the expected results and determine the need to search for new, modern means of teaching in higher education during the martial law in Ukraine.

The achievement of the educational objectives of the program of choice for the students' information and communication competence development is based on the application of such forms and methods of teaching: seminars, trainings, lectures, master classes, teaching studios, bar-camps, individual and group consultations; independent work, practical classes on creating electronic educational and methodological complexes and their content; knowledge, skills and abilities assessment through testing and questionnaires; individual and joint work in the system of the following: a) the use of ICTs in education; b) the development of the student's skills and competences in the field of information and communication. The program is designed to: provide theoretical knowledge about the role of ICTs in education; develop skills in using ICTs in educational and research activities.

The content component of students' information and communication competence development is implemented in the following forms of training: face-to-face (training sessions, workshops, bar-camps, interactive lectures, individual and group consultations), remote (thematic discussions, interactive lectures, webinars, video conferences, individual and individual teamwork in distance learning system).

In order to successfully achieve the pedagogical objectives based on certain approaches and principles it is necessary to take into account the following factors that affect the teachers' information and communication competence development effectiveness: general characteristics of adult learning (need for justification, self-actualization, independence, focus on results, not on process results, etc.); students' professional characteristics (professional formation and self-identification stage, individual psychological characteristics, special features of the personality, etc.).

Consideration of these factors ensures the effectiveness of the educational process and is expressed in the achievement of students' psychological readiness, which is characterized by a high level of motivation development and absence of psychological barriers to work with ICT-platforms.

The students' information and communication competence development was carried out in the following cyclical stages:

1) organizing and conducting the respondents' information and communication competence level assessment;

2) creating an individual program of choice based on the obtained data;

3) implementing the obtained results in training in all types of practical training;

4) carrying out self-analysis for further self-improvement and involvement of education applicants to assess the results of the distance learning products implementation developed by them.

The sequence of stages allows for full implementation of students' information and communication competence development motivational-target and organizational-procedural component.

The program we offer will contribute to the students' information and communication competence development if the above-mentioned organizational and pedagogical approaches and principles are followed, as well as if the influence factors are taken into consideration, the effective implementation of the students' information and communication competence development model becomes possible, which is proved by the experimental research.

The implementation of motivational-target and organizational-procedural program components involves monitoring the level of students' information and communication competence formation using appropriate tools, namely: survey; development of electronic teaching and learning packages for distance learning; analysis of students' systematic use of electronic teaching and learning packages; level of Web 2.0 services (blogs, wiki, social networks, etc.); implementation of projects in educational environment LMS Moodle; use of formative assessment tools with feedback; analysis of participation in seminars and conferences using electronic means of communication; analysis of student publications (presence of profiles in open and closed databases, citation indices, etc.); analysis of distance learning system reports on applicant satisfaction with quality of educational services provided; testing information and communication competence; analysis of e-portfolio is a business card for graduates.

For example, here is an analysis of a student's e-portfolio created based on electronic resources. It includes personal data, research activities, educational activities and professional development.

The personal data of the e-portfolio included the name and surname of pedagogical staff, acquired professional experience, contacts and links to profiles in social services as well as social and volunteering activities.

The pedagogical activities of students in e-portfolio included the following data: publications, monographs, articles in publications of scientometric databases, articles in professional publications, articles in collections of scientific papers, citation index of open publications, participation in international projects and mobility programs, participation in national educational projects; employment in research and development activities.

The following information was entered into the educational activities of students in e-portfolio: rating among education applicants, textbooks and teaching aids, teaching and learning materials, curricula, developed electronic teaching and learning packages, use of electronic teaching and learning packages, foreign language proficiency, scientific achievements of education applicants; participation in innovative activities of higher education institution.

Such indicators form a holistic representation of students' educational activities. Application of e-portfolio system allows students to systematically collect, quickly update data about themselves, check the accuracy and correctness of the data, which are filled in automatically from relevant registers, conduct reflection on their own activities, present themselves and their achievements on the Internet.

The feedback from the result component of the model reflects the correlation of the students' information and communication competence formation level monitoring results with the challenges posed by the information society, regional education system as well as corporate standards of digital education.

Based on the data obtained while monitoring, it is necessary to make appropriate adjustments in the developed program of choice, which will be amended, clarified, and improved.

Consequently, students' information and communication competence, being a complex multifunctional structure, which is in constant dynamic development, cannot be fixed as a stable pattern, as it is perceived only in the development context. Under such conditions, the respondents' information and communication competence development process is of a continuous nature, which puts a condition for a flexible and dynamic higher education system implementation as well as a unified education quality monitoring system.

The main work of the experimental study was focused on testing the working hypothesis, verification of theoretical provisions and deeper investigation of the research difficulty. The developed experimental pedagogical research program assumed: preliminary observation of the research object; theoretical definition and practical creation of conditions for the experiment; developing the teachers' information and communication competence development levels and criteria system in postgraduate education system; conducting measurements in control and experimental groups; determining research results; mathematical processing of the obtained factual material.

The experimental study consisted in the pedagogical experiment. The program was made based on the

pedagogical experiment requirements (Trushnikova, 2006).

The aim of the pedagogical experiment was to examine the teachers' information and communication competence development program effectiveness in postgraduate education system. The experiment consisted of the ascertaining and formative stages. Let us consider the stages of the experimental research in more detail.

During the ascertaining stage of the experiment, we developed questionnaires to determine the students' information and communication competence formation level; surveyed and determined the students' information and communication competence formation levels in higher education in the humanities through monitoring tools (questionnaires, tests); developed a students' information and communication competence development model in higher education. The input data have been collected, and the analysis results have been used to determine the students' information and communication competence formation level, to express wishes and to formulate expectations. The purpose of this stage was to diagnose the state of students' information and communication competence formation for further formative stage of the experiment and testing the hypothesis of the research.

During the respondents' survey process, we used a control questions system, answering which the respondent had to make a reflection of their own digital education. For example, we used a question like: "Do you always know how to use modern means of ICT in practice?", "Do you know all the national level documents which regulate the informatization process in the education system?". If most students do not acknowledge the initial imperfection of the respondent – the survey is considered insincere; the deployment of "acute probing" – an interview to clarify certain positions of the respondent, conducted after the survey. For example, we conducted clarification of the respondents' conceptual apparatus understanding used in the questionnaire, e.g., 'modern ICT training tools', 'competence', 'non-formal learning', 'informal learning', etc.

Consequently, the respondents' survey was sample-based in terms of the general population coverage degree, questionnaire-based in terms of the communication method between the respondent and the researcher, formalized, factual and event-based in terms of the information content, and group-based in terms of the respondents' type (Halfdan Farstad Competencies for Life, 2002).

The survey data analysis showed that 22% of the teaching staff do not use ICTs in their practical training, 45% use the computer only as a word processor, 33% create presentations for lessons and use Internet resources. The Covid-19 pandemic and martial law have affected the need for respondents to master and actively use information and communication technologies in practical training more relevant, which leads to the need for the information and communication competence components development. This allowed us to formulate a conclusion that ICTs have a significant impact on the higher education training process. Equipping higher education with computer and interactive assets motivates students to be active in developing their own information and communication competence by means of digital learning tools. The impact of modern ICTs on teachers' inquiry and research activities determines the need to develop new skills to publish their materials in Internet publications, international projects, etc.

We have identified the factors that required a revision of approaches to the professional development system for teaching staff, namely: 20% of the teaching staff have not mastered the initial level of use of the available computer equipment, have not overcome a psychological barrier concerning the use of ICTs in professional activity; information about the use of forms and methods of informal and informal learning was new for 46% of the trainees; 44% did not know about the educational policy of the institution and its informatization program; 76% did not participate in the formation of an informatization policy at school level; 28% of respondents are not motivated to learn how to use ICT in their future professional life.

During the formative stage of the experiment the results of the pilot experiment have been systematized and generalized, the experimental program has been developed, the interim results have been published, the competence development dynamics has been monitored and the author's sample program effectiveness has been tested.

The experimental research was conducted in 2021-2022 based on the following higher education institutions: Institute of Pedagogy of National Academy of Pedagogical Sciences of Ukraine (Kyiv), Ivan Franko Zhytomyr State University (Zhytomyr), National Pirogov Medical Memorial University, Khmelnytskyi Humanitarian-Pedagogical Academy.

The experimental study covered 150 undergraduate students in the humanities, who studied at higher educational institutions of Ukraine, including 74 participants in the control group (CG) and 76 participants in the experimental group (EG).

The control group included students who studied according to the traditional approach. The experimental group included students whose training organization included the implementation of the author's program of

choice for the students' information and communication competence development as well as mastering digital learning tools.

At the first stage of the formative experiment the plan of its implementation has been developed, the effectiveness of the principles influence, forms and methods providing the respondents' information and communication competence development has been determined. In accordance with the program goal the following tasks of the experiment forming stage have been defined: to develop, test and implement the students' information and communication competence development program; to check the effectiveness of its use in the educational process; to trace the changes dynamics in the applicants' information and communication competence development.

To perform the first task of the experiment formative stage we used expert assessment according to the methodology of V. Bykov (2019). The expert assessments method is a scientific and technical forecasting method based on the assumption that the future students' information and communication competence development can be modelled based on expert opinions. This method can largely ensure objectivity, versatility, validity, and comprehensiveness of the decisions made.

The method implies excluding the possibility of direct communication between the members of the expert group. Each member of the expert group works independently and completes an individual expert report. The method involves several procedures aimed at obtaining a necessary and sufficient set of expert judgements and their influence on the experimental study.

The peer review involved six stages. In the first stage, an expert assessment was carried out. It involved defining the purpose, objectives of the pilot study, timing of the work, selecting the leader and the group of experts. At the second stage, methodological guidelines for the students' information and communication competence development problem implementation have been developed. At the third stage, the formation of the expert group was carried out because of the following methods: mutual recommendations, reasoning, studying questionnaire data. The rating of each expert was calculated in points based on the methodology of V. Grabovsky (2016).

The fourth stage involved the preparation and interviewing the experts using a questionnaire designed according to the respondents' information and communication competence structure. The questionnaire was shaped according to the applicants' information and communication competence structure. The experts were asked to use the following rating scale: "I completely agree", "I agree", "I agree rather than disagree", "I disagree rather than agree", "I disagree". This scale allows to determine the higher education applicants' attitude to the information and communication competence development in higher education system. The fifth stage involved analysis and formalization of the expert assessment results. The generalized results of the students' information and communication competence development program assessment criteria are reflected in Table 1.

Table 1. Summarized results of the students' information and communication competence development program assessment criteria

	Motivation-target criterion	Organizational-process criterion	Content and operational-technical criterion	Diagnostic criterion	Result criterion
I completely agree	0,34	0,57	0,51	0,58	0,61
I agree	0,45	0,27	0,29	0,24	0,28
I agree rather than disagree	0,14	0,13	0,17	0,14	0,09
I disagree rather than agree	0,04	0,02	0,02	0,03	0,01
I disagree	0,03	0,01	0,01	0,01	0,01

After the expert assessment of the students' information and communication competence development the proposed program effectiveness has been studied; the directions of each student development in accordance with

the expected results and personal qualities of the respondent has been determined; an individual current map of the students' information and communication competence development program has been made; the forms and means of program implementation for the information and communication competence development of personality have been determined. At the beginning of the experiment in the groups of EG and KG the questionnaires have been conducted to determine the students' information and communication competence formation level.

The questionnaires have been made on the basis of the higher education indicators quality in accordance with each of the professional activities and combined the following sections: determining the awareness level of the policy and procedure for quality assurance in higher education; mastering the modern ICT training tools; determining the level of information and educational environment development of the institution; monitoring the applicants' distance form of educational activities implementation, determining the involvement level of the students' information and communication competence development model. The diagnostics instruments of its level formation have been developed. The evaluation of students' information and communication competence level has been performed according to the five-point system (from 1 to 5 points) for each type of educational activity, where 5 points represent the reference level of competence formation. The total maximum sum of points should not exceed 25.

Table 2.
Qualimetric model of students' information and communication competence

Criterion	Assessment tool	Criterion weighting	Indicator	Indicator weighting
Understanding the role of ICT in education and their use	Questionnaire	0,2	Basic knowledge	0,5
			Participation in regional and national group initiatives levels	1,5
			Development of strategies informatization of the educational institution	3,0
In total		0,2		**5,0**
Use of ICT	Expertise of the created products	0,2	Basic tools	0,5
			Creation of electronic educational and methodical complexes	1,5
			Continuous update e-portfolio	3,0
In total		0,2		5,0
Use of ICT in educational activities	Expertise of the created products	0,2	Application of knowledge and skill	0,5
			Systematic use of ICT	1,5
			Creation and support of open educational resources	3,0
In total		0,2		5,0
Use of ICTs in science activities	Questionnaire	0,2	Use of ICT to search for information	0,5
			Presenting the results of own educational activities to the educational community with ICT	2,0
			Coordination of or participation in international educational projects	2,5

In total		0,2		**5,0**
Use of ICT in professional development	Questionnaire	0,2	Access to professional development resources	0,5
			Creation of own e-portfolio	2,0
			Participation in MOOC (Massive Open Online Courses)	2,5
In total		0,2		5,0
Total amount		1,0		25,0

The results of the KG survey at the beginning of the experiment are shown in Table 3.

Table 3.
The results of the KG pedagogical workers survey at the beginning of the experiment

Questions by type of activity	Average value
Understanding the role of ICT in education and their use	2,6
Use of ICT	2,3
Educational activity	3,6
Search and research activity	1,2
Professional improvement	1,3

The results of the KG survey at the end of the experiment are shown in Table 4.

Table 4.
The results of the KG survey at the end of the experiment

Questions by type of activity	Average value
Understanding the role of ICT in education and their use	2,5
Use of ICT	2,9
Educational activity	4,0
Search and research activity	1,5
Professional improvement	2,4

The results of the EG survey at the beginning of the experiment are shown in Table 5.

Table 5.
The results of the EG survey at the beginning of the experiment

Questions by type of activity	Average value
Understanding the role of ICT in education and their use	2,1
Use of ICT	2,5
Educational activity	3,8
Search and research activity	1,3
Professional improvement	1,6

The results of the EG survey after the end of the experiment are shown in the table. 6.

Table 6.
The results of the EG survey after the end of the experiment

Questions by type of activity	Average value
Understanding the role of ICT in education and their use	5,0
Use of ICT	4,5
Educational activity	4,4
Search and research activity	4,6

Consequently, the given generalized results of the EG survey before and after the experiment prove that there were differences in the general population: the level of the "understanding the role of ICT" indicator increased 2.2 times, the level of the "using ICT" indicator increased 1.7 times, the level of the "learning activities" indicator increased 1.7 times, the level of the "research activities" indicator increased 3.2 times.

Table 7 summarizes the data for each indicator of the teachers' information and communication competence formation measuring tools. The data are marked as a percentage, which allows to note the positive dynamics of changes in the higher education applicants' information and communication competence development.

Table 7.
Students' information and communication competence development model effectiveness criteria

Indicators	Before the experiment	After the experiment
Knowledge of national level education policies and informatization programs	18%	65%
Knowledge of educational policies at the level of an educational institution	19%	75%
Knowledge of the informatization program at the level of the educational institution	18%	74%
Rationale for the use of selected ICT tools	22%	65%
Proficiency in general purpose software, system software (Windows, Microsoft Office 365)	Text data processing technologies – 37% Numerical data processing technologies – 39% Technologies development of graphics and multimedia data – 18% Internet services and computer Tools networks –17%	Text data processing technologies – 89% Numerical data processing technologies – 78% Technologies development of graphics and multimedia data – 68% Internet services and computer tools networks – 77%
Using digital devices	Printer – 35% Scanner –14% Webcam – 9% Camera – 46% Interactive whiteboard – 19%	Printer – 91% Scanner – 89% Webcam – 67% Camera – 98% Interactive whiteboard – 68%

Knowledge of the project technology elements, formative assessment, group work, collaborative pedagogy, person-centered educational activities	Project-based technology – 10% Formative assessment: – 11% Group work methods – 38% Collaborative pedagogy – 58% Person-centered educational activities – 61%	Project-based technology – 70% Formative assessment: – 71% Group work methods – 79% Collaborative pedagogy – 87% Person-centered educational activities – 95%
Use of online resources in learning activities	Use of off-the-shelf web-based information resources – 19% Creation of own web-based information resources – 5% Consultation of applicants for education on the optimal choice of online services to solve educational tasks – 9%	Use of off-the-shelf web-based information resources – 68% Creation of own web-based information resources – 15% Consultation of applicants for education on the optimal choice of online services to solve educational tasks – 58%
Awareness of the use of funds Information and communication activities	Use of repositories – 25% Use of scientometric databases of e-libraries, e-journals – 29% Number of publications in institutional repository – 21% Index of citations in Google Academia – 11% Number of international publications – 78% Availability of E-portfolio – 0%; Number of joint international publications with researchers in other postgraduate institutions – 15% Organization and conduct of online conferences, seminars – 2%	Use of repositories – 75% Use of scientometric databases of e-libraries, e-journals – 80% Number of publications in institutional repository – 85% Index of citations in Google Academia – 74% Number of international publications – 81% Availability of E-portfolio – 85%; Number of joint international publications with researchers from other higher education institutions – 21% Organization and conduct of online conferences, seminars – 15%
Selection of methods, forms and tools for organizing the learning activities of higher education applicants according to the purpose of the lesson	26%	52%
Participation in professional virtual communities, communicating on professional issues through the Internet	27%	51%
Self-learning activities with open educational resources	65%	87%

The dynamics of students' information and communication competence development in comparison with CG and EG is presented in Table 2, i.e., after completion of the individual sampling program, the EG respondents significantly increased their scores on the questionnaire question corresponding to each type of activity. While in

the CG the scores of these parameters remained low. After processing the students' information and communication competence criteria, the obtained data was summarized in Table 8 and defined as the arithmetic mean of the corresponding values of its components.

RESULTS

According to the goals and objectives in the research process the following results have been obtained: the study of the students' information and communication competence development problem search state allowed to establish insufficient research level in conditions of higher education institutions educational process informatization and prove the relevance of the research; it has been found that at the current national education system reform and transformation stage insufficient attention is paid to the students' information and communication competence development. The goal and objectives implemented during the study are the basis for the following conclusions: the scientific papers analysis on the study of the specialists training problem in ICT usage shows that, despite awareness of domestic and foreign scientists the need to develop students' information and communication competence is solved insufficiently. This is expressed in the lack of the students' information and communication competence unified essence understanding; its identification with the concepts of "technological literacy", "information competence", "information and computer literacy"; diversity of approaches to the definition of its components, mechanisms, and conditions of development.

The notion of "information and communication competence" is understood as readiness on the basis of dynamic combination of knowledge, abilities and practical skills to autonomously use information and communication technologies as well as electronic educational resources for preparation to design future professional activity, conduct educational activities aimed at ensuring responsible social interaction and behavior in information and educational environment as well as satisfaction of individual needs.

The notion of "development of students' information-communication competence" is defined as a systematic and regular process of progressive changes of a student's personality in the basic professional skills development process, in particular the ability to use information-communication technologies and electronic educational resources in practical training.

The methodological basis for solving the problem of developing the investigated teachers' competence is defined as the scientific theory of knowledge, laws and categories of dialectics, theory of system analysis, theory of information society development; system, structural-functional, activity, integration, andragogic, axiological, personality-centered, competence-based approaches.

The peculiarities of students' information and communication competence development in higher education have been revealed, namely: educational process should provide development of learning competence and the practical training process should be based on both generally accepted didactic (scientificity, consistency, accessibility, unity of theory and practice, individualization) teaching, ensuring creative activity and independence, etc.) and andragogic principles (reliance on student experience, joint activity, elective learning, development of educational needs; stimulation of self-education and autonomy).

It is stated that the students' information and communication competence development implies quality assurance in higher education on the basis of effective management and productive learning process (development of unorthodox, innovative and adaptive thinking, computational thinking, project thinking, social intelligence, cognition, virtual interaction); creation of computer-oriented educational environment in higher education, filling it with high-quality content (development of ability to communicate with students).

The content of criteria and their development indicators for information and communication competence of students have been characterized.

The motivational and value criterion combines motives, goals, value attitudes, needs for the use of ICT tools in professional activities and satisfaction of individual needs, self-development, etc. The basic level of the value-motivational criterion is characterized by awareness of the need and responsibility for the use of ICT tools in professional activities. The advanced level is characterized by the motivation to use ICT for professional recognition and professional realization, the need for professional development based on the use of ICT tools. The professional level is manifested in responsibility and readiness for active use of ICT to improve one's professional outlook in accordance with the requirements of the information society; the desire to achieve success in the implementation of scientific research using ICT.

The cognitive criterion of students' information and communication competence development implies

knowledge of ICT use in educational activities of teachers, the ability to observe, establish analogies, compare and contrast facts and phenomena, compare new with known, use thinking techniques (induction and deduction, synthesis), structure, systematize and classify information and data. The basic cognitive criteria level implies the formation of knowledge, which allows teachers to perform work functions using ICT tools at an advanced level. An advanced cognitive competence level implies more advanced knowledge enabling teachers to perform the work function using ICT tools at an advanced level. The professional cognitive criterion level is demonstrated by the ability to perform complex professional tasks using ICT, the ability to implement an educational process using ICT tools, and the ability to create new information and data using ICT tools.

The students' information and communication competence development operational-activational criterion is defined as the procedural essence of using ICTs to solve professional and individual needs. It combines skills and abilities to apply acquired ICT knowledge in preparation for professional activities. The basic operational-activational criterion level implies awareness and understanding of the appropriateness of one's level of capabilities and skills to use ICTs at the basic level to solve professional tasks in accordance with job functions. The advanced operational-activational criterion level is expressed in the planning and administration of the professional tasks solving processes using ICTs; the ability to choose the course of action using ICTs in the professional tasks solving process. The professional operational-activational criterion level is characterized by the presence of professional integration of the use of ICTs in the professional activity process.

The students' information and communication competence development research criterion combines problem analysis, research of processes and phenomena, modelling and process implementation, prediction and analysis of obtained results; covers knowledge, abilities, skills, activity experience, values and personal qualities and is manifested in the ability to conduct research activities in order to create new educational products based on application of scientific cognition methods, creative approach in goal-setting as well as planning of new activities. The profound activity criterion level is expressed in the formation of sustainable knowledge of ICTs, necessary for psychological and pedagogical research; independent organization of research activities using ICTs; planning professional activities using ICTs; active use of Internet resources. The professional activity criterion level implies monitoring the results of educational activities based on the use of ICT tools.

The students' information and communication competence structure combines three levels: basic, advanced, and professional. The following criteria are common for each level: understanding the role of ICTs in education and their use; educational activity as a type of students' professional activity; research activity as a type of professional activity.

It has been found that the students' information and communication competence development is carried out in the following stages: I stage – basic information and communication competence level formation (minimum set of knowledge and skills for ICT application in pedagogical activity at user level); II stage – advanced information and communication competence level formation (readiness to actively apply ICT and ability to provide professional advice to colleagues), III stage – professional information and communication competence level formation (ability and willingness to transfer their ICT knowledge and skills to colleagues and fellow educators).

An individual students' information and communication competence development program has been designed. The program is based on basic provisions of UNESCO recommendations, European ICT Competency Framework 2.0, and International Standards for the Classification of Education (ISCED) and considers features of professionals in the context of Standards and Guidelines for Quality Assurance in Higher Education, the European Qualifications Framework and National Qualifications Framework, namely: understanding the role of ICT in education and their application, the use of ICT, educational activities, research activities as well as professional development ( ).

The aim of the program is to develop students' information and communication competencies. The objectives of the program are to provide students with an understanding of the ICTs role in education and their application; develop skills in the use of ICTs in educational and research activities as well as improve professional skills.

The aim of the elective program educational activities is to develop students' information and communication competence. The objectives of the program are aimed at providing students with the acquired knowledge on understanding the role of ICTs in education and their use; developing the skills and abilities to use ICTs in educational and research activities as well as improving professional skills.

The key tools for measuring the pedagogical staff information and communication competence development in post-graduate education are survey of applicants and teachers; development and content of electronic teaching and learning packages in distance learning; analysis of systematic use of electronic teaching and learning

packages; level of use of Web 2.0 services (blogs, wikis, social networks, etc.); availability of individual and team work in the distance learning system; use of formative assessment tools and implementation of individual and collective project activities with feedback; participation in international programs; analysis of participation in seminars and conferences using e-conference systems; analysis of teachers' publications; analysis of distance learning system reports on teachers' satisfaction with the quality of educational services provided; testing of students to determine their educational performance; analysis of respondents' electronic portfolios.

Table 8.
Summary of the students' information and communication competence development dynamics

Students' information and communication competence development criteria	Group	Before experiment	After **experiment**	**Increase**
Understanding the role of ICT in education and their use	EG	2,3	4,8	**2.7**
	KG	2,5	2,7	0,2
ICT skills	EG	2,6	4,5	**1.9**
	KG	2,3	3,2	0.7
Educational activity	EG	3,8	4,3	**0.7**
	KG	3,6	3,9	0.3
Scientific activity	EG	1,5	4,6	**3.1**
	KG	1,6	1,7	0.1
Improvement of professional skills, internship	EG	1,5	4,9	**3,4**
	KG	1,4	2,3	0.9
∑ EG		11,7	23,5	
		46,8%	**94%**	
∑ KG		11,2	13,4	
		44,8%	53,2%	

Thus, the objectives of the study led to its goal of identifying and scientifically substantiating digital learning tools that will contribute to the European-based effective students' information and communication competence development in Ukraine.

DISCUSSION

The proposed program combines criteria defined in accordance with the general activity structure theory: motivational-target criterion (provides goals and objectives of the educational process); organizational-procedural criterion (defines the information and communication competence development process principles, pedagogical conditions of embodying this process, reasons for action on the outcome of educational activity); content and operational-technological criteria (defines the educational activities content by levels of information and communication competence formation, which specifies the information and communication competence development organizational forms and methods); diagnostic and performance criteria (defines the students' information and communication competence effectiveness development criteria and indicators, examination and analysis of this process' effectiveness).

The students' information and communication competence development program combines three levels: basic, advanced, and professional. For each information and communication competence level according to the practical training types in designing future educational tasks (understanding the role of ICTs in education, using ICTs, educational activities, research activities) appropriate tools to determine the students' information and communication competence formation level have been allocated.

Comparing with the results of previous studies, student's information and communication competence could be undoubtedly regarded as an indicator of the new quality of education (Babayev, D., Saipidinova, B.,

Babaeva, A., Alieva, B., Abdullaeva, Z., (2020). Information and communication competence of students is closely related to the mobilization of knowledge, abilities, skills, and behavioral attitudes adapted to the conditions of specific activities. This position focuses on the results of the student's activities, in the form of promotion and assimilation of certain social experience, as a driving force for the development of students' information and communication competence. From our point of view, achieving a new quality of education cannot be achieved without teachers applying such forms and methods of educational activity with the support of information learning tools like: seminars, trainings, lectures, bar-camps, individual and group consultations; independent work; practical lessons on creating electronic teaching and learning hubs and their content criteria; knowledge, skills and abilities assessment through testing and questionnaires; individual and joint work in LMS Moodle, webinars, the use of formative assessment tools by introducing individual and collective project activities with feedback. Only the constant introduction of individual and collective project activities and application of diagnostic tools contributes to the formation of information and communicative competence levels of students.

At the same time, teachers and students are faced with the challenges of working on e-learning platforms, such as flexibility, security, efficiency, usability, and practicality, as in practice. This aspect, according to Aljawarneh, S., (2020) has not been given due attention in education. For example, universities around the world are yet to realize the significance of improving security for e-learning systems. In order to secure their systems, these universities use some off-the-shelf security tools. Are the participants of the educational process today ready to operate them successfully without informational support?

We couldn't but draw attention to equally interesting and poorly researched gender approach to developing students' information and communication competence. (Aesaert, K., van Braak, J. (2018). For example, girls are particularly better in delivering digital information in a socially acceptable and understandable way than boys. Consequently, gender preferences still need to be studied. Moreover, the impact of teachers and schools is limited as almost no teacher and school characteristics seem to contribute to students' ICT competences. Consequently, it can be assumed that students still develop these competences especially in informal, out-of-school settings. This means that students enter schools with different and differently developed ICT competences. Moreover, this approach can be used both in classroom and during self-study, providing more freedom and flexibility to learn at one's own pace and convenience and can help to face modern educational challenges more prepared (Sovhar, O. M. (2021). Therefore, it is important for teachers to take this approach into account during the formation of assignments for independent work and individual tutorials. This discussion confirms the need to introduce alternative (selective) programmes for students, which provide more freedom and flexibility for each student, namely at his or her own pace and comfort.

CONCLUSIONS

The formative experiment results analysis on all students' information and communication competence components led to the following conclusion: at the beginning of the experiment the respondents' information and communication competence in the CG group was 46.8%, which corresponds to the basic level (30-50%), and in the EG group 44.8%, which also corresponds to the basic level (30-50%). After the completion of the experiment, this level increased to 53.2% for the CoG teachers, which corresponds to the advanced level (50-75%), and 94% for the EG teachers, which corresponds to the professional level (75-100%). The dynamics of changes between the levels of information and communication competence is 38.8% higher in the EG than in the KG. After the selective information-communication competence development program training the EG respondents had a higher level of information-communication competence formation than the CG respondents who studied independently. The conducted pedagogical experiment proved the hypothesis that the organization of an individual ICT program will contribute to the future specialists' information and communication competence development level.

The basis for achieving the educational objectives is carried out through the application of interactive forms and methods of educational activities (seminars, trainings, lectures, individual and group consultations; independent work; individual and joint work in LMS Moodle), the use of information evaluation tools, webinars, peer-to-peer methodology and by implementing individual and collective project activities with feedback reflection; knowledge, skills and abilities assessment through testing. Given the obtained data the effectiveness of the students' information and communication competence selected formation program has been proved.

Consequently, the students' information and communication competence formation result in the higher education system is: the development and adoption of a corporate standard for students' information and com-

munication competence, which defines the tools for measuring the competence formation; differentiated and integrated content, forms and methods of future teachers' information and communication competence formation, continuous scientific and methodological support of students' information and communication competence formation, created and constantly updated content of the higher education information and educational environment components; autonomy and responsibility in the application of ICT in the practical training of students.

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