5. ABOUT THE INFORMATIZATION OF PHD-STUDENTS’ ACADEMIC AND RESEARCH WORK

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Informatization of educational space during postgraduate studies is a priority task of training applicants for the third educational and scientific level of higher education. A fundamentally important characteristic of the current stage of the development of science is its informatization. The process of informatization of society includes mediatization, computerization, and intellectualization. The Government of Ukraine has legislatively approved the task of informatization of society, thereby confirming the relevance of the issue. Among the scientific developments in open print on the issue of integration of academic and scientific activities of PhD-students, the question of the influence of informatization on this process is little researched. The purpose of the research is to study the impact of informatization on research and academic work of PhD-students and the possibility of using it as a tool for integrating these interrelated aspects of the activities of PhD-students. In the national doctrine of the development of the education system, the determining factor of the effectiveness of its informatization is the ability of teachers to carry out professional activities using information and telecommunication technologies. The development and informatization of science and education require universities to constantly adjust the methods of training PhD-students, taking into account new progressive methods of teaching and research. Educational researchers prone to innovation find it easier to introduce the results of modern research into the educational process and effectively use modern information technologies. It is useful to increase the attention of PhD-students to the fact that computer equipment and information technologies contribute to the automation and intensification of research. Informatization should become an essential factor in the integration of scientific and academic work of PhD-students.

Keywords: informatization, higher school, institution of higher education, graduate (PhD) student, academic work, research work.

5.1. INTRODUCTION

In the conditions of globalization and acceleration of integration processes in higher education, one of the key elements of the innovative infrastructure of modern higher education is the research degree of professional
training of highly qualified personnel. The key trends of modern higher education are changing the structure and methodical approaches to the organization of training of research specialists. Therefore, a pedagogical understanding of the processes taking place in this area is necessary.

In modern higher education, the need for a personally oriented, creative, competitive teacher, who is ready not only to reproduce acquired knowledge, formed abilities and skills, but also to independently design one’s own activity, is growing with great progression [1].

Informatization of the educational space during postgraduate study is the priority task of training the students of the third educational and scientific level of higher education as a new generation of teachers capable of carrying out professional activities in the conditions of information and communication technologies.

In this way, the process of providing the education system with the theory and practice of developing and using new information technologies, focused on the realization of the goals of education and upbringing — informatization of education [2], is carried out.

On the other hand, at the turn of the 20th–21st centuries, the e-science paradigm replaced the empirical, theoretical, and computational paradigms, which could no longer provide the necessary rates of registration, accumulation, processing, and speed of exchange of the required volumes of scientific information using existing means, methods, and technologies. All over the world, appropriate infrastructures are being created that are able to ensure the rapid movement of both primary and processed data, as well as intensive scientific communication, based on the use of global networks and Web technologies [3].

Thus, a fundamentally important characteristic of the current stage of the development of science is the formation and rapid development of computer sciences and information technologies, that is, the informatization of science.

Informatization, according to the Ukrainian Wikipedia, is a policy and processes aimed at building and developing a telecommunications infrastructure that combines territorially distributed information resources. The informatization process is a consequence of the development of information technologies and the transformation of a technological, product-oriented way of production into a post-industrial one. Informatization is based on cybernetic methods and management tools, as well as information and communication technology tools.

It is common knowledge that scientific and academic work are the main types of activity of any PhD-student, and the necessity of their interconnec-
tion is beyond doubt. At the same time, the necessary processes of integration of similar activities of PhD-students take place against the background of global processes of informatization of education and widespread dissemination of innovations.

It is necessary to search for significant factors of increasing the effectiveness of PhD-student training in higher education institutions, after which the training of the pedagogical elite is carried out in the graduate school — specialists who are able to develop and implement a large number of innovative approaches in the field of pedagogy. Graduate students are traditionally required to combine practical academic, research and innovation activities in conditions of widespread use of information technologies. With this very technology, there are many innovations.

The wide spread of modern information technologies has fundamentally changed the traditional ideas about the possibilities of development of human intelligence and led to the development of fundamentally new ways of organizing its educational and cognitive sphere, in particular at the third educational and scientific level.

The relevance of the use of new information technologies is dictated primarily by pedagogical needs to increase the effectiveness of learning, in particular, the need to develop skills for independent learning, a research, creative approach to learning, the formation of critical thinking, and a new culture. Nowadays, with the rapid increase in the volume of information, knowledge ceases to be an end in itself, they leave the conditions for the successful realization of an individual, his professional activity. In this regard, it is important to help graduate students become active participants in the learning process and to form their need for constant search. Accordingly, the task remains to create such a model of the educational process that would allow revealing and developing their creative potential. Information and communication technologies contribute to the construction of a similar model created for an open information and educational space, based on which the principle of joint creative activity of those who study and are being studied is laid. The main goal of informatization is the creation of a unified information and educational space of the university, which is necessary to support the educational, research and organizational and commercial activities of the institution of higher education in the conditions of the introduction of modern information technologies.

In the new conditions of the formation of professionally significant qualities of the future of philosophy, education should be oriented not so much on the volume and completeness of specific knowledge, but on the ability to
independently replenish knowledge, set and solve various tasks, put forward alternative solutions, develop criteria for selecting the most effective of them.

In general, there is a process of informatization of society, which includes at least three elements that complement one: mediatization as a process of improving the means of working with information, computerization as a process of improving the means of information processing, and intellectualization as a process of improving human knowledge and abilities to generation and perception of information [4].

A year ago, the government of Ukraine adopted Law 2807-IX (draft law No. 6241) “About the National Informatization Program”, which demonstrates the relevance of the issue in modern Ukraine [5].

An important manifestation of the work of modern trends in the development of the educational space is the informatization of educational and scientific PhD-students [6, 7].

5.2. ANALYSIS OF LITERARY DATA AND STATEMENT OF THE PROBLEM

Many specialists investigate the issue of informatization of education and science in higher education, in particular, the activities of those who have obtained the third educational and scientific level of higher education. Thus, I. V. Oliinyk notes that informatization of the educational space of future doctors of philosophy can significantly affect the effectiveness of the pedagogical process, the improvement of the personality in professional and research aspects [8]. In the review of the study of world trends in the development of informatization of education, KNEU named after V. Hetman’s attention is focused on the fact that the informatization of education requires the introduction into it of innovative methods, means and the formation of professional training of future specialists of the new education, the creation of a powerful information infrastructure in institutions of higher education with a developed information and computer educational environment, the introduction of the Internet — technologies, electronic learning, communication networks (global, national, local) [9].

O. O. Gagarin and S. V. Tytenko reveal the essence of the Web-system and the distance learning system regarding artificial intelligence in education, knowledge delivery model, site content management system, semantic content modeling, etc. [10]. A. Yatsyshyn emphasizes that in accordance with the new requirements for the training of PhD- and doctoral students in
Ukraine, significant organizational and methodical changes must take place in the institutions that will further implement the educational program and the research aspect; the indicated innovations require justification and development of new educational programs, and for this need to coordinate and scientific and methodological support, which should be provided by the National Academy of Pedagogical Sciences of Ukraine [11]. Advanced countries recognize informatization as a factor of national development and create an appropriate legislative and regulatory framework on the basis of which policies (content, resources, finances) are implemented in this direction [12]. Aspects of informatization of science and education are considered in the works of V. Yu. Bykov [13, 14], V. P. Vember [15], R. S. Gurevich [16], and M. P. Shishkina [17]. The work of V. I. Lugovoi [18], I. Yu. Regheil [19, 20] is devoted to issues related to the training of highly qualified scientific and scientific-pedagogical personnel.

However, the issue of integration of research and academic work of PhD-students in institutions of higher education for informatization of these areas of their activity is little researched.

5.3. THE PURPOSE AND TASKS OF THE RESEARCH.

The purpose of the study is to study the impact of informatization on research and academic work of graduate students and the possibility of using it as a tool for integrating these interrelated aspects of the activities of graduate students.

The objectives of the research are the following:
— to investigate the essence of the main types of activities of PhD-students in institutions of higher education;
— clarify the concept of informatization of academic and scientific activities in higher education;
— justify the need for the birth and development of the innovative component in the activities of PhD-students;
— to analyze approaches to the study of educational material by PhD-students, methodical principles of scientific thinking, logical means of cognition, stages of the cognitive process;
— clarify the components of the updated strategy for the development of the higher education system;
— to systematize approaches to the development of creativity in the scientific and academic activities of PhD-students.
Research methods and materials. The main method of the conducted research was the system method. Empirical methods such as observation and description are also used, and theoretical methods include analysis, generalization, induction, deduction, explanation, classification, etc.

5.4. RESEARCH RESULTS

Rapid and profound changes taking place in the modern world, which are often described as the formation of a global information society based on knowledge, have become the most important factors affecting the development of higher education in the late 20th and early 21st centuries. The role, organizational forms and methods of functioning of science are changing. The forms of life of the university as one of the main elements of the education system, which plays both a systemic and culture-forming role in it, are also changing. A modern institution of higher education increasingly finds itself at the forefront of innovative development, where it is required not only to perform educational functions, but also to create scientific divisions for the development of industry, conduct scientific expertise of business projects, develop science-intensive technologies and advanced theories that can be converted into marketable advantages for the research customer.

The vector of transformation of university education is accompanied by various organizational changes and a review of the mission of universities, in which the tasks of flexible management of intellectual and material resources, stimulation of innovations, positioning in the market of educational services, etc. become priorities. At the same time, universities remain a space where traditions of scientific knowledge are created and maintained.

Postgraduate studies were traditionally considered the pinnacle of the system of higher professional education. This degree, focused on the training of research specialists, focused on the values and content of the culture of university education itself, based on a combination of the traditions of scientific work and the values of knowledge and the pedagogical mission of preserving and transmitting cultural heritage. Remaining an integral part of the academic world and university education, the system of training specialists-researchers also faces the need to revise its orientations and forms of work.

One of the most important tasks of a higher school is the most complete disclosure of the intellectual potential of students, their abilities to generate and perceive new knowledge, the formation of skills to apply them in their everyday and professional activities, using modern information methods
and tools. This task, namely the introduction of educational innovations, in particular information technologies, among other priority areas of state policy, is set in the national doctrine of education development. The determining factor in the effectiveness of informatization of the domestic education system is the ability of teachers to carry out professional activities using information and telecommunication technologies (Fig. 5.1).

![Diagram of Components of Informatization of Education]

**Fig. 5.1. Components of informatization of education**

Against the background of global processes of informatization of education, which mean the processes of providing the education system with the theory and practice of developing and using new information technologies aimed at realizing the goals of education and training, the process of integration of research and academic work, which are the main activities of any — some graduate student.

PhD-students must master the methods of selection from the content, methods and means of science of basic ideas, patterns, and information technologies and build on this their innovative activity, and through it, the content and methodology of education. The constant development of science and the expansion of approaches to informatization of education require the institution of higher education to constantly adjust the methods of training PhD-students, taking into account new progressive methods and means of teaching and research.
Today’s PhD-student tomorrow will be engaged in the training of higher education seekers in higher education, and only a teacher-researcher inclined to innovation can introduce the results of modern research into the educational process, share the most valuable scientific findings with students and effectively use modern information technologies. This will support the innovative atmosphere of classes, increase the attractiveness of scientific creativity, and introduce students of higher education to modern tasks facing science.

Informatization of education is a multifaceted process, which involves the PhD-student — the future teacher:

– management of the educational process based on the use of automated data banks of scientific and pedagogical information, informational and methodological materials, as well as communication networks;

– improvement of the methodology and strategy of content selection, methods and organizational forms of education, upbringing, relevant tasks of the student’s personality development in modern conditions of informatization of society;

– creation of methodological training systems focused on the development of intellectual potential;

– formation of skills to independently acquire knowledge, to carry out experimental and research activities; various types of independent information processing activities;

– creation and use of computer testers, diagnostic methods of control and assessment of students’ knowledge level.

The program of informatization of the educational process involves the introduction of new forms of work with the use of information technologies by a PhD-student — a future teacher. One of the effective ways of introducing new forms of work can be seen in the creation of a comprehensive system of ensuring the educational process.

Informatization of education is the process of changing the content, methods and organizational forms of training students at the stage of transition to life in the conditions of the information society.

Thus, the logical main directions of implementation of the educational process informatization program in modern conditions are:

– a systemic vision of the role of information computer technologies within the framework of informatization of education;

– designing and monitoring the development of the information and educational environment of the university at all levels of the educational process in it;
– formation of the readiness of the teaching staff to use new information technologies in education based on the system of supportive education, based on the continuous acquisition of new knowledge;

– development of the technical base; the use of telecommunications and their inherent technologies; development of educational information resources.

A great role in the formation of the innovative activity of a PhD-student belongs to his scientific supervisor, who should be a role model in conducting scientific works. He should lead the PhD-student to the conclusion that science is enriched by problems, through the solution of which new innovative ideas arise. At the same time, PhD-students develop creative thinking skills, the need for innovative activities and the use of information technologies develops.

In the process of training graduate students, special attention should be paid to the analysis of approaches to studying the material, their involvement in methodological principles of scientific thinking, arming with logical means of cognition, familiarization with the stages of the cognitive process. The cognitive result in this case can be new facts, laws, theories, innovations, methods of activity obtained by postgraduate students themselves, based on the use of new computer developments.

It is also necessary to develop in graduate students the idea that computer equipment and relevant technologies are capable of automating and intensifying work in many ways, increasing the effectiveness of the practical part of the research being conducted. Postgraduate students need to take into account that any research work begins with the study of domestic and foreign literature on the chosen topic. Such literature can be published in electronic resources of the Internet and be available for standard methods of searching for scientific sources.

Informatization of the educational activities of graduate students led to the creation of electronic textbooks, electronic planning, and electronic control. A characteristic feature of informatization at the university in general is the transition from fragmented to large-scale informatization, based on the creation of information resources (databases, knowledge bases, electronic libraries, etc.), the development of telecommunications, the creation of software for network information technologies, the development of conceptual and methodological foundations for the informatization of research. In addition to information technologies, which are the main elements of the actual educational process, the university began to pay more attention to the implementation and support of so-called service technologies (electronic textbook, multimedia, expert systems, publishing systems, video advertising).
The high efficiency of modern education can be ensured only if graduate students — future teachers create such computer packages (electronic textbooks, manuals, simulators, testers, etc.), the presence of which will ensure the same computer environment in a specialized classroom for practical classes, in computer classrooms of a higher education institution or dormitory, equipped for independent work of higher education students, PhD level students, as well as at home on a personal computer or on any gadgets.

Informatization of the educational process at the university is based on good basic computer training and implementation of the principle of continuous use of information technologies in the educational process. Therefore, it is impossible to talk about informatization without computer support.

Each study guide is a channel of the teacher’s pedagogical influence on the student. Collectively, such influences merge into information noise. In this noise, it is almost impossible to single out a systematic and comprehensive source of information. A paradoxical situation arises: the large number of textbooks does not reduce, but rather increases the need of the teacher and student for a new textbook, which is as adequate as possible for the specific educational process in which they are involved.

An electronic textbook is a computer-based pedagogical software tool designed primarily for the presentation of new information that complements printed publications, serves for individual and individualized learning and allows to a limited extent to test the acquired knowledge and skills of the learner. Modification of the electronic textbook may be necessary, first of all, to adapt it to a specific curriculum that takes into account the specifics of the discipline studied at this university, the possibilities of the material and technical base, the personal experience of the teacher, the current state of science, the basic level of preparation of students, the amount of hours, allocated for the study of the discipline, etc.

It should be noted that the electronic textbook should not simply repeat printed editions, but should use all modern achievements of computer technologies.

An electronic textbook is necessary for independent work during face-to-face and, especially, distance learning, because it facilitates the understanding of the material studied due to methods of presenting the material other than in printed educational literature:

— inductive approach, impact on auditory and emotional memory, etc.;
— allows adaptation in accordance with the needs of the listener, the level of his training, intellectual capabilities and ambitions;
— frees you from cumbersome calculations and transformations, allowing you to focus on the essence of the subject, consider more examples and solve more problems;
— provides the widest opportunities for self-checking at all stages of work;
— provides an opportunity to carefully prepare the work and submit it in the form of a file or printout;
— performs the role of an endlessly patient mentor, providing an almost unlimited number of explanations, repetitions, tips, etc.

An electronic textbook is necessary for the student, because without it he cannot get solid and comprehensive knowledge and skills in this discipline.

The electronic textbook is useful in practical classes in specialized classrooms because it:
— allows you to use computer support to solve a larger number of tasks, frees up time for the analysis of the obtained solutions and their graphic interpretation;
— allows the teacher to conduct classes in the form of independent work on computers, retaining the role of manager and consultant;
— allows the teacher to quickly and effectively control the students’ knowledge with the help of a computer, to set the content and level of difficulty of the test.

The electronic textbook is convenient for the teacher because it allows you to bring to lectures and practical classes the material at your own discretion, perhaps smaller in volume, but the most significant in content, leaving for independent work with it what turned out to be outside the framework of classroom classes, as well as:
— frees from tedious checking of individual tasks, typical calculations and control works, transferring this work to the computer;
— allows you to optimize the ratio of the number and content of examples and tasks that are considered in the classroom and assigned at home;
— allows you to individualize work with students, especially in the part related to homework and control measures.

Speaking about the control and systematization of the results of the innovative activities of graduate students, one cannot help but dwell on the regular reports, abstracts and reports that they prepare. During the implementation of such projects, there is an active process of consolidating scientific achievements, systematizing the knowledge obtained during the study of scientific literature and reference manuals, conclusions are drawn about the need to adjust the directions of experimental activity, new means of informatization of education are used more effectively.
One of the examples of Ukraine’s involvement in the processes of globalization of education and science is its participation in the Bologna process, which from a separate political process aimed at improving the quality of training and mobility of qualified personnel in the European Union, became the basis for reforming the professional education system in Ukraine and other countries of the world. The Bologna Accords consider postgraduate studies (doctorates in the terminology of Western education) as the third degree of education, which must also build its work taking into account its basic principles. In addition to the European Union, the United States and countries of Anglo-Saxon culture, which accumulate more and more young researchers, exert a powerful influence on the development of university research.

Thus, Ukraine faces the influence of new global trends in the field of training of research specialists. Therefore, for the introduction of appropriate approaches to the use of information technologies in postgraduate studies, the experience of informatization of the training of future scientists, available in other countries, can be useful.

In general, the world has developed three main models of organizing the scientific and pedagogical life of a university, which differ in their priorities and attitudes regarding the role of science and education in their activities.

The German model envisages a merger of teaching and research in universities. The French model prefers to separate these two functions, leaving mainly pedagogical tasks to the university. The third, “Atlantic”, British model is a combination of the first two, borrowing different experiences and traditions.

The French model is currently experiencing a deep crisis.

Two other types of organization of academic life, which were embodied in continental Europe, over the last 50 years have significantly evolved towards compromise solutions. The experience of countries — economic leaders shows that the leading role in the transition to an innovative economy belongs to universities, since the main components of success are concentrated here: training of highly qualified specialists; scientific and technical ideas and developments; opportunities to solve interdisciplinary problems.

At the top of the pyramid of the educational system of developed countries are universities of a special type, which have recently come to be called innovative universities, which do the most for the development of science, the invention of new technologies and the development of new markets and industries.
Doctoral students play a significant role in collaboration between universities and industry. Doctoral students perform three key functions in this collaboration:
— first, they act as producers of new knowledge within the framework of scientific creativity and the system of developing innovations and technologies;
— secondly, they contribute to the spread of knowledge in the wider social environment;
— thirdly, it is a connecting link in the configuration of partnership networks between universities and commercial enterprises.

Doctoral training allows a research specialist to acquire skills in critical thinking, scientific communication, and organization of research, which he can implement in those areas of activity where he continues his professional development. Doctoral students of universities create the infrastructure of innovation as a set of human and social capital within the framework of the organizations in which they conduct their activities. Thus, the training of researchers in higher education fulfills important functions of creating communities and social networks composed of people who are able to create new knowledge, perceive it and translate it into technologies that serve the public good and economic growth.

Distance learning in doctoral studies has become widespread in the USA. In Europe, universities in only a few countries, such as Great Britain, Spain, Cyprus, Switzerland, have online doctoral education programs.

According to the “Guide to Online Schools” collection, 274 accredited universities or their divisions offer online education in various subject areas aimed at further obtaining PhD degrees in the USA [21]. A total of 1,425 online doctoral programs are offered by American universities. The most popular distance learning programs are in the field of business (120 programs) and leadership (118 programs). They are offered by 14 and 52 American educational organizations, respectively. Physiology programs are also popular: 95 online PhD training programs are offered by 15 educational organizations. Doctoral programs in pedagogy (about 458 programs) are offered by 122 educational organizations.

These factors indicate a clear expansion of the scope of application of information technologies during the training of graduate students. In addition to the traditional use of computer technology in conducting research and processing the results of their experimental parts, informatization tools become an integral component of the system of educational tools in graduate school. In combination with new organizational approaches to the training
of graduate students, informatization will have the corresponding effect and contribute to the growth of the number of highly effective scientific personnel.

It should not be forgotten that the scientific and closely related innovative work of graduate students is a connecting link between a higher education institution and socially useful professional activity, and its main goal is to consolidate theoretical knowledge and acquire skills in their practical application, to form the creative and innovative potential of future scientists, involving them in the use of advanced information technologies. Important for the development of such innovative work is the possibility of integration of all types of activities performed by graduate students: pedagogical, research and innovative against the background of widespread informatization of education.

Regarding the informatization of research conducted by graduate students, it should be noted that information technologies play a key role in the process of accumulation, dissemination and effective use of new knowledge (Fig. 5.2). Today, the traditional methods of information support for research, which consisted mostly in the computerization of mathematical calculations, the use of statistical modeling methods and the distribution of scientific and technical information through telecommunication networks, no longer satisfy scientists. They are being replaced by new methods based on the use of rapidly advancing capabilities of informatics and promising information technologies.

![Fig. 5.2. Tasks of informatization of scientific and research activity](image-url)
Clear examples can be teleconferences, distributed scientific teams united by a common information and telecommunications network, and even methods of complex information modeling of complex natural processes and phenomena; artificial intelligence methods that allow finding solutions to poorly formalized tasks, as well as tasks with incomplete information and vague initial data; methods of cognitive computer graphics, which allow to present various mathematical formulas and ratios etc. on the computer screen in a spatial form.

For the successful planned development and introduction of new information technologies in higher education, fundamental development of the scientific foundations of new information technologies is necessary for the following problems:

- systematic analysis of the development and implementation of new information technologies, timely clarification of selected priority directions, forecasting and prevention of possible negative trends;
- development of new principles of organization of computing processes, methods of presentation, processing and assimilation of data and knowledge;
- development of methods of description of subject areas and mathematical modeling;
- design and use of new information technology tools (interactive audio and video tools, computer and telecommunication environments).

The purpose of informatization of research activities is to accelerate the acquisition and deepening of scientific knowledge about phenomena and regularities in nature, technology and society due to the use of new information technologies at all stages of scientific work.

For this, it is necessary, in particular, to ensure the following tasks are solved:

- conducting research in fundamental fields that determine the methodological base of new information technologies in research;
- conducting research on the use of promising hardware and software tools;
- providing access to data banks and knowledge bases of leading scientific centers in the field of higher education of Ukraine and foreign countries using telecommunications;
- organization of profiled scientific and educational centers for the informatization of research, retraining of specialists taking into account these centers.

As mentioned, today the e-science paradigm dominates the world. Its characteristic features are as follows:
– automated registration and accumulation of observation and experiment data on electronic media;
– extensive use of computer resources and numerical methods for modeling phenomena, including the use of distributed computing environments;
– wide use of automated data processing and analysis methods to identify patterns and gain new knowledge;
– use of global networks (Internet) for exchange of research results, scientific communication, access to accumulated scientific results;
– cooperation of scientists and scientific resources in conducting research at different levels [22].

Carrying out research in such conditions requires the pooling of resources of the entire scientific community at various levels (institutions, states, international collaborations), the distribution of the entire volume of research between individual scientists and scientific teams, and the intensive exchange of research results. For this purpose, both in individual countries and in the whole world, appropriate infrastructures are being created that are able to ensure the rapid movement of both primary and processed data, as well as intensive scientific communication, based on the use of global networks and WEB technologies.

The transition to a new paradigm requires a corresponding restructuring of the material and organizational base of research, the mastering by each scientist of new methods of performing research, scientific communication and interaction in the scientific process.

The status of the National Academy of Sciences of Ukraine as the highest state scientific organization assumes its leading role in the organization and coordination of fundamental research, the implementation of scientific forecasting and expert assessment of the development of the economy, society, science and technology, active participation in the formation and implementation of state scientific and scientific and technical policy [23].

For the National Academy of Sciences of Ukraine, constant scientific and technological updating of the processes of informatization of the entire cycle of scientific activity — from scientific search and planning of scientific developments to the innovative implementation of results is vital. The strategic goal on this path is to support and develop the information infrastructure of the National Academy of Sciences of Ukraine with the connection of its institutions to national and international research and educational telecommunication networks.

For this purpose, a target program of the NAS of Ukraine was launched in 2004 — “The Informatization Program of the NAS of Ukraine” for the
managed transition to a new paradigm, the creation of an appropriate technical base, information resources and software tools, and the implementation of the results in the everyday practice of the Academy.

To ensure a purposeful and controlled process of building, developing and supporting the information infrastructure of the NAS of Ukraine, the Institute of Software Systems of the NAS of Ukraine developed the Concept of the Informatization Program of the NAS of Ukraine, which was constantly refined and supplemented during the entire period of its operation. According to the concept, the goal of the Program is the wide implementation of new information technologies (NIT) in the scientific, scientific organizational and economic activities of scientific institutions and organizations, the Presidium of the National Academy of Sciences of Ukraine, increasing the productivity, quality and efficiency of research.

The problem of informatization of actual research is multifaceted, and its solution requires significant progress in the field of computer technology, programming, artificial intelligence, etc.

The specificity of the process of research requires a combination of computing and information resources of scientific communities and their joint use. Carrying out numerical theoretical calculations, processing the results of experiments requires enormous capacities, beyond the reach of a single scientist and even a separate scientific institution. At the same time, the load on computing power in the process of research is rather uneven. During the period of experiments, it is large, but the processes of analysis and preparation of results do not require such huge capacities. The combination of resources and their joint use allows to smooth out the unevenness of the resource load.

Back in 2009, implementation of the State target scientific and technical program “Implementation and application of grid technologies for 2009–2013” began and the Ukrainian National Grid was built [24]. The main achievement of the implementation of the programs is the creation of the Ukrainian national grid-infrastructure of the production type, integrated into the European grid-infrastructure, which unites more than 22 thousand researchers from all over the world. This provided the necessary services for Ukrainian scientists to conduct world-class digital research both independently and in collaboration with scientists from other countries.

Currently, higher education institutions are implementing an updated development strategy, which involves focusing on the formation of the student’s creative personality, development of non-standard thinking, freedom of choice, needs and readiness for innovative activities in the conditions of
informatization. In the set of means that ensure the solution of these tasks, a special role belongs to the accounting and analysis not only of the experience of modern higher education, but also of the positive historical experience of post-graduate studies and the activities of outstanding scientists and teachers. The need to study the experience accumulated by mankind is fully related to the process of training graduate students and to their integration of pedagogical, innovative and activities.

Graduate students in their activities need not only to rely on positive domestic and foreign experience, but also to look for their own ways of solving the problems facing the theory and practice of education, while realizing the relationship of educational, research and innovative components in the conditions of informatization of education. Analysis and characterization of the structure of pedagogical, research, and innovative activities of graduate students show that the optimality of the integration of these three main areas of training depends on various factors, such as specialty, age and year of study, general and pedagogical work experience, ability to use computer equipment in professional activity.

An important factor influencing the success of innovative activities of graduate students is the necessary level of professionalism in both teaching and research activities. It is formed in future scientists during training at a higher education institution in the conditions of independent practical activity, which is directed by a scientific supervisor when using information and telecommunication technologies. Moreover, the foundations of scientific, innovative and pedagogical creativity should be laid within the walls of the institution of higher education and serve as the main indicator of the quality of training of graduate students. An obvious conclusion is the desirability of increasing the share of post-graduate students who are professionally proficient in both pedagogical, research, and innovative aspects of activity in the context of informatization. Informatization of education and the correct application of appropriate technologies and tools can be considered as a significant factor in the integration of such activities.

The role of independent work in postgraduate studies in modern conditions tends to grow, based on the requirements for highly qualified specialists, where great importance is attached to the ability to navigate independently in the rapid flow of information and the need for constant improvement of professional growth and self-improvement.

One of the most revolutionary achievements of the last decades, which significantly influenced the educational process all over the world, was the creation of the worldwide computer network Internet. This factor led to new
requirements for the technical equipment of educational institutions, their access to global information resources, and on the other hand, gave a powerful impetus to the development of the content of the teacher’s activity, the use of new types, methods and forms of education, oriented to the active cognitive activity of graduate students. The Internet develops skills related to mental operations: analysis, synthesis, abstraction, comparison, juxtaposition, verbal and semantic prediction and prediction, etc.

The use of new information technologies in graduate studies is due to both the desire for novelty and the opportunity to implement a personally oriented approach to graduate students, which is the main conceptual direction of education in the 21st century, and provides individualization and differentiation of training taking into account the abilities of the students, their level of education, inclinations, etc.

Today’s priority in the education of future doctors of philosophy is to focus on the formation of communicative competence, the rest of all goals (educational, upbringional, developmental) are realized in the process of implementing this main goal. Communicative dominant in education presents serious requirements for the content and forms of organization of the educational process. The communicative approach in its modern understanding implies learning to communicate and forming the ability for intercultural interaction, which is the basis of the functioning of the Internet.

The ability to learn is a by-product of any educational activity. The formation of self-learning skills (that is, the acquisition of the ability to learn) is an integral part of all educational goals. Therefore, the problem of formation of educational competence in graduate students in the process of their independent work is very relevant today.

In addition to communication needs, graduate students need to master the methodology of working on the Internet to be more responsible for their own learning.

The main task of information and communication technologies in the educational process is to develop in graduate students new cognitive capabilities necessary for people living in the age of digital technologies, to provide an opportunity for self-education to students with different strategies in learning.

The training of graduate students should be carried out taking into account many factors of their pedagogical, scientific and innovative activities with a focus on increasing the efficiency of teachers and scientists working in a higher education institution, as well as based on numerous aspects, trends and advantages of informatization of education. At the same time,
innovations, their creation and promotion in combination with informatization can be considered as a basis for the desired integration, academical, educational and research work of graduate students (Fig. 5.3).

Undoubtedly, the development of the Internet became an objective condition for the actualization of the concept of electronic management of an educational institution.

Electronic management of an educational institution is based on the possibilities of information and telecommunication technologies and the values of an open society, characterized by a focus on the needs of the learner, economic efficiency, openness to control and initiative. As one of the consequences, it will ensure a new organization of the activities of the administrative divisions of the educational institution and a change in the entire complex of relations between the administration and students and teachers.

The principles of this type of management imply that the student, teacher and employee of the institution receive a real opportunity to access information or submit information in the shortest possible time, in an optimally convenient mode and in comfortable conditions. At the same time, financial management, personnel management, optimization of its distribution and use, management of training programs, schedule, etc. are simplified and made transparent.
In order to transition to full electronic control of the tower, a number of tasks should be solved. Including:

– creation of higher education management websites, their regular updating with the publication of basic information on key topics of higher education institution development;

– organization of interactive interaction of the higher education administration with higher education applicants, graduate students and employers. This includes, for example, providing electronic access to various document forms required by higher education applicants and employers, or searching for vacancies based on user-defined criteria;

– creation of an Internet portal with a wide range of higher education services (submission of documents for admission to a higher education institution, obtaining diplomas of higher education, exchange of lost documents, financial transactions by students, etc. in electronic form). At this stage, one of the main problems is ensuring the safety of working with official documentation and information.

These tasks have either already been partially solved, or are being partially solved today by the leadership of higher education institutions, or are considered as close prospects.

The development of interactive services and servers for students and employers should be a new concept for the websites of higher education institutions.

Among the program activities carried out within the framework of the concept of electronic management of a higher education institution, projects aimed at organizing administrative relations within it and improving interaction between the higher education institution and the student of higher education can be implemented.

Constant access to information about his success, which the student of education can obtain through the “Electronic Dean’s Office”, forms in him a sense of responsibility for the results of his studies. Thus, the introduction of IT forms a new concept of the relationship between the university and the student of higher education in a competitive educational environment and ensures a shift in emphasis in the organization of professional training for teaching an academic discipline for the active educational activity of the student, which involves the use of effective educational technologies, the ability of the student to independently assess the success or failure of his studies, to make corrections in time.

Today, the following educational models using IT are being implemented in the domestic system of higher education:
– independent activity of students: case technology and Internet technology (independent study of printed/electronic textbooks and manuals, completion of tasks, passing of self-tests);
– student interaction: Internet/Intranet technology (discussions and joint projects through computer conferences, audio and video conferences), chat, forum, audio and video communication programs;
– a model based on the teacher’s pedagogical activity: telecommunication technology (video lectures and video conferences);
– a model of the context of the student’s professional activity: any of the listed technologies (trainings, practical tasks, exercises, specific situations).

Today, the electronic space of the higher education institution opens up new opportunities for subjects of education: on the one hand, in remote access to get acquainted with the material and technical base and equipment of the educational process, on the other hand, to literally look into each classroom and laboratory, to understand where the student will “bite” granite of science.

It is intended to create the full effect of being present at the class both in the off-line and online mode, so that the user can not only fully feel the effect of being present at the class, but also repeatedly return to the material from one or another discipline, receive for personal use lecture content with both video signal and multimedia presentations, etc., and download the audio signal of the lecture for listening on iPode.

A single informational and educational space of a higher education institution can and should be built by ensuring high interactivity of the educational process, a uniform learning pace, and timely feedback.

The principle of interactivity is implemented through the joint activity of all participants of the educational process, as well as the interactive form of presentation of educational and methodical material. The principle of a single pace of learning allows to organize effective interaction of those who study with each other during the educational process. Consistency between the individual learning trajectories of individual students and the trajectories of a study group or discussion group gives students the opportunity to simultaneously participate in virtual discussions, carry out joint projects and carry out other types of educational activities. Implementation of the principle of timely feedback helps to strengthen the listener’s motivation. In the system of traditional education, help to the student from the teacher’s side is always late. The educational process within the framework of the analyzed model can be organized in such a way as to ensure timely feedback between the teacher (methodologist) and the student, and this allows
him to be provided with timely psychological-pedagogical and technical support.

For this, there is no need to create special educational computer networks. Already existing ones can be used, in particular the Internet and services provided by the servers included in it. Such programs can be used for lecturing and conducting practical classes, similar in form to traditional ones. They allow you to organize a virtual educational session that exactly repeats the traditional one, but expands the audience of students quantitatively and spatially.

In such an educational model, it is possible to organize:

– the work of a teacher and a student with common applications and a common desktop;
– joint study of educational material by all students at the same time;
– teacher consultations in any of the permissible forms of interaction — text, audio or video;
– communication and interaction between students;
– transfer of files containing software, educational material or assignments.

A methodical solution to the problem of organizing independent search for information will be the creation of electronic workshops (electronic workplaces), which have a self-accumulating database of tasks and are used in the training of trainees in all specialties. For this, a software environment is organized, where a database works like a social network with a convenient interface that looks like an employee’s workplace (desk, computer, webcam, calculator, pen, task and report sheets, etc.).

Performing tasks within the electronic workshop allows:

– to create conditions for the implementation of interdisciplinary connections in education;
– use the knowledge and skills acquired in the process of studying the basics of science;
– integrate knowledge from different blocks;
– to understand the role of knowledge in practical activities.

The interdisciplinary nature of the final result consists of step-by-step results achieved by individual interested groups of listeners — technologists, mechanics, automatists, specialists in the field of information technology, etc. The duration of the project is determined by the educational schedule.

The cyclical nature of actions related to the performance of tasks can be traced at the micro- (separate group of students within the specialty) and macro- (group of students within the same course, faculty/faculties, institute/institutes) levels. The cycle includes:
– definition of the topic;
– independent performance by the trainee and/or trainees of their part of the task;
– preparation of an intermediate product in accordance with the assigned task (programs, economic justification, business plan, etc.);
– creation of the final product;
– presentation of the received product;
– analysis of the work done.

Having completed a full cycle of work at the micro-level, the group passes the finished product to the next group. And the cycle repeats again. The procedure for working on the task and at the macro level is generally the same.

The main time of work on the task is allocated to the students’ independent work with the involvement of various resources.

The effectiveness of the implementation of this stage depends on the availability of “excess information resources”, such as modern technical means. As methodical support of the process, electronic educational and methodical complexes are used, which include electronic textbooks and video courses located in the electronic library of the higher education institution. A hardware and software complex is used for their development.

At the final stage of the task, the final product is presented, which is evaluated by teachers of various departments.

Thus, forming a self-filling database of tasks from one discipline of any cycle, using interdisciplinary connections and practical work of students, the departments form a common data bank of self-filling tasks for training in the specialty in general.

Created virtual workplaces with real practical tasks with proper and profitable interaction with partner companies (employers) can give students of higher education not only practical work experience, but also real earnings.

This approach to the organization of the training of future specialists in the higher education system has reason to be in demand for the reason that such an approach involves a change in teaching technology, focuses on the “modularity” of the educational process, on solving the problem of interdisciplinary “disconnection” and moving from knowledge with a separate discipline to the professional competencies of the future specialist.
5.5. CONCLUSIONS

1. The priority task of training applicants of the third educational and scientific level of higher education is the informatization of the educational space during graduate studies.

2. A fundamentally important characteristic of the current stage of the development of science is its informatization.

   The main goal of informatization of the institution of higher education is the creation of a single informational and educational space in it.

3. The process of informatization of society includes mediatization, computerization, and intellectualization.

4. The Government of Ukraine has legislatively approved the task of informatization of society, thereby confirming the relevance of the issue.

5. Among the scientific developments in open print on the issue of integration of educational and scientific activities of graduate students, the question of the impact of informatization on this process is little researched.

6. In the national doctrine of the development of the education system, the determining factor of the effectiveness of its informatization is the ability of teachers to carry out professional activities using information and telecommunication technologies.

7. The development and informatization of science and education require universities to constantly adjust the methods of training graduate students, taking into account new progressive methods of teaching and research.

8. Educators-researchers prone to innovation find it easier to introduce the results of modern research into the educational process and effectively use modern information technologies.

9. It is useful to increase the attention of graduate students to the fact that computer equipment and information technologies contribute to the automation and intensification of research.

10. In addition to information technologies, it is important to introduce service technologies (electronic textbook, multimedia, expert systems, publishing systems, etc.) in universities.

11. The electronic textbook serves for individual and individualized training.

12. The implementation of the e-science paradigm requires the pooling of resources of the entire scientific community at different levels, the distribution of the entire volume of research between individual scientists and scientific teams, and the intensive exchange of research results.
13. The specificity of the process of research requires a combination of computing and information resources of scientific communities and their joint use.

14. The introduction of electronic management of a higher education institution will ensure a new organization of the activities of its administrative units and a change in the entire complex of relations between the administration and students and teachers.

15. A single informational and educational space of a higher education institution can and should be built by ensuring high interactivity of the educational process, a uniform learning pace, and timely feedback.

16. A methodical solution to the problem of organizing an independent search for information can be the creation of electronic electronic workplaces that have a self-accumulating database of tasks and are used in the training of students of all higher education specialties.

17. Informatization should become an essential factor in the integration of scientific and educational work of graduate students.

5.6. REFERENCES


