IMPACT OF HIGHER EDUCATION DIGITALIZATION ON STUDENTS' CAPACITY FOR EDUCATIONAL SELF-ANALYSIS IN ELECTRONIC ENVIRONMENTS

IMPACTO DE LA DIGITALIZACIÓN DE LAS INSTITUCIONES DE EDUCACIÓN SUPERIOR EN LA CAPACIDAD DE LOS ESTUDIANTES PARA REALIZAR AUTOANÁLISIS EDUCATIVO EN ENTORNOS ELECTRÓNICOS

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ABSTRACT

This article defines the main scientific approaches to organizing educational activities in a university's information educational environment. It summarizes the experience and identifies the specific features of managing student educational activities in information educational environments. A methodology for organizing independent student work in a university's information educational environment is developed. Conditions for improving the effectiveness of student learning through the use of innovative information technologies are substantiated.

The methodological basis of the study was formed by philosophical propositions on objective trends in the development of society and science, the relationship between content and form, and the hierarchical and functional nature of systems; concepts of personal development in the educational environment and the formation of personal experience as a system of relationships; activity-based, systemic approaches to the analysis of pedagogical objects and phenomena; and the ideas of the holistic, systematic, and fundamental nature of education.

Keywords:

Higher education, students, information technologies.

RESUMEN

Este artículo define los principales enfoques científicos para la organización de las actividades educativas en el entorno educativo informacional de una universidad. Se resume la experiencia existente y se identifican las características específicas de la gestión de las actividades educativas de los estudiantes en entornos educativos informacionales. Se desarrolla una metodología para la organización del trabajo independiente de los estudiantes en el entorno educativo informacional universitario. Se fundamentan las condiciones para mejorar la efectividad del aprendizaje estudiantil mediante el uso de tecnologías de información innovadoras. La base metodológica del estudio se formó a partir de proposiciones filosóficas sobre las tendencias objetivas en el desarrollo de la sociedad y la ciencia, la relación entre contenido y forma, y la naturaleza jerárquica y funcional de los sistemas; los conceptos de desarrollo personal en el entorno educativo y la formación de la experiencia personal como un sistema de relaciones; enfoques basados en la actividad

y sistémicos para el análisis de objetos y fenómenos pedagógicos; y las ideas sobre la naturaleza holística, sistemática y fundamental de la educación.

Palabras clave:

Educación superior, estudiantes, tecnologías de la información.

INTRODUCTION

he modern education system, both at the institutional level and as an integrated social system, can be conceptualized as an information-rich educational environment that possesses vast potential for the transmission, reception, and transformation of knowledge. This informational educational environment not only stores and disseminates content but also provides a structured framework within which students actively construct personal knowledge, develop critical thinking skills, and acquire competencies essential for both professional and personal growth (Acosta et al., 2025; Pellini & Bredenberg, 2015).

The transformation of information into meaningful personal knowledge demands deliberate effort, reflective practice, and the acquisition of specialized cognitive and technical skills, which are cultivated through carefully organized learning activities supported by advanced educational technologies (Chávez et al., 2025; Gioffre, 2017).

Pedagogical technologies achieve optimal efficacy when integrated within well-designed didactic information environments. This requires the careful selection and systematic integration of core components—such as digital content, instructional resources, software platforms, and interactive tools—to maximize the educational potential of these environments. Empirical experience, however, suggests that the optimal composition and functional integration of these components remain underdeveloped, which may restrict the effectiveness of student learning processes in electronic educational settings.

Current research has explored aspects of this phenomenon, including the creation of innovative educational resources (Gioffre, 2017; Pellini & Bredenberg, 2015), the application of network-based educational and methodological complexes in universities (Batagan et al., 2011), and the operational dynamics of information-didactic environments (Lunenburg & Ornstein, 2012; Stevens, 2013). These studies collectively (Littlejohn et al., 2016; Iasechko & Iasechko, 2024) underscore the transformative potential of digitalization while also highlighting gaps in the systematic organization of students' independent learning activities, particularly in specialized disciplines such as military engineering education.

Currently, the integration of information-based educational environments is characterized by multiple contradictions. There exists a gap between the inherent technological potential of digital tools and their actual utilization by students; a tension between traditional educational methodologies and innovative digital technologies; and a challenge in aligning digitally mediated learning activities with established educational management practices.

Furthermore, discrepancies are evident between the theoretical sophistication of new information technologies and the degree of their educational and methodological support. Such contradictions impede the development of students' capacity for reflective practice and educational self-analysis, which are crucial for fostering autonomy, critical thinking, and self-regulated learning. Addressing these challenges is essential to enable students to transform digital information into actionable knowledge and to fully engage in the educational process.

The necessity of exploring this topic provides the rationale for the present study. Its primary objective is to scientifically substantiate the conditions for enhancing the effectiveness of student learning activities within information-based educational environments. The object of the study is the university's digital educational environment, while the subject is the structured organization of students' learning activities in such contexts (Jasechko & Iasechko, 2024; Pellini & Bredenberg, 2015).

By examining the interplay between digital technologies, pedagogical design, and student learning processes, this research aims to contribute to the understanding of how higher education digitalization can strengthen students' reflective capacities, information literacy, and self-directed learning skills, ultimately bridging the gap between technological potential and educational practice (Batagan et al., 2011; Gioffre, 2017).

METHODOLOGY

The study's hypothesis was that students' learning activities would be more effective if the following conditions were met:

- the educational information environment is designed based on the principle of modularity;

- the educational process utilizes a networked educational and methodological complex as a software and information component;

- elements of learning technology are integrated into the educational information and subject environment;

- students' independent work is prioritized in the learning process.

The methodological basis of the study was formed by: philosophical ideas about the connection between theory and practice, the universal connection between phenomena and processes; concepts of the formation and development of personality; ideas of the humanization of education.

To achieve the stated goal and objectives of the study, the following methods were used:

– Theoretical: analysis of scientific literature (philosophical, pedagogical, psychological, sociological, etc.), logical methods of concept analysis (interpretation, comparison, operational definition, generalization, specification, idealization, and extrapolation), purposeful design, and modeling;

– Empirical: expert assessment, observation, survey, pedagogical experiment (ascertaining, formative, and control stages), interpretive method, statistical and mathematical analysis of the results of experimental work.

The theoretical basis of the study is based on theories of personality-activity and personality-oriented approaches; general learning theory, theories of educational informatization, computer-based didactics, and modern psychological and pedagogical research on the development of a professionally oriented personality in educational systems.

The theoretical foundations for organizing learning activities in a university's information educational environment analyze the information educational environment as an object of pedagogical research, describe the essential characteristics of learning activities in an information educational environment, and identify the specific features of organizing the learning process based on information technology and the specifics of managing learning activities (Bray, 2007).

In a broad sense, «environment» is the set of conditions that ensure the development, socialization, and education of a person. The learning and educational environment refers to the functioning of a specific educational institution or several institutions of the same type (for example, military educational institutions). In this case, the learning and educational environment comprises a set of material and spatial-subject factors, social and moral-psychological components, and information technology resources (Guasch et al., 2012).

The information environment is a part of the information space, the information environment closest to the individual, and the set of conditions in which their activities occur. The type of this activity determines the nature of the information environment: if the activity is educational, then the environment is informational and educational.

Learning activities take place within the educational information environment of a discipline (subject). This information environment requires special measures for its creation, organization, and management.

The study of the information educational environment as an object of scientific knowledge allows us to identify the following areas of relevance to pedagogical science: substantiation of a set of psychological and pedagogical conditions, factors ensuring learning and personal development; identification and substantiation of methods for organizing, structuring, and developing the educational environment; study of the specific features of organizing educational activities in the information educational environment, the role of software and methodological complexes used in the educational process for the purpose of its optimization; search for ways, techniques, and means of integrating traditional and information technologies of teaching; methods and means of designing information educational environments in vocational schools.

The information educational environment, including didactic, psychological, pedagogical, communicative, logistical support for the educational process, is designed based on the principle of modularity, which presupposes the organization of curricula through modules belonging to a single field of subject activity. Each module, in turn, has a general structure: an educational goal (target program), an information bank; Methodological support, technological tools for developing necessary competencies, correction, self-assessment, and assessment of the degree of competency development. A significant advantage of modular learning is that it allows each student to independently (or with the «soft» support of the teacher) achieve specific educational and cognitive goals (Leighton & Griffioen, 2023).

There are two approaches to organizing learning activities in an information-based educational environment: pedagogical and information-based.

The pedagogical approach is based on the need to implement various didactic goals in the educational process (the nature of the presentation of the surrounding reality, the organization of various types of educational and cognitive activities, the implementation of motivational, educational, and control-corrective functions, etc.). The information-based approach, which involves a significant restructuring of educational technology, aims to create a unique learning environment in which, through the use of certain pedagogical technologies, the process of cognition and intellectual development occurs. The main idea of the information-based approach is that the computer is a tool for learning, an effective, universal,

and programmable teaching tool. The most constructive alternative, in our opinion, is the use of information-based pedagogical technology based on students' individual choice of an interactive mode of working with educational information and its consolidation in individual forms (Wolfe & Andrews, 2014).

Organizing educational activities in a computer environment creates conditions for autonomous, individual-cooperative, and collaborative activities and enables the achievement of the following goals: developing knowledge competence that meets personal and societal needs; achieving communicative competence; achieving systemic-activity competence—understanding the meaning of one's activities in a computer environment; creating a self-image as a person who controls a computer and uses it to solve personal problems; creating an internal image of the computer; defining one's attitude toward it; developing understanding of the computer education system and one's role in it.

The development of the environment is achieved, firstly, by increasing the volume and increasing the level of complexity of methodological support; secondly, by introducing information technologies that offer a rich set of tools for designing educational activities (e.g., presenting information in various forms with various graphic, sound, and video effects, the ability to simulate educational dialogue with a computer, business games, etc.). Modern multimedia systems offer significant potential, allowing any audiovisual information to be presented on a computer screen in an integrated manner, enabling interactive dialogue between the user and the system. The system also allows the user to select the desired development of the presented plot or situation based on an analysis of the user's actions (Balzer, 2020).

Educational computer programs typically offer two modes of learning: information and reference, and assessment and training. The first mode (information and reference), in combination with printed materials, audio, and video recordings, is actively used to expand and simplify access to educational material, to structure it conveniently and clearly, and to facilitate navigation. The assessment and training mode is widely used for both self-testing and for preliminary or midterm testing during distance learning. The principle of modularity is one of the fundamental principles in designing the content and structure of educational computer programs.

Organizing computer-based learning is possible in two ways. In the first case, the instructor provides emotional support without actively participating in the learning process; in the second case, they use the computer as an assistant—a technical teaching tool.

A particular feature of the introduction of new information technologies into engineering training is that they must be applied comprehensively, as a set of interconnected components: objects of study, learning tools, and engineering disciplines. It is also essential that the study of disciplines be continuous and consistent throughout students' education, taking into account the specific principles of organizing the educational and information environment. Furthermore, in addition to general education courses, computer science curricula should include applied courses focused on the subject area and professional environment of specialists (Alexander et al., 2019).

One of the most productive methods for integrating new information and traditional teaching methods and techniques is the project-based method. Its distinctive feature is its pragmatic focus on the result that can be achieved by solving a particular practically or theoretically significant problem. This result can be observed, understood, and applied in real-life practical activities. The project-based method facilitates a high level of collaborative student engagement in solving a problem proposed by the teacher or independently chosen by the student. The use of computer technology allows for the creation of telecommunications projects, which represents a fundamentally new learning technology.

Today, engineers are required to know not only the principles of working with programs and technical equipment, but also how to implement them in specific production environments. Therefore, it is important for students to master computer modeling techniques for individual components and devices, to study general design principles in depth, and to apply computer engineering methods in the practical application of computational and graphic design, to process experimental results, and to create information support for the educational process.

It is advisable to integrate information technology into the study of tactical, tactical-special, and specialized disciplines. The use of simulation models significantly improves the effectiveness of classes by simulating combat situations that cannot be achieved in real-life educational settings (Iasechko et al., 2021).

Therefore, at the current stage of addressing the issue of improving educational activities in the information environment of a military university, the idea of organizing the educational process with individualized learning and based on management models for the application of information technology in the educational process is relevant. An important task in improving the educational process at a military university is the development of technologies and requirements for modernizing automated university management systems (functional

subsystems, information and technical support), as well as modernizing telecommunications equipment that support the integration of information technology into departmental work.

Pedagogical Conditions for Improving the Effectiveness of students' Academic Performance in the Information Educational Environment of a Military University. This paper substantiates the technology for organizing students independent work, methodological support for academic work, and ways to enhance students academic performance in the university's information environment. The results of experimental work are analyzed.

Conditions that contribute to improving the effectiveness of independent work include: the availability of the necessary educational and methodological support, a system for monitoring the quality of independent work, a mobile feedback system (e.g., test assignments), and computer support.

Using a personal computer allows for interactive learning. During independent study, students can complete assessments, including tasks examined on a personal computer, with a graphical representation of the results obtained. During independent study (including under the guidance of an instructor), it is important to create conditions that allow students to master the necessary educational information in a short time and independently write a summary of a technical text. It is advisable to use test assignments in such classes.

Internet technologies offer significant opportunities for improving the effectiveness of independent learning. To fully realize these opportunities, knowledge and skills in using the internet, as well as specialized methods for preparing students for independent online work, are essential. As the educational environment becomes increasingly networked, a completely new type of educational material has emerged: Internet textbooks, which are applicable to traditional and distance learning, as well as independent work by university students. Combining these textbooks with testing and assessment programs, and with asymmetrical distance communication between instructor and students, leads to increased effectiveness of the learning process.

The main areas of methodological support for students educational work in the university's information environment are: enriching the database, database, and knowledge base; creating electronic learning systems; developing monitoring systems for the quality of the educational process; and developing active and interactive teaching and assessment methods. The university's educational and methodological structures experience the greatest difficulties in quickly identifying, understanding,

and implementing modern, innovative pedagogical technologies. The study revealed a number of shortcomings in the informatization of higher military schools: a lack of a methodology for implementing new information technologies; insufficient scientific and methodological support for the informatization of military professional education; insufficient effectiveness of modern information technology in the educational process; and a low degree of integration between the educational, methodological, and scientific structures of these universities in solving major information technology problems. New information technologies enable instructors to achieve didactic goals by using both specific types of educational work and any combination of them, that is, by designing a learning environment. Teacher-focused tools allow for the prompt updating of automated educational and assessment programs in accordance with new knowledge and technologies.

At the current stage of addressing the issue of improving educational activities in the information environment of a military university, the idea of organizing it with individualized learning and based on management models for the application of information technology in the educational process is relevant.

To organize educational activities in an information educational environment, it is advisable to use information and pedagogical technology based on students' individual choice of interactive mode of work with educational information, its study, and reinforcement in individual and group settings.

The effectiveness of students independent learning activities largely depends on the instructors' readiness to use educational computer programs in the educational process and their ability to competently and pedagogically appropriately use networked computer educational and methodological systems.

The effectiveness of independent work in the university's information didactic environment largely depends on students awareness of the important role of educational computer programs in optimizing their educational and cognitive activities.

The scientific results of the article are:

1. The use of new information technologies in the university educational environment requires consideration of the individual's information and didactic space. The need to manage academic work in an information educational environment alters the position and functions of the teacher (consulting, support, and mentoring become priorities);

2. The success of using information technologies as a means of organizing educational activities and managing the educational process depends on a number of factors:

a quantitative and qualitative assessment of information sources; the integration of traditional and information technologies for teaching; the choice of a design method for the educational environment; and consideration of software features consistent with the university's profile.

3. The most effective means of activating academic activity is increasing the role of independent work, which requires appropriate educational and methodological support: the establishment of a virtual laboratory, changing the role of the teacher, the integration of traditional and new information teaching and monitoring methods, and the enhancement of the functional potential of computer tools. These measures are implemented in the author's project for the use of computer tools, which includes teaching, monitoring, and developmental techniques and tools.

CONCLUSIONS

The scientific novelty of the study lies in identifying the specific features of organizing educational work in an information environment; in substantiating the methods of managing educational activities in the context of informatization of education (for the first time, the specifics of information sources, changes in the functions of a teacher, features of educational activities, software were determined, requirements for the design of an educational environment were systematized, forms of integration of special and information disciplines were developed); in substantiating the pedagogical conditions for increasing the effectiveness of educational activities (educational and methodological support, actualization of the role of independent work, organization of a virtual laboratory), as well as methods for expanding the functional potential of computer tools (use of a terminal service).

The theoretical significance of this study lies in its clarification and specification of the concepts of "information educational environment" and "information and educational space," its typology of software tools used in military engineering universities, its generalization of models of interaction between faculty and students in the information environment, and its systematization of requirements for the design of educational management technologies in the information environment.

The practical significance of this study lies in the development of a classroom design using a terminal service, as well as the development of methodological recommendations for instructors of specialized and natural science disciplines on the design of educational and methodological support for educational work in the information environment.

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