Factors and Didactic Characteristics that Determine the Information and Educational Environment of the University

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Abstract. The development of Informatization and the need to ensure the quality of education determine the relevance of research on the information and educational environment of the University. A departure from formalism in understanding the goals and objectives of education is possible only based on a combination of a set of paradigms. The environmental approach, combined with the system approach, is aimed at organizing such connections and relationships in the educational system that will contribute to improving the efficiency of its functioning. Activity-based, personality-oriented and competence-based approaches are the basis for the modernization of the educational environment in which the updating of the content, forms, and methods of communication and training is focused on the developing nature of modern higher education under the axiological approach. The information and educational environment for University students is a teleonomic open pedagogical system. The didactic characteristics of this environment, which are caused by the need to correlate external and internal assessments of the quality of education, include Informatization, intersubject, connectivity, heterogeneity, flexibility and manageability, and productivity of interaction between the components of the environment. The methodological system of training as the core of the information and educational environment, functions, is adjusted and developed under the macro- and micro-goals of training specialists in higher education. Under the methodological system of training students of engineering specialties in the subject of information educational environment of the University is understood as a set of components, leading of which are the subjects of teaching and learning, whose interaction is determined by the order covers didactic principles, contents, forms, methods of teaching, training and methodological support of educational process and enhances the effectiveness of training in the University. These didactic characteristics of the information and educational environment determine the emergence and expediency of the methodological system of teaching mechanics students.

Keywords: polyparadigm approach, quality and effectiveness of training, information and educational environment of the University, didactic characteristics, the methodological system of teaching.

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1 Introduction

Trends in the development of modern society determine the new challenges facing modern higher education. Among them is the integration of in-depth professional training with socio-cultural adaptation programs, the task of developing students' skills not only ineffectively solve professional problems but also to assess the role and significance of new ideas for the development of science and professional innovations. The changes in the development of science and its methodology are also reflected in higher education. It is especially true in the last decade, as the higher education system has become aware of the disparity between the increasing volume of scientific knowledge, requirements for the competencies of University graduates, and their training. To eliminate this disparity, we need new conditions and learning environments that involve purposeful, scientifically based implementation of the interrelationships of social, material, didactic, and communication conditions that increase the productivity of teaching and learning processes. In the context of the priority of the knowledge economy and Informatization, one of the tasks of training at the classical University is to increase the effectiveness of students' self-development skills, independent educational, cognitive, and research activities, and the ability to use information computer technologies in the process of applying fundamental knowledge to solving professionally-oriented tasks [1]. The concept of quality education is becoming more diverse. It is connected with consideration such problems as the socio-economic request for experts with particular qualifications and requirements of the labor market, society, and academic community [2], developed didactically-based scenarios assessment of personal achievements of the students [3], equipment of educational process of modern computer and technological equipment and the experience of its use in the educational process [4, 5].

It is necessary to pay attention to the difference between such concepts as «quality of education» and efficiency that are at first glance similar but essentially different. The difference between efficiency and other quality measures is detected in a triad outcome – costs (resources) – goals space. In the education system to the category of the result can be an expert, personality, quality of education, etc. The effectiveness of the learning process does not always make sense to determine based on the study of the achievability of the desired result concerning the minimum cost. It is more appropriate to consider the achievement of the expected outcome t with the allowable expenses: you can give a lecture on mathematics to 400-500 students at once, but how effective will its assimilation be? As a rule in an educational institution intermediate results of the educational process are recorded in the form of changes in the knowledge (cognitive-conceptual), operational (skills), and motivational-value spheres of the student's activity. These changes are detected using qualimetric monitoring, and the concept of the final result changes depending on the level of management, the scale of consideration of a particular system, the stage or level of its study. Naturally, the criterion of effectiveness as the outcome of the educational process changes over time. It depends upon the level of scale of the systems and processes under consideration, on the goals and tasks dictated by the social order.

The tasks of higher education in Belarus and the goals of the Belarusian State University correlate with the modern model of science development. The post-non-classical period of natural science is characterized by value orientations due to the" human-dimensional " nature of the study of self-developing systems as well as the integration of science, education, and production.

2 The Polyparadigm approach as the base of creation and functioning of the information and educational environment

The study of the educational environment due to its complexity, non-linearity of changes, and multi-vector of development require a revision of the research methodology 6]. Avoiding formalism in understanding the goals and objectives of education, creating conditions for the formation of the educational environment is possible only based on a combination of the main provisions of a set of paradigms – the Polyparadigm approach [7, 8].

The environmental approach allows us to move away from science-centrism in understanding the goals and objectives of education to the strategy of forming not only a didactic triad – professional knowledge, skills, and abilities, but also the experience of reflexive attitude to them and their transformation taking into account internal and socio-cultural requirements. Besides, orientation to the learning environment allows you to shift the focus in the teacher's activities from active pedagogical influence on the student's personality to the area of formation of the learning environment in which his training, self-learning, and self-development take place. The environmental and system approach are focused on the development of communications in education. The organization of such connections and relationships in the educational environment will contribute to improving the effectiveness of its functioning. The implementation of the system and environmental approaches are in the explore the socio-economic requirements, tendencies of development of education and science. There is the basis for establishing the factors and instructional characteristics that determine the nature and specificity of modern information and educational environment of the University as well as the relevant properties of the methodological system of training students for the improvement of learning efficiency.

Activity-based and competence-based approaches serve as the basis for building a system of goal-setting and goal-achievement of macro-and micro-goals of training, education, and development of students, and developing ways to manifest the selected properties of the methodological system in its components (goals, content, methods, forms, and means of training). Development and modernization of the subject and educational and methodological support of the educational environment in which updating the content, ways of combining forms and methods of communication and training are focused on the developing nature of modern higher education, and are implemented based on personality-oriented, interdisciplinary and axiological approaches.

The polyparadigm approach as a methodological basis for higher school didactics allows us to take into account the openness and non-linear nature of the educational

system's functioning since it is expressed in taking into account the prognostic and managerial aspects of its development. This involves the correlation of external and internal factors, the establishment of properties, principles, and didactic provisions of the organization of students' education in the context of the orientation of the subjects of the educational process to interaction and co-creation.

From the system analysis point of view, a system is a set of structurally interrelated and functionally interdependent elements. The system approach serves as a methodological basis and is the basis for solving real problems if its use provides for the complex application of deductive and inductive research methods [9]. The deductive method is necessary to determine which path of development of the situation may have or already has a place in the analyzed process and is expressed in establishing the characteristics of the system due to external factors such as the level of socio-economic development and society's needs, leading conceptual approaches to the development of education, the level of development of science, etc. The inductive method is necessary for the selection of relevant, appropriate technologies, methods, and forms of education that allow you to get the desired result – improving the efficiency of training students – most likely [8].

The large-scale development of computer technologies, for example, has not spared all sections of theoretical and applied mechanics. Almost all methods, computational methods, and approaches to teaching mechanics today require and are focused on their computer implementation and use based on updating the intersubject relations of computer science, mathematics and mechanics as a tool for integrating the fundamental and professionally-oriented components of the educational process. At the same time, the processes of Informatization and computerization in the modern information learning environment add new opportunities and advantages to it. Processes that were previously only the subject of mechanics are now studied within the framework of intersubject interactions of both natural science and the Humanities.

In this regard, the evolutionary paradigm of natural science development becomes an important methodological basis for research in the theory and teaching methods of mechanics students: knowledge of objects of modern mechanics not only requires traditional skills of analysis, problematization, identification of cause-and-effect relationships and the essence of processes but also requires the development of the experience of a value attitude to the world and is associated with humanistic ideas of personal development and self-development [10].

3 Factors and characteristics that determine the information and educational environment for students at the University

The mechanism to achieve a higher education is productive only if the components of information educational environment and learning system can dynamically adjust, as reacting to external factors, and such «internal» conditions, such as level of motivation and the initial academic training, logistical and methodological support of educational process, professional and scientific level of the cadre. With all the originality, uniqueness, and multiplicity of pedagogical systems, they are subject to the general

law of the organizational structure and functioning of the system as a process. At the same time, we can talk about the quality of education (the quality of a specialist) as a result of the functioning of the pedagogical system, we can only speak if its design and monitoring of effectiveness are based on the fact that the goals, functions, and means of achieving these goals are determined by the convergence of external and internal factors. From this position, we should consider the information and educational environment of students' learning.

Thus, the information and educational environment of student's training is a teleonomic, open construct, which is determined by a set of the following factors that are significant for the subjects of the educational process:

- content sources for the formation of academic, professional, meta-subject, and socio-personal competencies, which involve the purposeful actualization of intersubject relations between fundamental, and professionally-oriented disciplines;
- procedural possibilities for implementing the personality-oriented nature of professional and educational training based on a combination of subject-subject and subject-object active and interactive interaction;
- external (socio-economic, cultural, etc.) and internal influences and incentives for educational, cognitive, communicative, and research activity of students;
- conditions for students to gain experience of value-semantic attitude to educational, research, and professionally-oriented activities.

The fruitfulness of such an environment is ensured by the fact that the components of this environment meet the following didactic characteristics: informatization, connectivity, heterogeneity, flexibility and manageability, the productivity of interaction of the components of the environment [8].

The term «informatization» means the speed of searching for any data; the availability of materials and their prompt use for educational, research purposes, and in the preparation of publications; the ability to independently prepare and study educational materials; performing calculations with the function of modifying the conditions of the problem by replacing any parameter; ensuring the choice of educational trajectory, individual pace and time of mastering the material; building an open learning system that involves the integrated use and flexible variation of methods, forms, and means of learning. All of them, along with the opportunities to reduce the cost of research, project development, and training, as well as the transition from a disciplinary to a system model of education, constitute the advantages of the information and educational environment of a modern University.

Informatization and interdisciplinarity are expressed in the systematic actualization of the relationship between the content of teaching theoretical mechanics, continuum mechanics, and the tasks determined by the specifics of the future professional activity of students with the main provisions of fundamental mathematical Sciences and the use of computer technologies. Of particular importance are the applied aspects of vector geometry, algebra, differential, and integral calculus, which, subject to the integration of natural science knowledge, open up the possibility of expanding the range of physical effects studied.

Interdisciplinarity becomes one of the most important characteristics of the information and educational environment, since it is a pedagogical category that reflects

real processes, denotes the connections between objects studied by the Sciences, is reflected not only in the content but also in the forms and methods of organizing the learning process and contributes to the comprehensive implementation of educational, developmental and educational functions, acting as a tool for implementing the integration of theory and practice of learning [11].

In particular, a significant role in the organization of relationships between professionally-oriented and fundamental components of the educational process is played by intersubject links of the course «Theoretical mechanics»(as a basic course for training mechanics) and such educational disciplines as «Resistance of materials», «Robot Mechanics», «Biomechanics», «Computer mechanics».

In the activity aspect, it is especially important to develop students' skills to build and study mechanical and mathematical models of real processes. This implies not only a sufficient degree of mastery of the mathematical apparatus and methods of building models but also a certain level of independence in solving modeling problems.

At the same time, due to such individual differences as different levels of proficiency in mathematics, different rates of perception and assimilation of knowledge, the educational environment should provide opportunities to build individual educational trajectories for students. This implies following the principle of expediency and selectivity of using the capabilities of computer technologies per such didactic characteristics as connectivity, heterogeneity, flexibility, and manageability in the organization of the environment. Heterogeneity of the environment implies a variety of tools (organizational, subject, scientific and methodological, research, etc.) that it has. Connectivity, flexibility, and manageability are expressed on the one hand in providing subjects of the educational process with the choice of trajectories for the implementation of training on the other – consist in the orientation of all components of the environment to improve its efficiency.

It is necessary to consider that the introduction of any innovations and advances in scientific progress in the educational environment often leads to conflict, and therefore requires a special management effort involving flexibility (variability) and efficiency of interaction of the various components that define an environment. Following the provisions of management theory, unproductive, undesirable ways to resolve the conflict between innovation and tradition include expansion (innovation destroys tradition), annihilation (mutual destruction of tradition and innovation), inconsistency or duplication (as a synonym for infertility or the fact that innovation practically does not affect the effectiveness of the result). The large-scale development of computer technologies, for example, has not spared all sections of theoretical and applied mechanics. Almost all methods, computational methods, and approaches to teaching mechanics today require and are focused on their computer implementation and use based on the actualization of intersubject relations of computer science, mathematics, and mechanics as a tool for integrating fundamental and professionally-oriented components of the educational process. At the same time, the processes of Informatization and computerization in the modern information environment of learning add new opportunities and advantages to it.

4 Conclusions

Information and educational environment (IEE) of the University is a specially organized educational system of a teleonomic nature, aimed at students' acquisition of certain knowledge, skills, and experience of an emotional and value attitude to learning and self-development, as components of academic, professional, and socio-personal competencies within a particular specialty and in a particular educational institution.

The above-mentioned methodological grounds for improving the effectiveness of training mechanics students, as well as factors and didactic characteristics of the information and educational environment of the University cause the following properties of the methodical system as a tool to enhance student learning: the consistency of innovative and traditional approaches to organization of educational process; the contingency of aims, content, forms, methods and means of education from the standpoint of improving its effectiveness; the focus effect on indicators such as "information enrichment", developmental nature of learning content; focus on creation of conditions for development of activity of subjects of study, their learning and self-development; personal-oriented nature of training by enabling students to build their own trajectories and select computer-based learning tools in accordance with the effectiveness criteria: the ratio of software cost/task completion time/ quality of the resulting solution.

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