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PRINCIPLES OF EDUCATION THAT DEVELOP AN INNOVATIVE APPROACH TO ENGINEERING PROFESSIONAL ACTIVITIES

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Abstract: The main principles that develop the ability to innovate in professional engineering are the principles of integration, fundamental integrity and professional orientation. In turn, the preparation of students for innovative engineering careers in the process of higher education should be built on the basis of a purposeful, comprehensive program, and it should be focused on their future professional innovative activities.

Keywords: engineering, principles, integration, aggregation, decomposition, design, cluster, innovation, emergency.

INTRODUCTION.

From the point of view of logic, we can interpret the principles as generalizations of the theoretical cases that apply to all didactic phenomena. From a normative point of view, this is seen as a clear guideline in a sense for the practical pedagogical process.

Principles can replace the laws inherent in the didactics of higher education and form a methodological system that differs from axioms in specific disciplines. The principle of completeness in education can be satisfied only by the principles in conjunction with the rules of education. In other words, the principles of education are a system of basic requirements, through which the general educational tasks and the content, organization and methods of education in accordance with the laws of the educational process are understood.

The main principles that develop the ability to innovate in engineering are the principles of integration, fundamental integrity and professional orientation. We will try to analyze them in detail.

The principle of fundamental integrity and professional orientation. Whatever the goals of higher education, the most important of them is the professional training of a specialist with sufficient qualifications in accordance with the social order. Adapting to modern requirements is the readiness of a graduate of technical specialties for an innovative engineering career.

Thus, in the methodological system, which forms an innovative approach to the engineering professional activity, exactly two principles that prevail over other principles - the principles of fundamentalism and professional orientation - must be implemented simultaneously. Their interdependence and coherence have a positive impact on the task of preparing the future engineer for the innovative engineering professional activity [1].

The principle of professional orientation for higher education is the same as the principle of fundamentalism, and it has always been and remains relevant to the profession. There are several interpretations of this principle, according to which it reflects the following aspects of vocational education: vocational orientation of general education; as our country has chosen the path of innovative economic development - the vocational orientation of vocational education to address the challenges that provide it; professional orientation of an individual to a specific profession and his or her ability to pursue innovative engineering careers.

In turn, the preparation of students for innovative engineering careers in the process of higher education should be built on the basis of a purposeful, comprehensive program, which should be focused on their future professional innovative activities.

The pedagogical integration of the principles of fundamentalism and professional orientation is one of the manifestations of scientific integration, which is carried out within the framework of pedagogical theory and practice. The structure of such integration consists of: factors, levels, components, tools, the goal of integration and its results. According to them, there are three types of integration: internal content - knowledge and skills; interdisciplinary - knowledge with skills, knowledge with creative experience and innovation; external content - knowledge with organizational forms.

- The integration of the above principles of the methodological system into the development of innovative engineering skills is organized on the basis of all of the above:

- the internal content is realized through the unification of a block of general professional disciplines - lectures, individual assignments, research work of students - with the discovery of fundamental laws and scientific and technical theories in the form of synthesis, design, creation of appropriate engineering structures in conditions of innovative engineering; unloading;

- through the solution of interdisciplinary career-oriented professional tasks - through all forms of teaching and learning activities using active, problematic, developmental, innovative and other types of education;

- integration of external content - allows you to think about its integrity when designing a methodological system, about the need to implement the interdependence of general, special, optional disciplines when choosing content, methods, forms and means of teaching - based on the principles of fundamentalism and vocational guidance. carries out the selection of fundamental and professional material corresponding to the content [2, p. 73-75].

Integration principle. The principle of the integration of didactics is known in advance and is widely used in integrated education. The term integration itself comes from the Latin word integer, which means whole and whole - for restoration, creation, whole. In the pedagogical literature, there are many terms, such as "integration", "integrative", "integrated" and others, similar in content to this term. Then we will use the term “integrated” more.

As a rule, integration is the integration of the education system in a vertical projection - integrated education systems, within one subject in a horizontal projection, for example, the theory of machines and mechanisms, resistance of materials and machine parts - as the integration of generalized knowledge in applied mechanics or the use of various methods learning.].

The analyzed teaching principles, along with the principles of integration and integrity, fundamentalism and professional orientation, constitute a solution to the teacher's problem of forming an innovative approach to engineering and professional activity in students in the process of teaching general education subjects. They reflect the basic laws of the educational process, and the teacher as a whole by the methodological system in the process of his activities must adhere to these principles [4]. Preparation for innovation should be based on these principles.

It should be noted that this is of particular importance for the analysis and synthesis of complex systems based on the integration of engineering methods (decomposition, aggregation) and teaching methods (design, cluster), which are important from the point of view of our research. Decomposition-design is the separation of systems into parts, and then independent consideration of the individual parts.

It is clear that design decomposition is a concept directly related to this model, because the system itself cannot be broken without breaking the structure of features. At the modeling level, disproportionate relationships are replaced by mutually equivalent equivalents, or system models are structured in such a way that their division into separate parts becomes natural.

Decomposition design is one of the most effective tools for studying complex systems. Aggregation-cluster is the opposite of decomposition-design. In the course of the study, it is necessary to combine the elements of the system in order to consider them from more general positions. Decomposition-design and aggregation-cluster form two opposite sides for considering the complex systems used in the dialectical unit.

G. Kron M. Mesarovich and S. We will consider the basic principles of decomposition-design based on the definition of Yablonsky's ideas:

The principle of dividing the decomposition-design object into elements is possible in accordance with the functions of the decomposition object control system; end-to-end channels for multi-channel objects; on the implementation (execution) of procedures; based on structural interpretation of complexity for homogeneous objects [5].

The principle of functionality corresponds to the requirement that each element has its own function, and the quality of its implementation depends only on this element.

The principle of completeness corresponds to the following conditions: the set of elements is equivalent to the composition of the decomposition of the object; the set of functions of all elements is equivalent to the function of the decomposition object; The set of element descriptions is sufficient to define descriptions of the decomposition object. This principle provides fairly adequate transitions in the hierarchical model of a complex system [6].

The principle of maintaining links meets the requirements for creating additional models at each stage of decomposition-design, which are described as follows: vertical links between the decomposition object and the decomposition elements (content models); vertical relations between the same parameters of the decomposition object and decomposition elements (vertical link equations); horizontal connections between elements of the same level of decomposition (structural models); horizontal relationship between input and output parameters of one level of decomposition elements (horizontal constraint equations).

The principle of stopping (suspending) the decomposition requires the implementation of the decomposition procedure, regardless of the complexity of the elements, if: each parameter and function obtained in the course of decomposition can be supplied with a functional element from different basic elements (during the formulation and generalization of requirements); the corresponding parameter values for the decomposition element are known or determined analytically (during analysis); each element has a complexity corresponding to the applied research tool (when the complexity of the problem decreases) [5].

Hence, aggregation-clustering is viewed as the opposite of decomposition-design, which involves combining several elements into one whole. Combining elements into a single whole leads to the appearance of new properties without reducing the properties of the elements. The emergence of new functions in systems is called an emergency. This feature is a manifestation of the internal integrity of systems - the factor that makes up the system.

Conclusion. The need for an aggregation-cluster can arise for different purposes and is observed in different situations, which leads to different (sometimes radically different) methods of aggregation-clustering. Similar to considering different levels of decomposition-design, that is, the level of detail of an existing system model (object, event, etc.), We can talk about different levels of aggregation-cluster of a model as a balance between precision and abstraction. In particular, the methods of aggregation-cluster, decomposition-design were used directly in the training of engineers in the course of our research.

Thus, the content of the skills of future engineers to prepare for innovative professional activities (thinking outside the box, constructive design and creativity) in an uncertain environment and a lack of information has been improved on the basis of interdisciplinary principles and principles of integrity.

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