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COMPONENTS OF GRAPHIC TRAINING CONCEPT FOR FUTURE MECHANICAL ENGINEERS

The article considers the components of graphic training concept for future mechanical engineers in institutions of higher and vocational education. The definition of «concept» is analyzed in various aspects of application. The essence of «didactic concept» is clarified and pedagogical theories that are embedded in the concept of the developed methodology are identified. It is determined that on the basis of the theory the methodology of learning at university is formed. It is proved that the implementation of this approach in training is based on both purely didactic principles and didactic principles of production training: polytechnic principle, the principle of combining learning with practical activities, the principle of modeling professional activity in the educational process, the principle of professional mobility, the principle of modularity, the principle of self-management in cognitive and production training, the principle of computerization of the pedagogical process, the principle of individuality, the principle of subjectivity, the principle of free choice, the principle of creative realization, the principle of developing potential. Principles of production training have their own characteristics, which are characterized in the article.

It is determined that the detailed stage of the concept expresses the specific subject methodology and includes: the goals of teaching engineering graphics by means of computer modeling at the level of engineering and graphic training of future mechanical engineers, at the level of training of engineering and graphic disciplines (in particular, the educational discipline «Descriptive geometry, engineering and computer graphics»), at the level of organization of educational and cognitive subject activities training; didactic principles of structuring the content of engineering and graphic disciplines (including the discipline «Descriptive geometry, engineering and computer graphics»); interactive style of learning engineering graphics by means of computer modeling; criteria, indicators and levels of engineering and graphic training of students as a result of teaching engineering and graphic disciplines.

Keywords: *computer modeling*, *engineering graphics*, *mechanical engineer*, *teaching methods*, *graphic disciplines*, *the concept of graphic training*.

The relevance of the problem. In the structure of the leading tasks for solving modern social problems of Ukraine, the development of manufacturing industries, in particular, mechanical engineering as a basic branch of industry will take a significant place. Machine building enterprises need competitive specialists with high productivity and quality of work, therefore, the efficiency of their training in educational institutions becomes relevant.

General trends of professional engineering training are reflected in the Laws of Ukraine «On Education», «On Higher Education», the National Doctrine of Education Development of Ukraine in the XXI century, which focuses on the formation of national and universal values; improving the quality of training of specialists; updating the content of education and forms of the educational process; integration of domestic education into the European and world educational space.

The professional competence of the engineer is largely determined by the peculiarity of graphic training for students in engineering specialties, taking into account the close relationship between the graphic activity of the specialist and his professional activity and the specifics of the operation by graphic forms of information.

The importance of improving the methodology of teaching engineering graphics to future mechanical engineers by means of computer modeling is proven by the course of research of theoretical and practical experience in solving various aspects of the problem. We are convinced that along with positive achievements in pedagogical science and practice of engineering and graphic training of specialists, there are issues that need to be solved both at the general didactic and concrete methodological levels. To disclose the problem of our research and solve its problems, we consider it appropriate to develop the concept of graphical training of future mechanical engineers by means of computer modeling.

In order to determine the content and logic of graphical training concept for future mechanical engineers by means of computer modeling, it is necessary to reveal the concept, requirements for its structuring.

Analysis of previous research and publications. It is important to note that the problem of teaching engineering and graphic disciplines at different stages of pre-professional and professional training of young people has been widely reflected in the works of many domestic and foreign scientists.

Questions of theoretical foundations of graphic preparation of schoolchildren and students were reflected in textbooks by E. Antonovich, S. Bogolyubov, D. Borisov, V. Vanin, V. Vyatkin, V. Levitsky, V. Mikhailenko, A. Haskin and others. Vorontsova, A.Gedzyka, V. Holovy, O. Dzhejuly, M. Kozyara, G. Raikovskaya, V. Sidorenko, M. Yusupova, etc.

From the point of view of graphic training young people by means of information technologies, the problem of training future specialists was studied by O. Glazunova, N. Hollywood, R. Gorbatyuk, V. Kondratova, M. Ozhga, Yu. Feschuk, etc.

The purpose of the article is to clarify the components of graphic training concept for future mechanical engineers and determine the influence of graphic disciplines on its formation.

Presentation of the main research material. The most general understanding of the essence of the concept is found in explanatory dictionaries. For example, the dictionary by S. I. Ozhegov, an explanatory dictionary of the Ukrainian language interprets the term «concept» as a system of evidence of a certain position, a system of views on a particular phenomenon (An explanatory dictionary of the Russian language by Ozhegov S. I.).

In the economic encyclopedia, this concept (concept - Latin conceptio - perception) is interpreted more widely:

– system of consideration of certain phenomena that explain the results of modern theories;

– the formation and use of scientific knowledge, which are a way of understanding, explanation of the main idea, theory; scientific justification and logical proof of the basic content of the theory, but unlike the theory it may not be included in the system of exact scientific concepts;

– system of views, which defines the main direction, strategy and tactics of the activities of economic subjects (Economic Encyclopedia).

The concept should present the most priority directions for the development of the management object for a specific period of time or until the achievement of the goal. It essentially serves as a general scenario for achieving goals that should also be clarified in the process of developing a concept. In addition, the concept defines ways of transition from the current position of the management object to the desired one in accordance with the goals set by the subject of management.

The purpose of the concept was to create a management structure capable of defining strategic goals and key directions of developing a strategy for the development of the management object (Concept. Types of concept. Levels of concept development; Frey, 1961).

Since the sphere of our interests is higher vocational education, and its basis is the educational process, it is obvious that the object of management is learning.

The learning process is determined by the purpose of education and is determined by the interaction of the following components: a) the content of learning, that is, the educational subject, which is a system of knowledge (basics of science) for mastering it for students; b) teaching, that is, the activity of the teacher, which should form the students' motives for learning, teaching the content of the subject, organizing the activities of students and directing their independent work aimed at studying and using knowledge, in testing knowledge and acquired skills; c) learning, i.e. comprehensive activities of students, namely their mental and physical actions; d) learning tools (textbooks, tutorials, technical tools, devices, etc.) (Fitsula, 2009).

Our task is to build a didactic concept, under which we understand the following: didactic concept is a system of views on the learning process, expressing the directions, priorities and technologies of its development as an object of long-term management.

Based on this, we have to decide on the directions of pedagogical theories that will be put in the concept of the developed technique.

Depending on what is understood under the learning process, we can talk about the division into a traditional, pedocentric and modern system of learning. In the traditional system, teaching plays a key role (the activity of the teacher), pedocentric – learning (the activity of the learner). The modern didactic system is based on the fact that learning is characterized as an interdependent activity – teaching and studying (Kremen, 2000; Meshchaninov, 2005; Sysoieva, Kristopchuk, 2012).

The modern didactic system is based on a position that defines teaching and learning as an integral part of the learning process, and their didactic relationship in its structure is the subject of didactics. The modern didactic concept is determined by such directions as programmed, problematic, developing learning (P. Galperin, L. Zankov, V. Davydov), humanistic pedagogy (K.Krogers), cognitive psychology (J. Bruner), pedagogical technology, pedagogy of cooperation of teachers-innovators, interactive learning, etc. (Galperin, 1971; Pedagogical sciences: realities and prospects, 2015).

According to the new paradigm of education formed in the modern world, in the educational process, a new subject-subject relationship has developed, by which the teacher helps more the student to learn than teaches him. The authors of the new paradigm of higher education are American scientists R. Bar and D. Tag. Its content is to change the roles of participants in the educational process, when students must be responsible for their

studies. The key task of teachers is to form the interest and creative attitude of students to study and, accordingly, to create conditions for this. The teacher acts, first of all, as a coach who develops a game plan, controls the work of giving useful advice to team members (Volovych, 2004).

Accordingly, the construction of the learning process must meet certain requirements, based on pedagogical theories - a system of scientific and pedagogical knowledge, which explains and describes the elements of real pedagogical activity at university. Pedagogical theory includes the following components: pedagogical ideas, pedagogical concepts, pedagogical concepts, pedagogical regularities and pedagogical principles. The theory systematizes them in individual phenomena. Based on the theory, the method of teaching at university is formed (Goncharenko, 2007; Zagvyazinsky, 2001; Fundamentals of Higher School Pedagogy).

The implementation of this approach in training is based on both purely didactic principles and didactic principles of production training. The principles of production training have their own characteristics.

The polytechnic principle is determined by the correspondence of the content of training to the main directions of development of modern science, technology and production. The task of polytechnic education is to master the system of knowledge about the basics of modern production, which make it possible to form a general technical and special knowledge.

General technical provides for the assimilation of the system of knowledge about the general principles of classification of technology and technology of production of a particular industry, materials and methods of their obtaining; about new equipment and technologies of production, standardization, measurement and evaluation of product quality.

Special knowledge reveals the essence of the designs of equipment, tools, devices used to perform certain operations and types of work, rules for their operation; explain the technological processes and features of production, etc.

The principle of combining learning with practical activities, the connection of theory and practice is determined by the synthesis of branch knowledge and various educational subjects and activities, as well as by the organic connection of educational and labor activities.

The principle of modeling professional activity in the educational process is determined by identifying typical tasks, turning them into educational and production tasks, choosing the necessary forms and methods of training, in addition, in establishing compliance between the requirements for the qualification training of specialists and the actual amount of professional knowledge and skills to create a model of professional activity. Modeling will provide an opportunity to obtain advanced information about the justification of goals, content, means, methods of training, as well as the development of professional qualification characteristics, curricula, programs, textbooks.

The principle of professional mobility increases the possibility of rapid assimilation of new activities and transition to other activities, leaving the content of professional training updated, improving and adapting it to social changes and transformations, to innovations in technology, technology and labor organization.

The principle of modularity is determined by the fact that the student has the opportunity to independently work with the proposed individual curriculum, which contains a bank of information and methodological recommendations for achieving the set complex didactic goals. A complex didactic goal contains a structure and modifies a program module that prepares for a particular activity.

The principle of self-management in cognitive and production training is determined by the ability to form an individual style of activity.

The principle of computerization of the pedagogical process allows the use of electronic computing tools, which make it possible to provide information and process it extensively, as well as to provide individualization and differentiation of learning, control and self-control, modeling and simulation of the investigated objects, processes, phenomena, development of cognitive interests of students (Batyshev, 1997; General and Professional Pedagogy, 2006; Theory and methodology of vocational education, 2012).

The most effective implementation of these principles is possible in the context of a personally oriented approach to the learning process. I. Yakimanska emphasizes that the basis of a personally oriented approach «is the recognition of individuality, self-worth of each person, its development not as a collective object, but, first of all, as an individual endowed with his exceptional subjective experience» (Yakimanskaya, 2005).

The principle of individuality guides the organization of the learning process to determine the goals of the student's development in accordance with personal intellectual and necessary baggage.

The principle of subjectivity involves the subject-subject interaction of participants in the educational process. Moreover, we are talking not only about the system «teacher» but also about the system «teacher-student».

The principle of free choice involves the implementation of an individual space for each student.

The principle of creative implementation focuses on the problem-search style of the participants in the educational process.

The principle of developing potential activates each participant of the educational process to program their personal educational prospects.

As for the methodology of teaching engineering graphics by future mechanical engineers, it is interconnected with the methodology of teaching graphic disciplines, which reveals the issues of studying the main sections and topics of the course, the role of graphic problems and their use in learning, the ways of forming the skills of drawing and performing drawings, the use of computer modeling, etc.

The methodology involves the construction of a meaningful component of learning engineering graphics and the trajectory of its implementation in the appropriate conditions, the algorithm for its implementation in practice, the transformation of knowledge and skills into the structure of the planned final result.

Therefore, the methodological level of concept development should include:

– determination of specific objectives of engineering graphics training, its importance as part of the professional training of future mechanical engineers;

– determination of the content and structure of engineering graphics learning by means of computer modeling;

– development of the most rational forms, methods, means, learning technologies that will ensure proper learning by students of knowledge, skills and skills as the basis for the formation of competencies;

– provide a reliable and flexible approach to assessing educational achievements.

The third level of the concept, the most detailed, includes: detection of problems and tasks in each component of the previous level; key points of the trajectory of engineering graphics learning by means of computer modeling (objective components, key success factors); the value of the trajectory to achieve the goal.

Conclusions. As we can see, the detailed stage of the concept expresses the specific subject methodology and includes: the goals of teaching engineering graphics by means of computer modeling at the level of engineering and graphic training of future mechanical engineers, at the level of teaching engineering and graphic disciplines (in particular, the educational discipline « Descriptive geometry, engineering and computer graphics»), at the level of organization of educational cognitive activities of learning subjects; didactic principles of structuring the content of engineering and graphic disciplines (including the discipline «Descriptive geometry, engineering and computer graphics»); interactive style of learning engineering graphics by means of computer modeling; criteria, indicators and levels of engineering and graphic training of students as a result of teaching engineering and graphic disciplines.

Prospects for further research. Further research requires a detailed approach to the main trajectories of the justified concept implementation taking into account the success factors.

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СКЛАДНИКИ КОНЦЕПЦІЇ ГРАФІЧНОЇ ПІДГОТОВКИ МАЙБУТНІХ ІНЖЕНЕРІВ-МЕХАНІКІВ

У статті розглянуто складники концепції графічної підготовки майбутніх інженерів-механіків у закладах вищої та професійно-технічної освіти. Дефініцію «концепція» проаналізовано в різнобічних аспектах застосування. З'ясовано сутність поняття «дидактична концепція» та визначено педагогічні теорії, що покладаються в концепцію розроблюваної методики. Визначено, що на основі теорії формується методика навчання у ЗВО. При цьому доведено, що реалізація даного підходу у навчанні базується як на суто дидактичних принципах, так і на дидактичних принципах виробничого навчання: політехнічний принцип, принцип поєднання навчання з практичною діяльністю, принцип моделювання професійної діяльності в навчальному процесі, принцип професійної мобільності, принцип модульності, принцип самоуправління в пізнавальному і виробничому навчанні, принцип комп'ютеризації педагогічного процесу, принцип індивідуальності, принцип суб'єктності, принцип вільного вибору, принцип творчої реалізації, принцип розвиваючого потенціалу. Принципи виробничого навчання мають свої особливості, які охарактеризовано в статті. Визначено, що деталізований етап концепції виражає конкретно-предметну методику і включає: цілі навчання інженерної графіки засобами комп'ютерного моделювання на рівні інженерно-графічної підготовки майбутніх інженерів-механіків, на рівні навчання інженерно-графічних дисциплін (зокрема, навчальної дисципліни «Нарисна геометрія, інженерна та комп'ютерна графіка»), на рівні організації навчально пізнавальної діяльності суб'єктів навчання; дидактичні принципи структурування змісту інженерно-графічних дисциплін (у тому числі дисципліни «Нарисна геометрія, інженерна та комп'ютерна графіка»); інтерактивний стиль навчання інженерної графіки засобами комп'ютерного моделювання; критерії, показники та рівні інженерно-графічної підготовки студентів як результату навчання інженерно-графічних дисциплін.

Ключові слова: *комп'ютерне моделювання, інженерна графіка, інженер-механік, методика навчання, графічні дисципліни, концепція графічної підготовки*

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