

DESCRIPTION OF THE METHODOLOGICAL SYSTEM OF FORMING NORMATIVE-METROLOGICAL COMPETENCIES OF FUTURE ENGINEERS

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ABSTRACT

In this work, a detailed description of the methodological system for the formation of normative-metrological competencies of future engineers studying in technical higher education institutions is given.

Keywords: Competence, normative - metrological competence, higher education, engineer, future engineer, pedagogical system.

INTRODUCTION

The great reforms taking place in the world to increase the quality and efficiency of the educational system are aimed at the formation of modern knowledge and skills, close cooperation and integration between educational systems and the field of science, ensuring the integrity and continuity of education. Systematic works are giving high results. The most complex problems of modernization of the national economy and creation of conditions for local products to be released not only to the domestic but also to the foreign market require the improvement of the quality of industrial products. In this regard, the main means of achieving high quality are production standardization and metrological assurance. According to international experience, the integration of theory and practice through the implementation of integrated education in higher education requires the full formation of professional competencies of future specialists.

In order to ensure the implementation of the Decision PQ-4059 of December 12, 2018 [1] of the President of the Republic of Uzbekistan "On measures for further development of technical regulation, standardization, certification and metrology systems" 60711300-Metrology, standardization and product quality management, who study in higher educational institutions, are assigned the task of training future metrologist engineers to be able to compete with the personnel of leading countries in all respects.

The formation of normative-metrological competence of future engineers is considered a specially organized pedagogic process, which requires the introduction of a methodological system for the training of future engineers.

LITERATURE ANALYSIS

Pedagogical system is a set of interconnected tools, methods and processes necessary to create a pedagogical effect aimed at the formation of a person with given qualities. [2]

Pedagogical system is an integral unity of all factors that allow to achieve the goals of education, training and human development. Pedagogical system means a set of methodological methods used by him, which covers all the principles of the pedagogical process and defines the language of the work of the pedagogue. [3]

Methodology in education is an explanation of concrete methods and techniques of pedagogical activity in separate educational processes. [2]

N.V. Kuzmina describes the pedagogical process as a system consisting of five elements. [4]

1. The purpose of education (why to teach);
2. Content of educational information (what to teach);
3. Methods, methods, communication tools of education (how to teach);
4. Teacher
5. Students

He envisions the pedagogical process as part of a social system consisting of six interconnected elements:

1. Educational and educational goals.
2. Content of education and training
3. Education and training technology
4. Organizational forms
5. Teacher
6. Student

P.I. Pidkasistiy distinguishes the educational process as a system as a system-forming concept, educational goal, teacher's activity, student's activity and result. Management tools, which include the content of educational material, educational methods, material means of education and organizational forms of education, serve as variable organizers of this process. [5]

The following conclusion can be drawn from the above: the methodological (methodical) system being designed should have structural (structural) elements such as goal setting, content, implementation, control, correction.

The purpose of our study is to justify and verify the effectiveness of this system. Systematic, competent and functional-activity approaches were chosen as the theoretical basis of the system proposed in the study, which provide the following opportunities:

- Modeling the methodological system of formation of normative-metrological competences, which ensures the improvement of the quality of professional competence of future engineers;
- Development of students' ability to search for optimal ways of solving educational and professional issues related to standardization, accuracy regulation and metrological support of the production process;
- Formation of independent work skills for the development of regulatory and metrological competence;
- Realization of opportunities for development of personal qualities necessary for standardization of accuracy and metrological assurance of production processes.

Objective assessment of the results of the students' educational and professional activity and its practical direction.

The theoretical basis of the construction of the proposed system is also the laws identified in the research and the corresponding principles formed on their basis.

METHODS AND RESEARCH

For our study, the definition of "principle" given by V. I. Zagbiyazinsky is the most relevant. He considers the principle as a methodological reflection of the laws and facts of knowledge, as

knowledge about the goals, essence, content, and structure of education, which allows them to be used as regulatory standards of practice.

Thus, regularities are the theoretical basis for the construction of educational principles as important, stable, necessary and repetitive relations of the pedagogical process [6]

Based on the analysis of the process of formation of normative-metrological competences in future engineers, the laws and principles taken into account in the construction of the methodological system of the formation of normative-metrological competences were determined. We reveal the content of these laws and principles.

The success of the formation of normative-metrological competences in the future engineer of the study is related to the unity of the nature of activity on standardization of the production process, standardization of accuracy and metrological support, and for the formation of normative-metrological competence of the future engineer. depends on the content of the condition of educational and professional issues. The principle of professional orientation of the content of the conditions of educational and professional issues is related to this law. This principle requires the construction of a complex of educational and professional issues relevant to the professional activity of an engineer in the field of meaningful standardization and control of the subject, and in solving such issues, it is necessary to design the methodology of organizing the educational and professional activity of students.

Increasing the level of formation of the normative-metrological competence of the future engineer depends on the differentiation of the teacher's selection of educational and professional issues of different levels, corresponding to the actual level of the formation of this competence in the student group. The level of complexity of educational and professional issues increases with the transition to a qualitatively higher level of formation of normative-metrological competence of students. This law represents the principle of differentiation of the formation of normative-metrological competence of the future engineer. When following this principle, assignments will be beyond the reach of students, and at the same time, it will allow to maintain the interest of students in the professional activity in the field of problem-solving, standardization, accuracy regulation and metrological support of the production process. Identified laws and didactic principles serve as a basis for building a methodical (methodical) system of forming the normative-metrological competence of a future engineer.

We distinguish five interconnected components in the methodical (methodical) system of forming normative-metrological competences of future engineers: purposeful, meaningful, processual, control-evaluation and result.

The target component reflects the goals and tasks of forming normative-metrological competence in the future engineer.

The purpose of forming normative-metrological competencies is determined based on the requirements of the State Educational Standards and is to master the appropriate skills and ensure that the future engineer moves to a qualitatively higher level of the formation of this competence, which increases the efficiency of future professional activity. allows to increase.

In accordance with the set goal, it is necessary to solve the following issues:

- Formation of students' knowledge, skills and qualifications necessary for working in the field of standardization, accuracy regulation and metrological assurance of the production process;

- Development of personal qualities of the future engineer who excels in performance of work on metrological supply in accuracy standardization and production;

The basis of the substantive component is the spiritual completion of the formation process of normative-metrological competencies. He expressed the content of the conditions of educational and professional issues that actualize the performance of professional actions on standardization, standardization and accuracy control performed by an engineer.

The set of knowledge, skills and competencies necessary for the formation of normative-metrological competences is gathered by students in the process of studying the subjects of the curriculum. The analysis of the content of academic subjects to be mastered during the educational process at the higher educational institution allowed to distinguish the subjects that provide students with theoretical knowledge in the standardization of production and understanding of professional activities in the field of metrological supply (1- table).

60711300 □ Academic subjects, block hours and credits for Metrology, standardization and product quality management.

Table 1

Names of academic subjects, blocks and types of activities	The hour allocated to subjects for the daytime form of education	Allocated credit
Compulsory subjects	5010	167
Elective subjects	1620	54
Qualifying practice	420	14
Final state certification	150	5

Compulsory subjects: Logically continuous subjects - a set of subjects that complement each other in a logical sequence. In this case, the student's inability to get credit in the subject that comes before may lead to the student not being included in the training in the subject that is the next logical continuation.

Separate subjects are non-continuous subjects that serve to form professional competencies independently. In this case, if the GPA scores are sufficient for the student in these subjects to not get credit, it will allow the student to continue training in other subjects at the next stage. The selection of subjects consists of a set of subjects that serve to acquire additional in-depth theoretical and practical knowledge and skills, expand professional competences taking into account innovative methods and regional factors of the field, and each selection is less than three subjects. non-substitute subjects may be included. The total number of elective subjects in the curriculum can be up to 10.

Qualifying practice. The following qualification practices are carried out during the preparation of bachelors:

In stages 2, 3, professional practice - in production (in enterprises, organizations and institutions of the relevant field) is focused on strengthening the theoretical knowledge obtained from general and specialized sciences and combining it with practical (production) processes, forming relevant practical skills, competencies and qualifications ;

In the 4th stage, professional practice is focused on further strengthening of professional skills in production (in enterprises, organizations and institutions of the relevant field), adaptation to

professional activity, collection and systematization of information for preparation of graduation qualification work;

Other types of professional practices can be used according to the specific characteristics of the educational fields.

The process component of the methodological system answers the following question: how to organize the educational and professional activities of students on the formation of normative-metrological competences of students? This component reflects the procedural essence of education, regulates the activity of the teacher, student and their mutual actions.

The formation of normative-metrological competencies in the future engineer is carried out in the cooperative activities of teachers and students aimed at achieving a high level of the formation of these competencies.

The control-evaluation component of the methodological system includes the teacher's objective assessment, the diagnostic procedure for the purpose of monitoring, and the subjective assessment of students' level of normative-metrological competence formation.

The control-evaluation component is the most important component of the methodical system for the formation of normative-metrological competence, because it is used to monitor the educational and professional activity of students, evaluate the effectiveness of the methodical (methodical) system, and standardize the future engineer, determine accuracy. the problem of the quality of preparation in matters of metrological support of the recruitment and production process is solved. Therefore, it is appropriate to divide the control into three components: introductory, current and final.

Supervision is a natural part of the educational process and has educational, educational and developmental functions, but the main function of supervision is a diagnostic function, respectively:

- Entrance control is necessary to determine the level of general professional preparation of students for the process of forming students for the purpose of developing and applying normative-metrological competence, optimal methodical support;
- Current control is necessary to assess the educational and professional activity of students in order to determine the degree of formation of normative-metrological competence and, if necessary, to correct (correct) the formation process;
- The final control is necessary to record the level of formation of normative-metrological competence in order to train a competitive specialist.

The resulting component includes the results of its operation in accordance with the goals of the methodical system: the ability to move students to a qualitatively higher level of the formation of normative-metrological components, as well as the possibility of correcting the content of the components that make up this system. The result of the formation of normative-metrological competence is evaluated separately for each of its components: cognitive (ability to accumulate the necessary knowledge), operational-active (ability to effectively implement metrological maintenance of accuracy and production process); as a result, the student as an engineer performs professional tasks in a component manner, ensuring the given quality of the manufactured product: the result may not coincide with the announced goal. In this case, the methodical (methodological) system envisages the correction of components aimed at eliminating deficiencies in the formation of normative-metrological competence of the future

engineer. When necessary, individual components of the methodological system, as well as their combination, are subject to correction. The correction includes measures to eliminate the shortcomings identified in the process of formation of normative-metrological competence in future engineers and to introduce changes in the activities of teachers and students, during experiments, in the form of training sessions to achieve the desired result holds.

CONCLUSION

Normative-metrological competence consists of a set of interconnected knowledge, skills, abilities, and personal qualities that ensure the future engineer's ability to productively perform generalized professional actions in the field of standardization of the production process and metrological provision.

The success of the formation of the future engineer's normative-metrological competence is determined by the level of formation of each of the structural components of this competence: motivational-value, cognitive and operational-active. The content of these components was developed in the study. The motivational-value component reflects the content of the motives of activities in standardization of production, accuracy standardization and metrological support, and is necessary for the effective performance of professional activities by an engineer that allows responsibility and independent action in the specified areas. includes professionally significant personal characteristics and reflects a personal attitude to normative-metrological competence; the cognitive component consists of a collection of knowledge on standardization, accuracy measurement and metrological support; the operational component includes a list of necessary skills and is aimed at developing the ability to apply the acquired knowledge in solving concrete professional issues. The middle level of formation of normative-metrological competence is distinguished: high, average and low. The formation of normative-metrological competence is provided by the indicators and evaluation criteria of each level.

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