STRUCTURAL COMPONENTS OF TECHNOLOGICAL COMPETENCE DEVELOPMENT BASED ON A SYSTEMATIC APPROACH (USING THE EXAMPLE OF THE SCIENCE OF THE INTERACTION OF RADIATION WITH MATTER)

Butayeva Nargiza Buribayevna
Jizzakh polytechnic institute
n95047381@mail.com

ABSTRACT

The objective of this article is to examine the structural elements that underpin the generation of technological knowledge through a systematic methodology. The study examines contemporary pedagogical approaches designed to cultivate technical proficiency among students enrolled in technical universities. The essential elements that students must master in order to effectively grasp the fundamental principles and tools of technical competence are identified. A systematic approach is proposed, which includes planning, implementation, and evaluation of educational programs. The developed model takes into account the requirements of the modern labor market and the quality of training of specialists in the field of engineering and technology. The study includes a set of measures designed to ensure the successful formation of technological competence among students. The findings of this study may be utilized in the development of educational programs and teaching methodologies at technical universities with the objective of enhancing the professional competencies of future engineers. The example of gaining experience in the interaction of radiation and matter is used to illustrate the fundamental aspects of a systematic basis for learning and acquiring technological skills. This encompasses theoretical and practical education, scientific research, and the application of knowledge in real projects. The competence-based approach provides a framework for understanding the processes and conditions that facilitate the development of technological competence in students, as well as the effectiveness and accountability of graduates in addressing professional tasks through the use of various technologies. The article also reveals the fundamental features of competencies and the potential of structural analysis of competencies in the implementation of the competence approach in higher education. The article's analysis of contemporary approaches to teaching and enhancing technical proficiency in the field of radiation-matter interaction research paves the way for further research and development in this area.

Keywords: System, analysis, systematic analysis, systematic problem, system approach, system thinking, system model, system task, higher education, radiation, radiation dose.

INTRODUCTION

It is evident that the majority of sectors within the national economy utilize production equipment and machinery that emit harmful thermal radiation for humans. In recent years, the potential risks associated with radiation have become evident in a number of fields, including radio engineering, medicine, nuclear physics, information technology, and others. As a consequence of improper use, malfunctioning, and other related factors, individuals have developed minor, relatively straightforward illnesses. It is important to note that equipment and devices that utilize radioactive radiation in the field of medicine do not offer complete protection. Radiation is defined as the transmission of energy in the form of particles or waves.

In this context, the term "ionizing radiation" is used to refer to a specific type of radiation, rather than the broader term "radiation." Ionizing radiation has the capacity to penetrate matter, transfer its energy to it, and destroy chemical bonds between molecules. Consequently, ions and other chemically active substances are formed as a result of this process [5].
Technological competence is defined as a set of knowledge about methods, forms, and means of work, as well as skills and experience in using technology to solve various professional tasks.

Technological competence represents an indispensable component of the social and professional skills that graduates of higher education institutions cultivate during specialized training. This encompasses the capacity to address professional responsibilities through the utilisation of diverse technological resources, in addition to personal attributes such as efficiency and accountability.

A review of the literature revealed that the incorporation of electronic educational resources into university educational programs offers a number of advantages. Such resources furnish students with the requisite professional knowledge and technological abilities, thereby enabling them to utilize these resources for reading and study. Consequently, students' interest in their chosen profession and their level of proficiency in it are enhanced.

The distinctive quality of technological competence lies in its capacity to devise and execute an educational process that ensures the attainment of specific technological objectives. The specific technological goals are determined by the subject being studied, the activities of both teachers and students, as well as the internal processes of student development. In the context of technological competence, educational goals are established through the formation of learning outcomes, which are expressed in the actions of students. This approach allows for a clear focus on the most important aspects, the definition of goals, and the development of criteria for evaluating academic achievements.

An accelerated course in a specific subject could be structured around a set of learning objectives. In order to ensure the effectiveness of this approach, it is essential that the following five criteria are met:
1. The course should include a learning objective that corresponds to the basic level of knowledge acquisition.
2. It should cover a wide range of fundamental structural relationships within a given field of study.
3. The sequence of learning activities should be gradually increasing in complexity.
4. All cognitive techniques specific to the particular field of study should be identified and incorporated.
5. Creative activities should be included that allow students to independently apply previously acquired knowledge and skills in new contexts.
This encompasses the identification of novel issues in familiar contexts, the delineation of novel functions for objects, and the formulation of alternative solutions through the integration of established methodologies with innovative approaches [7].

LITERATURE REVIEW

The primary objective of such events in an educational context is to facilitate the acquisition of the requisite professional skills and qualifications by students. Furthermore, in the evaluation process, particular emphasis is placed on the performance of relevant professional duties. In accordance with the position of Sh. S. Sharipov, the selection of professional assignments in

accordance with the standards established by the State Educational Standards for the relevant field of study allows for an objective assessment of a student's readiness for professional practice [8].

N.A. Alekseev put forth the proposition that a personalized educational environment could be created by solving problems. He underscores the significance of content in defining learning objectives. Consequently, he developed a systematic approach to educational tasks based on a common methodological foundation with the proposed assessment system [1].

METHODOLOGY

It has been demonstrated through empirical evidence that the educational process is not confined to the resolution of individual tasks and problems. Rather, it necessitates a comprehensive approach with specific objectives. Systems of educational and cognitive activity based on various classification criteria, such as intellectual qualities characterizing the style of creative work, can be integrated into the framework of scientific and methodological tasks. N. Y. Postalyuk has developed a system of tasks that encourages the development of a creative approach to work [6].

The present study aimed to identify the psychological and pedagogical achievements in the field of education, taking into account advanced pedagogy, personal experience, as well as psychological and pedagogical achievements in this field and components of the development of technological competence among students of technical universities. To this end, a systematic approach was employed (see Fig. 1).

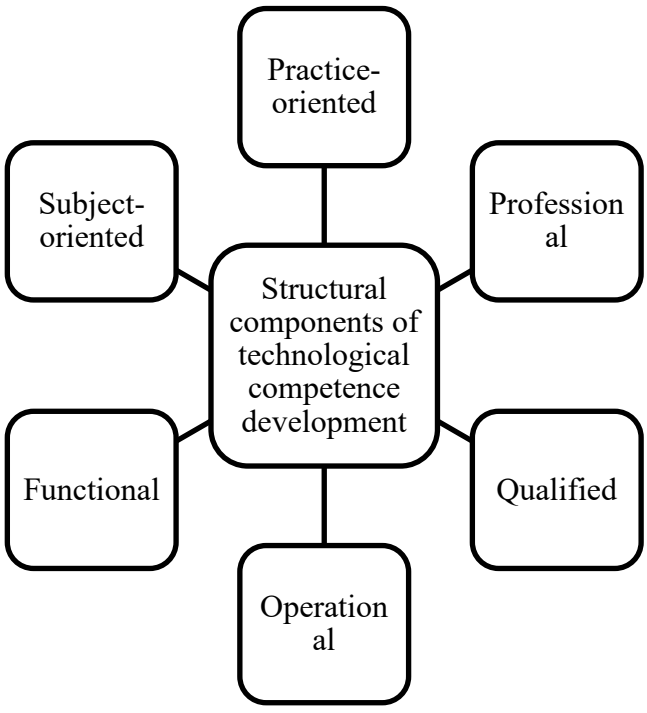

Figure 1. Structural components of the development of technological competence of students.

Our methodology for developing competency-based assignments entails integrating the learning process with a multitude of components pertaining to competencies. These components include specialized technical and socio-communicative knowledge, skills, and

professionally significant personal qualities. This integration is achieved by creating a situation of technological activity.

The competency-based assignment system affords students the opportunity to engage in practical, professional, and profession-like activities. The objective of these classes is to cultivate specialized technical and communicative knowledge, skills and competencies, as well as important professional qualities. These activities facilitate the development of technical competencies within the context of academic disciplines and professional cycles.

Competence tasks are employed at various stages of the academic disciplines and professional cycles, contingent upon their functional purpose. Thematic assignments are employed in the educational process with the objective of enabling students to acquire a set of specialized technological knowledge that is necessary and sufficient to enable them to master the skills and qualifications of a specialist in academic subjects. Furthermore, these tasks facilitate the development of professional qualities and specialized technical knowledge.

Thematic assignments are developed based on the choice of scenarios for obtaining special technological knowledge in academic courses related to professional fields. Such tasks may be assigned to students orally, in the form of test questions, or as practical laboratory work or control tasks in the classroom. Assignments may include a scientific contradiction, which serves as a cognitive test that helps students develop creative and emotionally rewarding experiences.

RESULTS

The theoretical framework of this study is as follows: The study demonstrates that technological competence in the field of radiation and matter science is based on a systematic methodology that includes understanding the fundamental principles of interaction, analysis, and modeling of phenomena, as well as the development of new technologies based on the knowledge gained.

A profound comprehension of the physical and chemical principles that govern the interaction of radiation and matter is a foundational aspect of technological competence in this field.

- The capacity to analyze and interpret experimental data and theoretical models;
- The capacity to utilize contemporary apparatus and software for scientific inquiry;
- The capacity to innovate and develop novel methods and technologies.

It is of great importance to apply a systematic approach. The study indicates that the utilization of a systematic approach is conducive to the efficacious advancement of technical knowledge. This necessitates a meticulous examination and comprehensive grasp of pivotal concepts, a meticulous approach to practice and experimentation, as well as a regular updating of knowledge and skills in accordance with contemporary requirements.

The findings of the study underscore the significance of integrating a systematic approach into educational programs and practical endeavors within the field of radiation and matter interaction. This approach ensures the effective training of specialists with a high degree of technical expertise, enabling them to address pressing challenges and pioneer new technologies.

CONCLUSIONS

A conclusion on this topic may include the following key points:

- The curriculum covers the content of academic disciplines from professional cycles that are associated with the development of competencies necessary for the future specialist to perform the main types of technological activities. These tasks can be employed to create functional

and operational professional tasks. Graduates receive these assignments in the form of a dissertation;

- Functional tasks are developed on the basis of qualification tasks. The content of academic disciplines from professional cycles is associated with the development of competencies at the level of functions (subfunctions) of a specialist. These tasks are taught to students in practical classes or course projects, and are also presented in the form of control tasks that students must complete in order to pass the intermediate certification;
- Operational tasks are developed based on functional tasks. The content of the educational programs and topics related to the professional development of competencies in the field of technology are covered. Furthermore, the work assignments are designed to align with functional requirements and encompass the course content and the topic of "Interaction of Radiation with Matter." This affords students a certain degree of convenience in the learning process.

Consequently, the advancement of technological knowledge based on a systematic approach in the context of studying the interaction of radiation and matter necessitates an integrated approach that encompasses both theoretical training and the practical application of the acquired knowledge.

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