

Modeling of organizational and administrative competence in future specialists of nuclear industry

Modelación de la competencia organizativa y administrativa en futuros especialistas de la industria nuclear.

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ABSTRACT:

The work theoretically grounds and builds an efficient model of forming the studied competence. The modeling uses the leading theoretical and methodological approaches: system, activity-based, competence-based, interdisciplinary, axiological, and student-centered. The set of efficient diagnostic tools was developed to determine the formation of administrative competence. The proposed model is an open educational system that provides the successful formation of organizational and administrative competence in future specialists of the nuclear industry and the efficient control of this process.

Keywords: Competence, Competence Based Model, Organizational and Managerial Competences, nuclear industry

RESUMEN:

El trabajo teóricamente fundamenta y construye un modelo eficiente para formar la competencia estudiada. El modelo utiliza los principales enfoques teóricos y metodológicos: sistema, basado en actividades, basado en competencias, interdisciplinario, axiológico y centrado en el estudiante. El conjunto de herramientas de diagnóstico eficientes se desarrolló para determinar la formación de la competencia administrativa. El modelo propuesto es un sistema educativo abierto que proporciona la formación exitosa de la competencia organizativa y administrativa en futuros especialistas de la industria nuclear y el control eficiente de este proceso.

Palabras clave: competencia, modelo basado en la competencia, competencias organizativas y de gestión, industria nuclear.

1. Introduction

It is known that "management is a function of organized systems of different nature that ensures the preservation of their specific structure, the implementation of their programs and goals," [1; p. 1379]. Hence, the importance of management in the life of any system is clear. It is no coincidence that the organization of economic development management and its timely improvement has top-priority in any country. For example, the United States maintained high productivity for many years primarily due to the efficient management of the production process, as well as of science and education.

The formedness of organizational and administrative competence of professionals in the nuclear industry should meet the requirements of State Atomic Energy Corporation "ROSATOM" [2], which have a direct bearing the subject of research.

The high interest in training the professional managers for the nuclear industry is proved by the international project of "ROSATOM" and the IAEA. It is a school for specialists in nuclear industry, found in 2016 with the aim to develop leadership in the management of nuclear programs.

In Dimitrovgrad (Ulyanovsk region), the need in training nuclear specialists is caused by the creation of the nuclear innovation cluster in 2010. Its growth was triggered by the development of the Federal High-Tech

Center of Medical Radiology in the city. In terms of the multidimensional scope of activities of this cluster, efficiency of management in all its forms plays a key role.

In November 2017, at the Interregional forum of scientists "Health and medicine in the XXI century", the employers and experts were questioned about the need for the formation of organizational and administrative competence of specialists in the nuclear industry. All respondents pointed out the relevance of the formation of this competence, at the same time, 30% of respondents believed that despite the importance of administrative competence, the majority of specialists in the nuclear sector had this trait feebly marked. As a result, there are certain difficulties and problems in the proper personnel management in the production process. The authors discovered insufficient cognitive knowledge and skills in making reasonable administrative decisions at different levels.

Moreover, in June 2018, the "MEPhI" institute conducted a survey of students on the specialty "Nuclear reactors and materials". Analysis of the results of the survey showed that 86% of students consider the formation of organizational and administrative competence in technical universities necessary for future specialists of the nuclear industry, 14% answered that they did not know, none of the students gave a negative answer.

The above analyses justifies the importance of organizational and administrative competence of specialists in the nuclear industry.

At the same time, the formation of this competence in students is a multidimensional problem, having a specific socio-educational characteristics. D. V. Kachalov [3], N.A.Ran [4], N. G. Khmyzova, L. I. Gubareva, E. P. Licinfo [5], and other addressed the problem of training administrators, considering it from the perspective of vocational pedagogy. Today, this problem is still relevant and still insufficiently studied.

The above justifies the **relevance** of the problem of forming the organizational and administrative competence in future specialists of the nuclear industry. It was necessary to structure an efficient formation system for this competence.

Therefore, the **purpose** of this research is the theoretical justification and building the models of formation of organizational and administrative competence in future specialists of the nuclear industry.

2. Methods and research organization

Theoretical and methodological bases of building the model of formation of the studied competence are pedagogical modeling, system-based, activity-based, interdisciplinary, competence-based, axiological, and student-centered approaches, as well as the expert method.

3. Results and discussion

Pedagogical modeling allows revealing the structural components of the studied pedagogical system, establishing links between them, identifying the existing regularities, and predicting the further development of this pedagogical system.

Modeling is a method of scientific cognition. It implies purposeful design of an object that identifies certain characteristics and regularities of the studied subject. That is, the models serve as analogues of the studied objects, they are similar, but not identical [6, p. 54]. Pedagogical modeling of V.V. Kraevsky [7] is interpreted as a reflection of the real pedagogical system created within the special object to achieve educational goals, presenting them as an instrument of achievement. The authors used this definition in the development of the model of formation of the studied competence.

Pedagogical modeling is widely used in the study of pedagogical processes, phenomena, regularities, and also in designing various learning environment. This method has been further developed in the works of G.V. Ahmetzhanova, S.I. Arkhangel'sky, V.S. Bezrukova, V.P. Bospalko, A.M. Bulynin, G.M. Il'mushkin, G.M. Kornev, K. K. Nuriev, M.A. Petukhov, V.A. Slastenin, N.F. Ta-lyzina, etc.

Modeling of the studied competence is efficient only if it is systemic and covers many aspects [16].

The authors applied a systemic approach to the theoretical study and modelling of the formation of organizational and administrative competence of future specialists of the nuclear industry, since the model essentially represents a system with all its components and the interactions between them. The works of M.K. Bocharov, V.G. Afanas'ev, V.A. Zverev, Yu.V. Vasil'eva, T.I. Shamova, S.Ya. Batyshev, A.P. Belyaeva develops the notion of "administration" through the systemic education in management.

A systemic approach is universal in nature and essence, on the basis of which one can structure managerial competence. Following on from the analysis of existing approaches to the definition of the system, the authors represented it as a set of interrelated elements and with integrated properties and regularities.

The formation of the competence in specialists in the nuclear sector becomes challenging without sufficient knowledge in nuclear science, nuclear power engineering, information technology, applied mathematics, economics, business, and entrepreneurship. Modern nuclear industry needs specialists with interdisciplinary knowledge in various fields of science, who generate ideas, are capable of innovative and entrepreneurship activities and innovative decision-making. This circumstance results in the use of an interdisciplinary approach in design and structuring of the content of training in nuclear disciplines.

The activity-based approach allows studying the formation of the competence in students not only in the context of its structural components, but also its functional relations and interactions. This approach is based on the conceptual theoretical principles of L.S. Vygotsky, A.N. Leont'ev, P.Ya. Gal'perin, who defined the fundamental psychological regularities of training and education on the basis of the regularities of personal development. The use of this approach allows studying the organizational and administrative competence in the aspect of functional relations and interactions, based on the fact that the designed model aims to provide efficient management at various levels.

Axiological approach considers the axiological attitude of future specialists of the nuclear industry to the formation of administrative competencies in the setting of multi-level production management.

The competence-based approach is particularly significant in designing the model of forming the administrative competence. It significantly affects the content of the training, as well as its structure and the use of various forms and methods of training.

The competence-based approach in education was studied by many Russian and foreign researchers. The issues of the content of the notion "administrative competence" are considered in a number of works [8-10].

It should be noted that the author [8] defines professional competence as a universal, integrated and internalized opportunity to provide sustainable efficient work in a certain industry and job position including problem solving, implementing innovation, and creating transformations. Competence consists of different competencies, it is a coherent set of knowledge, skills and attitudes that may be used in real activity.

S. Whiddett and S. Hollyford define administrative competence as a set of behavioral skills of an individual that allow achieving an efficient operation with-in an organization [9].

Krajcovicova, Caganova, and Cambal [10] describe the competence not just as a set of knowledge and skills, but the ability to meet the complex requirements of an organization using psychosocial resources. If managerial knowledge and skills are comparatively easy to evaluate, intangible assets like efficient communication and teamwork are harder to form and evaluate. They also note that the set of competencies that form the administrative competence may vary depending on the job or industry.

The author [11] formulated the following definition of organizational and administrative competence of nuclear specialties graduates on the basis of the comparative analysis of existing definitions and similar concepts, as well as with the requirements to the graduates of the nuclear programs in accordance with state educational standards and requirements of employers within the nuclear innovation cluster. It says: "Organizational and administrative competence of the graduate of nuclear specialties is the systemic education of personality, consisting of cognitive, motivational-value, operational-activity, reflexive evaluation, project and research, emotional competences, and personal traits allowing the expert to take appropriate management decisions in the implementation of the scientific and production tasks independently, to carry out the organizational and managerial functions successfully in a constantly changing environment, and quickly submerge to the research and production environment while implementing the nuclear research on the modern high-tech installations requiring precise maintenance and operational management".

Hence, according to the definition, organizational and administrative competence consists of the following components (competencies): cognitive, motivational-value, operational-activity-based, emotional-volitional, research, reflexive-evaluative.

Student-centered approach studies the influence of personal traits on the formation of the organizational and administrative competence.

Having studied the methodological approaches to modeling the studied competence of future specialists of the nuclear industry, the authors focus on designing the pedagogical model.

System-based approach to building model of organizational and administrative competence primarily involves the target block, consisting of goal setting and tasks on the development of the design model. The purpose is an essential component to any activity, including the management one [17]. It determines its place in the professional development of specialists in the nuclear sector.

The goal was to design a model (system) to provide efficient formation of organizational and administrative competence of future specialists in nuclear industry.

The goal is an intended image of the anticipated result, the target of human action [12, p.37].

The author reveals the main principles for the formation of this competence, They are consistency, fundamental nature, professional orientation, integrity, focus on personal development, and cooperation pedagogy.

The principle is a guideline requirement how to act to achieve the goal, the normal range of activities [13, pp. 48-49].

1. The principle of consistency. This principle enables the logic, order, continuity, and systematicity. These characteristics make up its contents. Consistency in the modern sense means systematicity, besides the order or continuity. Thus, it should be reconsidered in what ratio the element and the system, part and whole are [14, p. 42]. Leaning on this principle allows efficiently implementing the results of the system

analysis of the carried out pedagogical experiment in the formation of the studied competence. At the same time, the formation of administrative skills is a step-by-step process, thus it requires continuity.

2. The principle of fundamental nature and professional orientation. N.F. Talyzina [15] believes that the fundamental knowledge allows analyzing the essential phenomena of professional activity in general terms (fundamental knowledge). The fundamental nature of training involves the scientific character, completeness and depth of knowledge. Professional orientation of training ensures the formation of the system of generalized professional knowledge (including the administrative knowledge), which are necessary in future professional activities.

3. Integrity is one of the system's characteristics that ensure its integrity, designed to allow the creation of a coherent integrated set of disciplines on the basis of the principle of consistency and professional orientation. All this creates the conditions for the efficient formation of organizational and administrative competence.

4. Focus on personal development. This principle expresses the main purpose of functioning system of forming the organizational and administrative competence, aimed primarily at personal development. It brings together the main pedagogical categories: upbringing, teaching, education.

5. Joint training and professional activities of teachers and students is realized in accordance with the cooperation pedagogy, which is understood as joint activity, developing both teachers and students. It is bonded by mutual understanding, submerging into the spiritual worlds of each other, the joint analysis of the progress and results of their activity.

It should be noted that the principle of professional orientation is a core one in a reserved system of principles.

Content-wise and technological unit includes the content of training according to the state educational standards and the requirements of employers of nuclear industry. In turn, the content of training is realized in the joint activities on the basis of the cooperation pedagogy by the smart use of pedagogical communication and the step-by-step development of administrative competences. The training content is optimized by proper use of interdisciplinary ties: it eliminates the duplication of certain issues and topics.

Based on the analysis of the results of theoretical and experimental studies, the authors discover the complex of pedagogical conditions, the creation of which is to ensure the successful formation of the studied competence.

1. It is the advanced training of the teaching staff on the formation of students' administrative competencies in the context of training specialists for the nuclear industry.

2. The creation of the necessary educational and methodological support for the formation of organizational and administrative competencies.

3. Optimal structuring of the content of education for nuclear specialties according to the educational standards and requirements of employers, as well as the formation of students' organizational and administrative skills by using inter-disciplinary approach in education.

4. Extensive use information technology and innovative forms and methods of training in the formation of administrative competencies in future specialists of the nuclear industry.

5. Creation of the motivational and educational environment during the formation of organizational and administrative competence in students.

6. Creating efficient measurement tools to identify the formedness of the studied competence in students.

7. Step-by-step development of administrative skills according to the content of training.

In order to reduce the volume of the paper, the authors describe only the content of the first pedagogical condition: the advanced training of the teaching staff on the issues of forming the students' administrative competencies in the context of training specialists for the nuclear industry.

Active development of the nuclear industry today and current economic situation presents new requirements to training of specialists in this field, and, consequently, new demands on qualifications and competence of the teaching staff of the universities. Today there is a need for building a new, dynamic model of the professional teaching staff in universities, based on the requirements of the economy and the social order.

The competitiveness of higher educational institutions and, consequently, its graduates depends largely on the teaching staff. The training of teachers of the management disciplines contributes to the efficient development of organizational and administrative competence of the nuclear industry because the level of qualification affects the quality of teacher's educational services. The skill of a teacher depends not only on the quality of the content of the educational program, but also on the motivation of the students, as teachers of social disciplines and humanities often face a lack of motivation in students in engineering to studying non-major subjects.

The State Corporation "ROSATOM", being a major employer in the nuclear industry, is interested in the professional development of the teaching staff of major universities, as teachers qualification affects the competence of future specialists. The task of the cooperation with the State Corporation "ROSATOM" and

major universities is to align the training programs of universities to the current needs of the company and business environment.

The State Corporation "ROSATOM" carries out active work with higher educational institutions on introduction of additional educational modules in the educational program, and, if necessary, adjust them. One of the directions is the professional development of teachers. Thus, one of the projects aimed at training teachers is a summer school for teachers of major universities of "ROSATOM" on the development of the business competencies needed for conducting international activities. The main purpose is to prepare young specialists with the competencies relevant for successful participation in the international projects of "ROSATOM". In this school, the teachers received the ready teaching materials for teaching management and economic disciplines and developing the business competencies. The tutors presented the best practices for teaching these academic disciplines in the leading universities.

As the authors believe, the format of the summer school organized by the State Corporation "ROSATOM" meets the modern trends of education and can be used as effective tool of improving the qualification of the teaching staff of universities in the nuclear industry.

The authors developed the results and criteria unit within the designed model, which included the criteria, indicators and levels of the competence formedness (minimal, acceptable, efficient, advanced), as well as the correction of the process control.

Finally, the work presents the model of formation of organizational and administrative competence, which consists of the following blocks: theoretical, methodological, target, structural-functional, content-wise and technological, complex of pedagogical conditions, the results and criteria one.

Pedagogical experiment justified the efficiency of this model, as it is shown in the results of the pilot study. It was attended by senior students in nuclear specialties. The ascertaining stage of the experiment showed that the respondents expressed a relatively low level of the formedness of the administrative competence. Further, in the forming stage, the dynamics of this process has positively changed. This study defines the acceptable level in 23% of the respondents, efficient – in 55% of the subjects, advanced – in 22% of respondents.

4. Conclusions

Following on from a systemic, activity-based, competence-based, interdisciplinary, axiological, and student-centered approaches, the authors theoretically substantiated and developed an efficient model of a system of the formation of organizational and administrative competence. The process management implemented such functions as informational, motivational, prognostic, performance, diagnostic, regulatory, and remedial. The formation of the competence is ensured by the use of the following principles: consistency, fundamental nature, professional orientation, integrity, focus on personal development, and cooperation pedagogy.

The proposed model represents an open educational system that ensures the successful formation of organizational and administrative competence of future specialists of the nuclear industry and the efficient management of this process through its adjustment.

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