PROBLEMS OF QUALIMETRY OF PERSONNEL TRAINING QUALITY IN THE ASPECT OF THE COMPETENCE BASED APPROACH

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Abstract. *The article is devoted to the qualimetric approach in pedagogy, considered by researchers as a method of formalizing the qualitative characteristics of pedagogical phenomena and processes and expressing them in quantitative indicators.*

Keywords: *quality, conditions, knowledge, abilities and skills of students, competence, educational system, problems and tasks, professional orientation.*

ПРОБЛЕМЫ КВАЛИМЕТРИИ КАЧЕСТВА ПОДГОТОВКИ КАДРОВ В АСПЕКТЕ КОМПЕТЕНТНОСТНОГО ПОДХОДА

Аннотация. *Статья посвящена квалиметрическому подходу в педагогике, рассматриваемому исследователями как метод формализации качественных характеристик педагогических явлений и процессов и выражения их в количественных показателях.*

Ключевые слова: *качество, условия, знания, умения и навыки студентов, компетентность, образовательная система, проблемы и задачи, профессиональная ориентация.*

The qualimetric approach in pedagogy is considered by researchers [1, 2] as a method of formalizing the qualitative characteristics of pedagogical phenomena and processes and expressing them in quantitative terms.

Qualimetry (from the latin "qualis" - quality and the greek "metreo" - to measure) is a science with an interdisciplinary status that teachs the methods and problems of obtaining quantitative estimates of the quality of any objects and processes, regardless of their nature [2].

Pedagogical qualimetry is the science of the quality of education in all its diversity (the quality of the functioning and development of educational systems, the quality of the educational process, the quality of training students in a competency-based format, etc.) The researchers note that the use of the mathematical apparatus in pedagogical qualimetry ensures the scientific character and manufacturability of the results obtained [3].

The concept of quality of education was considered by M.M. Potashnik, A.I. Subetto and other researchers [4, 5]. They define this term as the demand for the competencies formed by university graduates in professional activities, including innovation.

The quality of higher education in a broad sense N.A. Selezneva defines it as “a balanced correspondence of higher education (as a result, as a process, as an educational system) to diverse needs, goals, requirements, norms (standards), conditions” [6], but in a close sense - as the quality of training of specialists with higher education.

According to A.M. Popov, the quality of education received at the university, characterizes how successfully its graduate implements his knowledge, we mean, how he works [7].

An analysis of scientific publications on this issue has shown that the main criteria for the quality of training at the present time include its fundamental nature, professional orientation, problem-oriented and advanced character.

In modern scientific and pedagogical literature, the problems of implementing a competency-based approach in higher education are often discussed, which is considered by researchers (V.I. Baidenko, A.A. Verbitsky, E.F. Zeer, I.A. Zimnyaya, A.I. Subetto, Yu.G.Tatur, V.D.Shadrikov and others as a new method of modeling the desired results of education, which act as standards for its quality. The results of higher education are understood as sets of general cultural and professional competencies, including knowledge, abilities, and skills of students, which are determined for each module of the program and for the program as a whole.

Currently, there is no generally accepted definition of the concept of “competence”, in our work, competence is understood as the ability of a student to successfully apply his knowledge, skills, and personal qualities in a certain field of activity.

V.I. Baidenko [8] divides competencies into the following classes:

· social and personal, revealing the ability of the individual to self-development and social interaction;

· economic, characterizing a person's ability to conduct effective behavior in the economic sphere;

· general scientific, expressing the ability to adequately use knowledge, methods and technologies;

· organizational and managerial, representing the ability of the individual to expedient activities for the formation of production teams, ensuring their effective work in conditions of risks and uncertainties;

· general professional, expressing the range of abilities of the individual to use the theoretical foundations of her professional activity;

· special, characterizing the professional profile of the graduate.

From the standpoint of the qualimetry of education, which takes into account the structural and hierarchical nature of the concept of "quality", the competence-based form of presenting the result of higher education as a system of general cultural and professional competencies of a graduate has a multi-level, hierarchical structure, which, according to A.I.Subetto, can be described by a "tree" of competencies. The lower level of the "tree" represents a set of single, conditionally indivisible competencies that involve the solution of a class of tasks or the performance of any function of an activity. The "nodes" of the tree are interpreted as complex competencies that involve solving a whole range of tasks, performing a complex function or type of activity [5]. The multilevel nature of competencies requires the creation of appropriate multilevel assessment tools for their diagnosis, combining traditional and innovative (activity and complex) forms of assessment.

Mathematical problems plays an important role in learning mathematics. Tasks are divided into several groups depending on the implementation of educational goals. Among these, it serves to develop students' creative personal qualities (quick thinking, risk-taking, promotion of new ideas, etc.).

At the initial stage of formation of creativity in higher education, professional, including mathematical tasks are aimed at generating students' interest in creative activities within the limits of their educational and future professional activities [9].

These types of questions include the student's attitude to creative activity, as well as questions that serve to evaluate his activity in the independent development of his creative personal qualities.

When a student gets into a problem situation, he uses external and internal opportunities to master a subject, study a specific topic, or solve a given example. Analyzing, comparing, summarizing, systematizing, etc. operations are used. At the same time as the analysis process, various associations appear (similarity of a science, topic or example to a previously familiar science, topic or example). In the process of solving the problem, various guesses begin to appear, and research on these guesses leads to their justification, proof, or, if not, to the conclusion that this guess is wrong [10,11].

We present some issues related to the topic of reasoning algebra, which are the basis for the realization of such goals.

Issue 1. Four friends - Anvar (A), Vakhid (V), Sobit (S), Dilshod (D) - decided to enter a university in four different cities - Moscow, Leningrad, Kiev, Tashkent. If it is taken into account that the following conditions are met, then which of them should go to which city:

P) if A does not go to Moscow, then C does not go to Leningrad;

Q) if B does not go to Moscow or Tashkent, then A goes to Moscow;

R) if C does not go to Tashkent, then B goes to Kiev;

S) if Д does not go to Moscow, then B goes to Moscow;

T) if Д does not go to Leningrad, then B does not go to Moscow.

Solution: "Anvar will go to Moscow" through A_M, $\neg A_M$ - "Anvar will not go to Moscow" through A, and if we define the rest of the opinions accordingly, then the set conditions can be expressed as follows:

$P = (\neg A_M \Rightarrow \neg C_Л) \cong (A_M \vee \neg C_L)$;

$Q = ((\neg B_M \wedge \neg B_T) \Rightarrow A_M) \cong (B_M \vee B_T \vee A_M)$;

$R = (\neg C_T \Rightarrow B_K) \cong (C_T \vee B_K)$;

$S = (\neg Д_M \Rightarrow B_M) \cong (C_T \vee B_K)$;

$T = (Д_L \Rightarrow \neg B_M) \cong (\neg Д_L \vee \neg B_M)$.

Taking into account that all conditions are met, we construct the resulting conjunction of conditions:

$P \wedge Q = (A_M \vee \neg C_L) \wedge (B_M \vee B_T \vee A_M) \cong (A_M \wedge B_M) \vee (\neg C_L \wedge B_M) \vee$
$\vee (A_M \wedge B_T) \vee (\neg C_L \wedge B_T) \vee A_M \vee (\neg C_L \wedge A_M) \cong (A_M \wedge B_T) \vee A_M \vee$
$\vee (\neg C_L \wedge B_M) \vee (\neg C_L \wedge B_T) \cong A_M \vee (\neg C_L \wedge B_M) \vee (\neg C_L \wedge B_T)$;

$P \wedge Q \wedge R = [A_M \vee (\neg C_L \wedge B_M) \vee (\neg C_L \wedge B_T)] \wedge (C_T \vee B_T) \cong$
$\cong [A_M \wedge (C_T \vee B_K)] \vee [(C_L \wedge B_M) \wedge (C_T \vee B_K)] \vee [\neg C_L \wedge B_T (C_T \vee B_T)] \cong$
$\cong (A_M \wedge C_T) \vee (A_M) \wedge B_K) \vee (\neg C_L \wedge B_M \wedge C_T) \vee (\neg C_L \wedge B_M \wedge B_K) \vee (\neg C_L \wedge$
$\wedge B_T \wedge C_T) \vee (\neg C_L \wedge B_T \wedge B_K) \cong (A_M \wedge C_T) \vee (A_M \wedge B_K) \vee (\neg C_L \wedge B_M \wedge C_T)$;

$P \wedge Q \wedge R \wedge S = [(A_M \wedge C_T) \vee (A_M \wedge B_K) \vee (\neg C_L) \wedge B_M \wedge C_T)] \wedge (Д_M \vee B_M) \cong$
$\cong [A_M \wedge C_T \wedge (Д_M \vee B_M)] \vee [A_M \wedge B_K \wedge (Д_M \vee B_M)] \vee (\neg C_L \wedge B_M \wedge$
$\wedge C_T \wedge (Д_M \vee B_M)] \cong (A_M \wedge C_T) \wedge Д_M) \vee (A_M \wedge C_T \wedge B_M) \vee (A_M \wedge B_K \wedge$
$\wedge Д_M) \vee (A_M \wedge B_K \wedge B_M) \vee (\neg C_L \wedge B_M \wedge C_T \wedge Д_M) \vee (\neg C_L \wedge B_M \wedge C_T \wedge B_M) \cong$
$\cong \neg C_L \wedge B_M \wedge C_T$;

Conjunctions about one person going to two different cities or two people going to the same city during shapeshifts are false judgments. Thus, we have shown that the conjunction $\neg C_L \wedge B_M \wedge C_T$ is true, that is, B_M and C_T are true propositions. Taking into account condition

T, from the truth of B_M we conclude that $\neg Д_L$ is true, that is, $Д_L$ is false. Then A_L is true. From this follows the truth of $Д_K$. So, Anvar was going to Leningrad, Vakhid - to Moscow, Sobit - to Tashkent, Dilshad - to Kiev.

The words in the condition of the given problem can be changed depending on the situation and students can be assigned to create new problems for practice. But it is necessary to demonstrate to students that it is not possible to behave like this all the time.

Formal logic uses "dry" facts to establish connections between given conditions and their consequences. For example, if we define the properties P and Q of an object x of a set E by means of P(x) and Q(x), then if we use the concept of equivalent formulas of mathematical logic, basic equivalences, we will have the following:

$$\begin{array}{l|l} \forall x \in E\ (P(x) \Rightarrow Q(x)) \equiv & (P \Rightarrow Q \equiv \neg P \vee Q) \\ \equiv \forall x \in E\ (\neg P(x) \vee Q(x)) \equiv & (P \vee Q \equiv Q \vee P;\ \neg\neg Q \equiv Q) \\ \equiv \forall \in E\ (\neg\neg Q(x) \vee \neg P(x)) \equiv & (P \Rightarrow Q \equiv \neg P \vee Q) \\ \equiv \forall x \in E\ (\neg Q(x) \Rightarrow \neg P(x)). & \end{array}$$

If we apply the obtained result to the statement "Any tasty food is not cheap" formed by the sentences "x food is tasty" and "x food is cheap", then we get the statement "Any cheap food is not tasty".

Issue 2. The three learners (Anvar, Khikmat and Babur) are found an ancient unique jug. Each expressed their opinion about the find:

1) Anvar: "This jug belongs to Greece, and it was prepared in the 5th century";

2) Khikmat: "This jug belongs to Phoenicia, and it was prepared in the III century";

3) Babur: "The jug belongs to Greece, and it was prepared in the IV century."

When the teacher of history check, that each learner is right in only 1 out of 2 assumptions. When and where was the jug made? Suggest at least three ways to solve this issue.

In the formation of students' motivation to master mathematics, non-mathematical texts (normative documents, opinions of famous people, ideas in their works, etc.) mentions about creativity and creativity in their future professional activities, as well as work outside the classroom, opening up the place of interdisciplinarity (especially with math) it is possible to offer tasks in the direction of giving. Their implementation leads students to understand the importance of mathematical knowledge and creative activity in the life of a modern specialist.

For example, in the first introductory lecture of the "Mathematics", the topic "The role of mathematics in the information century" can be discussed with students performing the following tasks:

Below are some considerations. For each of them (3-5), give one of the opinions "I agree" or "I am against":

- Mathematics should be studied only to bring order to the mind (M.V. Lomonosov);
- Mathematics - mental gymnastics (A.V. Suvorov);
- Mathematics - the queen of all sciences (K.F. Gauss);
- Mathematics is the art of calling different things by the same name (Henri Poincaré);
- The chain of mathematics-concepts, if one link falls, it is impossible to know what will happen next (G. Tseiten) [12].

Directions: Compare these considerations with your personal vision of your future career and the role of mathematics in your life.

If the student agrees with the last statement and does not express an opinion about the rest at all, he receives - 2 points (motivation is not formed); if an opinion is expressed on 1 (2) considerations - 3 points (motivation is formed at a lower level); if "I agree" or "I am against" opinions are given to no less than two opinions - 4 points (motivation is formed at a moderate level) are given.

In our opinion, problems and tasks such as those mentioned above serve to educate future personnel as creative individuals who meet today's requirements in the process of teaching mathematics.

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