Active methods of teaching technical disciplines in educational organizations

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Abstract. The article discusses the possibility of improving the quality of vocational training and the readiness of graduates of higher educational institutions for professional activity through the use of active teaching methods in the educational process in the study of technical disciplines for the formation of general cultural, general professional and professional competencies.

1. Introduction

In recent years, the requirements of employers to graduates of higher education institutions (universities) have increased in accordance with the trend and prospects for the development of the system, namely, the constant modernization of the equipment and equipment used, including the technologies used, taking into account the constant growth in the number and range of tasks for the intended purpose, expansion the conjuncture of professional and service activities.

To date, the main and often made complaint of employers against graduates is the excessive theoretical nature of the training received by young specialists, with a certain isolation of theoretical knowledge from practice. Ultimately, this manifests itself: in the inability to compare and use theoretical knowledge to solve practical problems; inability to work with modern technology and equipment; in psychological unpreparedness for the realities of everyday professional activity, for the function of management and leadership; in the absence of ideas about the norms of professional behavior.

In accordance with the type (types) of professional activity, tasks can be designated as follows: professional orientation, emphasis on self-education, development of cognitive potential, creative activity, the impact of methods on the internal structure of the personality (interests, needs, motivation, attitudes). The employer wants to get not just a disciplined and executive employee or an employee who professionally competently knows his job, but also a specialist with the readiness and desire to constantly educate himself, the ability to work in conditions of uncertainty, with high adaptability, innovative thinking, practical skills for making independent and responsible decisions.

The ability of a graduate to learn in the process of his further professional activity is one of the factors of his subsequent efficiency and demand by the employer and, accordingly, the most important task of the university educational process. One of these problems is the readiness of graduates of higher educational institutions for professional activity, methods of its formation and assessment.

Currently, in the education system of the Russian Federation, as a solution to the listed problems, the adoption of a competence-based approach in training specialists as fundamental for higher education
has become. This is evidenced by the introduction of educational standards that have received legislative approval as the Federal State Educational Standards for Higher Education. The system-forming component of the Federal State Educational Standard of Higher Education is competence - the characteristics of the results of training graduates of vocational education institutions that must be understood by employers, educational institutions and students.

Therefore, today the university must form in a graduate not only a set of necessary general cultural, general professional and professional competencies, but also ensure the acquisition of the aforementioned professionally important qualities. However, at the same time, the directive introduction of the competence-based principle was not accompanied by scientific research to measure what a university graduate should now possess [1]. In fact, the question of how to determine the presence and measure the size of those competencies that are currently standardized remained unresolved. The Federal State Educational Standard of Higher Education reserves the right to solve this problem for educational institutions on their own, requiring universities to develop a fund of special assessment tools that allow them to evaluate knowledge, skills and abilities - the level of acquired competencies.

For objective reasons, the educational process in higher education institutions is also undergoing changes. With the introduction of various and often completely different teaching methods, the methodological space of teaching is changing [1]. This resulted in heterogeneous scientific and methodological approaches to the study and assessment of the professional readiness of university graduates. It becomes necessary and natural to use active teaching methods, where consideration and assessment of a real professional situation, which makes it possible to understand how certain decisions are made in practice, and to assess the possible consequences.

In the scientific and methodological literature, the name of this technology is determined by various formulations: "Method of situational analysis", "Method of problem-situational analysis", "Method of specific situations", "Method of analysis of specific educational situations", "Case technology" [2].

The advantages and disadvantages of using the case method in the educational process are widely considered and indisputable.

2. Methods
A factor in the possible use of this teaching method in the educational process of universities, in the study of technical disciplines, is the formation of a complex of professionally necessary and important qualities and abilities in students with its help, for example: making decisions, thinking systemically, effectively functioning in a situation of uncertainty, communicative skills, independence and initiative, willingness to change, the ability to work with information, problem thinking, ethics [3–7].

Mainly practical and theoretical knowledge in technical disciplines is conditionally based on the theory of complex systems. Complex systems are characterized by diversity and diversity, with the possible integration of natural, natural, artificial and social components. This is typical for technical, cybernetic systems, the human-machine system, complex phenomena of technology and society. When creating a case for technical disciplines, the analysis of the knowledge system for which it is compiled is of great importance. It is very difficult to determine the specifics of these systems with the compilation of a logical and mathematical description, and it is most possible using the case method. In these cases, the description of a complex system is transformed into a case. The analysis of such a case will allow students to get acquainted with the existing complex systems that are actually encountered in professional activity.

At the same time, it is necessary to adhere to the systematic structure of compiling the case (figure 1), depending on the list of competencies formed for the academic discipline of a technical orientation, indicated in the working curricula of the direction of training (specialty) and in the working curricula of the disciplines, respectively.
Figure 1. Scheme - the structure of the case.

It is possible to implement the "case method" in such cases to understand and implement the actual, present state of a system, object or process, while taking into account the structuredness in time and space.

When forming professionally important qualities, using active teaching methods, students develop skills characterized by certain characteristics, taking into account methods that are a complex system, and then work with educational "cases", skills are formed and developed with experience in certain areas (That is, in fact, the target component of the technology), which contribute to the formation of the required competencies (table 1).

This structure can be considered as a certain pedagogical technology containing the technique of implementing the educational process, determined by a special set and arrangement of forms, methods, teaching techniques, educational tools [4]. Initially, the case method was applied in business education, its use is possible in teaching and technical disciplines.

3. Practice
Today, the maximum experience and practice of situational learning has been applied to academic disciplines such as pedagogy, philosophy, sociology, law, political science, etc.

The use of the case method in technical disciplines is rather limited and does not seem logical, since it is believed that technical education operates with strictly deterministic knowledge [3]. Nevertheless, the case method as a teaching method is suitable and applicable for the study of technical disciplines, the objects of consideration of which are distinguished by a variety of states, even when there is insufficient or no full information about the state of the system. For example, operational activities. A modern specialist works with complex technical systems. His professional activity is related to their diagnostics, adjustment, maintenance, as well as the commissioning and decommissioning of specialized machinery and equipment. These types of activities are determined by the difference and ambiguity of the final result, the interaction and influence of various factors, the nature and duration of the action, while they are formalized by the univariate solution of the existing departmental manuals, orders and instructions.

At the same time, the limitation of the use of the case method is that the supposed several answers, competing in the degree of reliability, do not have an unambiguous answer to the question posed, i.e. truth in which is pluralistic. Thus, correspondence to practice is possible, when the real state of affairs is comprehended and analyzed, which has arisen in a specific service situation and the description of which simultaneously characterizes not only any practical technical problem, but also actualizes the complex of knowledge, skills and abilities, and, accordingly, acquired competencies, which needs to be demonstrated when solving a given problem.
Table 1. The relationship between skills and competencies being formed when using the case method.

| Professionally important qualities [3] | Characteristics of skills [4] | Methods used [2] | Target component of technology * [2] | Formed competencies [5] |
|----------------------------------------|-------------------------------|------------------|-------------------------------------|------------------------|
| Analytical                             | Ability to distinguish data from information, to classify, organize, highlight essential and non-essential information. | Analysis (forms a systemic view, vision) | Work with information (understanding the meaning of the details described in the situation; analysis and synthesis of information and arguments; work with assumptions and conclusions, assessment of alternatives) | General cultural and general professional |
| Practical                              | Practical application of the obtained theory, methods and principles in the studied discipline. | Modeling (building a model of the situation) | * Identification, selection and solution of problems (development of skills of analysis and critical thinking; readiness to solve complex issues is formed) | |
| The ability to function effectively in a situation of uncertainty, the ability to make decisions, systematic thinking, independence and initiative, readiness for changes, the ability to work with information, communication skills, problem solving, ethics | Creative | As a rule, a case-situation cannot be solved by logic alone. Creative skills and abilities in finding alternative solutions that cannot be found in a logical way are very important. | Thought experiment (knowledge of the situation by mental transformation) “Brainstorming” (provides the generation of ideas about the situation) | * Competence in communication (the ability to listen and understand and conduct evidence-based polemics, take different positions and points of view, the ability to work together in achieving a goal, the willingness of others to make other decisions, the ability to resolve conflicts and disagreements). |
| Communicative                          | Ability to speak, persuade and conduct a discussion with others. Use visual material on discipline and other media, unite in groups, defend their own point of view, convince, draw up a report. Ability to listen and hear, assess people's behavior, support the topic under discussion and argue for opinion. | Discussion (carried out when exchanging views on the problem of ways to solve it) | * Competence in communication (the ability to listen and understand and conduct evidence-based polemics, take different positions and points of view, the ability to work together in achieving a goal, the willingness of others to make other decisions, the ability to resolve conflicts and disagreements). | |
| Social                                 | Ability to listen and hear, assess people's behavior, support the topic under discussion and argue for opinion. | Control and self-control methods | * Decision making, personal responsibility (independent thinking, self-confidence, self-control) | |
| Introspection                          | Divergence of opinions in the process of discussion contributes to the awareness, analysis of the opinions of others and their own. Ethical and moral problems that arise require the formation of social skills for their solution. | | | |
Moreover, the problem itself may not have unambiguous solutions. The technical sphere does not differ in situational and multivariate implementation, does not have much flexibility and variability, but at the same time it has a rigid conditionality. Therefore, the application of the case method in technical disciplines, taking into account such features as the presence or absence of the only correct solution and the creation of a situation of uncertainty, seems promising. With the use of the case-method, the preparation process, taking into account the extensive list of professional functions and tasks of a specialist, allows solving several didactic tasks at the same time.

In this case, the most optimal will be "cases" of a practical orientation, corresponding to absolutely real professional situations and "cases" of a training orientation, the main task of which is training.

At the same time, the basis for the successful application of the case method in the learning process is the fulfillment of the necessary conditions: preliminary training of the teaching staff in the field of design and application of cases; organizational and technical support of the auditorium fund; methodological substantiation of the application of the method for a specific technical discipline, the correspondence of the method to didactic goals and objectives; implementation of the principles and technologies of the case method; combination of the case method with other teaching methods. Based on the foregoing, we can conclude that the use of the case method as a modern educational technology in the study of technical disciplines is possible.

4. Discussion
In this situation, the effectiveness of the use of the case method in the study of technical disciplines is possible as an assessment of knowledge, skills and the level of acquired competencies. At the same time, the standard provides for the opportunity to involve external experts from among the current heads of territorial management bodies and divisions, as well as employees of specialized organizations, for the examination of assessment tools.

Thus, the solution of these problems was entrusted to the academic and professional community. At the same time, competence-based and personal scientific and methodological approaches are applied to the study and assessment of the professional readiness of university graduates, which is necessary for the successful achievement of the goals of professional activity. The procedure for assessing the professional readiness of university graduates includes an expert assessment by direct supervisors (or mentors) of the professional competencies and professionally important qualities of graduates shown by them in the course of their service.

5. Conclusion
The obtained results of the professional readiness of graduates can be considered as an indicator of the effectiveness of the use of the case method in the study of technical disciplines, and an addition to the existing system for assessing the professional readiness of graduates of higher education institutions, respectively, making it more comprehensive and objective.

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