The Project Method in Teaching Special Disciplines to Students of Technical Universities

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ABSTRACT: The article deals with the formation of general cultural competences of students of technical specialties, namely future specialists in the oil and gas industry in the process of studying special disciplines. The purpose of the formation of graduates' competences is the development of the ability to apply their knowledge to solve real problems. The proposed classification of competences reflects the interrelations of different types of competences. It is based on the analysis of the interpretation of the competence concept. The article also discusses the features of the project approach aimed at the formation of general cultural competences, as well as the requirements for the implementation of the project approach when teaching special disciplines.

I. INTRODUCTION

Throughout the world, the education system is the main social institution, through which people adapt to changing socio-economic conditions [1]. In order to be a specialist in high demand in today's dynamic world, a graduate must not only understand how to perform their professional duties but also have a set of competences, demonstrating their intellectual and moral development, as well as professional and social readiness [2-4]. Following global trends, Russia is implementing a number of important measures aimed to improve the quality and economic efficiency of education, in particular, by introducing the competence-based approach to assessing the quality of education [5]. This approach serves as the basis of the Federal State Educational Standards of Higher Education [6].

Rapidly changing requirements for graduates demand a search for new methods of organization and management of the educational process, the purpose of which is to produce specialists in high demand in the labor market. Modern employers need specialists who are able to independently understand a problem, correctly set appropriate task and apply their knowledge to find the best solution. This circumstance is the reason for the introduction of the competence approach to the control of educational results [7, 8].

II. METHODS

Until recently, the dominant lecture and seminar system of training was mainly aimed at the assimilation of knowledge, skills and abilities. The degree of assimilation of the material is only 30% (when using visual aids) and up to 50% (when using audio-visual aids). In addition, this system cannot provide students with the conditions for the transition from the assimilation of "ready" knowledge to its independent acquisition in practice, as it does not form concepts as ways of activity. Despite this limitation, the lecture and seminar system of education undoubtedly plays an important role in innovative education. Its purpose as one of the most information-intensive technologies consists in the formation, through lectures and seminars, of the cognitive component of general cultural and professional competences. However, due to the need to implement new educational goals, the functional purpose, types and methods of conducting lectures have to change.

In order for a graduate to perform adequately in the new realities, it is necessary to apply new methods of training, which immerse the student in a situation as close as possible to areal one. In the course of such a situation, the whole set of required competences is formed [9, 10]. One of the effective ways of such training is the project approach. As it has been noted, it is practically impossible to form general cultural and professional competences with the help of traditional teaching methods (listening to lectures and solving abstract, tasks, not related to practice). For these purposes, it is necessary to use modern interactive teaching methods that provide "immersion" of students in a specific problem, solving which the student forms the competences necessary for them as a future specialist.

The project approach is considered as an example of this method. It is noted that when student is involved in implementing their own project, which is of personal interest to them, they develop both the interest in the project and the desire to bring it to the end and win. This motivation significantly improves the quality of education. The project approach is especially effective as teamwork, during which interpersonal skills, as well as the abilities to work in a team, defend one's opinions and take into account the opinions of other team members, are formed.

When applying the project approach, the role of the teacher changes significantly. Instead of a lecturer and supervisor, they become a senior colleague and consultant, ensuring the interaction of active team members and transferring their experience and knowledge during the project.

Based on the analysis of the goals and features of the project approach, the requirements for the implementation of the project approach in the study of general technical and special disciplines are formulated. The purpose of the competence formation is related to the fact that during the educational process, theoretical

knowledge and practical skills are not simply transferred to a student who is often not able to apply them in the real world. They are formed as the ability to apply knowledge in order to solve real problems. Thus, a student understands what they learn and acquire experience that will help them to solve more complex problems.

Competence is a set of knowledge, skills and abilities that are necessary for an employee to successfully solve problems and perform the functions assigned to them [11]. It should be noted that in addition to special knowledge and skills, professional competence includes communication skills used to solve emerging issues in professional activities. At the same time, special attention should be paid to the formation of information, aesthetic and technical skills.

Competences are divided into two groups [12]:

1. Universal (general professional, social and personal, general cultural);

2. Professional (analytical, designing, production and technological, organizational and managing, research).

General cultural competences demonstrate the level of communication skills that are necessary for effective teamwork, the ability to self-study, knowledge of legal and ethical standards, required for a person to be responsible in their activities [13]. Professional competence is necessary for the employee to be successful in performing their duties and to become a specialist in high demand.

In order to develop universal and professional competences, federal state educational standards impose the following requirements on graduates:

• To know the disciplines that define a specific area of professional activity, to understand their relationship and value in the system of knowledge. It is an integrated system of knowledge that helps young specialist to develop independently in the chosen field;

• To know the basic processes and phenomena occurring in nature, to understand modern scientific methods of knowledge and the possibility of their application at the level that is necessary for solving problems in the professional field. Knowledge of the scientific methods of knowledge helps a specialist to orient in the ocean of information, to understand and master latest scientific achievements.

• To have a good knowledge of the subjects included in the program, which are part of the cycle of general humanitarian and socio-economic disciplines and general mathematical and natural sciences. The complex of humanitarian knowledge is a necessary condition for the formation of a highly-qualified specialist and citizen;

• To have the skills obtained at seminars, practical and laboratory work, during academic and practical training. The ability to communicate, conduct discussion, take into account the opinions of colleagues and receive necessary knowledge from them is a necessary condition for the adaptation of a specialist in the production team.

III. RESULTS

Educational technologies and methods included in them make it possible to successfully form both general cultural and professional competences. In the branch of the Industrial University of Tyumen in Surgut we have conducted a survey among teachers and students on the special methods and technologies used to form general cultural competences.

The technologies and special methods recommended for solving the problems of formation of general cultural competences are given in Table 1(results of Survey 1).

Table 1: Results of Survey 1.

Groups of general cultural competences	Recommended special methods and technologies
Competences of the subject of relations in the team	• Technology "Training in cooperation" when group work is used in project and game technologies, trainings. • Communication trainings. Discussions as an element of the traditional lecture and seminar system of training and various technologies of quasi-professional and educational-professional activities.
Competence of the subject of self-development	• Psychological trainings of personal growth and development. • Methods of internal and external control and assessment of knowledge used in the traditional lecture and seminar system of training, technologies and methods of quasi-professional and educational activities. • Special methods of internal and external control.
Competence of the subject of the labor market	•Design and gaming technologies of quasi-professional activities. •All methods of teaching and professional activities.

"Training in cooperation" is one of the most effective technologies in the formation of this competence.

Indeed, a new complex technical project can be created only by a well-coordinated team of specialists of various professions. Its development is a socio-economic activity that requires collective, multiprofessional interaction [14]. The success of the project largely depends on the ability of employees to find a common language with colleagues of other specialties. For example, one of the most important requirements of companies to oil and gas specialists is their communication skills. Modern education should take into account this fact and form students' competences necessary for collective interaction.

Many students of technical specialties do not understand the need to study disciplines of the humanitarian, social and economic cycle. However, these disciplines help to form general cultural competences. The basis of general cultural competences is the formation of professionally significant personal qualities of students, allowing them to carry out successful professional activities in the selected area.

The professionally significant personal qualities include system thinking, sociability, stress resistance, attentiveness and independence. A specific general cultural competence cannot be formed if the corresponding professionally significant personal quality is not developed. The survey was conducted in the second phase of this research study, the results of which allowed to correlate professionally significant personal qualities of students with the general cultural competences. The correspondence of general cultural competences and professionally significant personal qualities of students is given in Table 2 (results of Survey 2) [15].

Table 2: Results of Survey 2.

Professionally significant personal qualities of students	General cultural competences
System thinking (the ability to assess the situation from different points of view, to take into account the interaction of the elements under consideration, to choose the most effective way to improve the activity)	Possession of culture of thinking, ability to generalize and analyze, information perception, goal setting and choice of ways of its achievement.
Communication skills (ability to work in a group, initiative, ability to solve communication problems, take into account the opinions of colleagues, to argue their proposals and actions)	Willingness to cooperate with colleagues, work in a team. The ability to construct logically correct, reasoned and clear oral and written speech.
Stress resistance (ability to make decisions and be responsible for their consequences, adaptation in the social and future professional sphere)	Ability to find organizational and managerial solutions in non-standard situations and readiness to be responsible for them.
Attentiveness (the ability of the mental system to precisely distinguish currently valuable information from the incoming general information flow)	Ability to use regulatory legal documents in activities
Independence (the ability to make independent decisions, the desire for self-education throughout life)	The desire for self-development, improvement of skills; awareness of the social significance of future profession, high motivation to perform professional activities.

It is quite difficult to form general cultural and general professional competences of students, adhering to the existing curricula, because educational activity, most often, contains abstract tasks that only vaguely resemble the real functions of a specialist. One of the key factors influencing the model of competence is the orientation of the educational system to meeting the needs of potential employers – the main customers and consumers of educational services [16].

In order to bring a student closer to the position of a professional, it is necessary to draw up a curriculum, in which interactive forms and real production orders are used for training. The best teaching methods are those, which encourage students to take action, to experience the state of success and to strive to win. These requirements are largely realized through interactive teaching methods that help students to more easily understand and remember the material, as the material is studied through active involvement in the educational process. Interactive methods also teach to work in a team, to respect the rights of other participants, to form opinions and to realize the competence of students.

The use of interactive methods in the educational process should include all students in a group, where everyone should make an individual contribution. This is necessary for the exchange of experience, knowledge and ideas. When organizing interactive methods, it is necessary consider the principles of interaction, activity of trainees and obligatory feedback [17].

One of such interactive methods is the project approach. The appeal of the project approach is related to the fact that real-world problems help to develop a student's interest and accordingly, encourage the pursuit of deeper knowledge in the context of solving a specific problem. The teacher becomes a leader and helps students set goals, to understand the problems and solve them, controlling the acquisition of new knowledge and the development of social skills [18].

The purpose of the project approach is to solve a task or a problem that is personally important for students and to design a solution in the form of a ready-to-use result. The stages of the project are as follows: problem, planning (project), finding solutions, product presentation (project defense). In addition to this, one can name portfolio – a folder, which contains all the working materials of the project (drafts, daily plans, reports, etc.). The basis of the project method is its focus on the result. A student must clearly understand why they are doing something and how they will be able to apply this in real life [19].

IV. ANALYSIS OF THE RESULTS

Analyzing the results of the presented study, we should emphasize that the formation of general cultural competences is not considered separately from the formation of professional competences. Only their connection allows a specialist to successfully carry out their professional activities.

General cultural competences should be formed not only in the study of humanitarian disciplines but also in the study of general technical and special disciplines. Compliance of professionally significant personal qualities of students and general cultural competences specified in educational standards is considered. In accordance with the standards, three main groups of competences can be identified:

- competence related to oneself as a person, a subject of life;
- competence related to human interaction;
- competence related to human activity in all its types and forms.

For the formation of these interrelated competences, it is necessary to use modern interactive teaching methods that would help to solve specific problems rather than abstract ones. In solving them, a student forms the competences necessary for them as a future specialist.

In the given study, the project method of training is analyzed as an example. It is noted that if a student has a personal interest in the project, they develop an interest in learning, as well as the desire to work this project and bring it to the end. Such personal motivation contributes to a significant improvement in the quality of education.

V. CONCLUSIONS

Summarizing the above, we can formulate the basic requirements for the implementation of the project approach [20]:

1. Presence of a significant and interesting task or project, the solution of which requires conducting research and giving a comparative description of possible solutions;

2. Visible result of a decision: for example, if one wants to create a site for drilling equipment, the result is a working site;

3. Students work independently: the teacher is involved in the work only as a consultant and organizer of discussions;

4. At each stage of the project, one needs to prepare a report;

5. Research methods include the following steps:

- Definition of the task and its division into problems (decomposition);
- Choice of the best solution by means of discussion, voting, "brainstorming" [21];
- Choice of the method of the result registration(presentation, protection, creative report, etc.);
- Analysis of the obtained data;
- Summary.

The implementation of the project approach in the educational process would significantly improve the quality of education and produce specialists, which are in high demand in the highly-skilled labor market.

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