

# **Peculiarities of the formation of communication competences within the framework of project training in a polytechnic university**

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**Abstract:** The features of implementing projects in teaching students in a polytechnic university and the opportunities for graduates of communication competence are analyzed in the article. A formal logical approach that considers the concept of graduates' competence in relation to the labor market requirements, including regional ones, constitute the theoretical basis of the study. In this regard, the primary task is to determine the conformity of educational products to the demands of the labor market, the formation of the optimal structure of vocational education aimed at the final result - the training of a professional as demanded by an employer. It is determined how the use of digital technologies of practice-oriented educational technologies allows improving the communication process in the context of the training engineers, as well as developing their skills of rhetoric and effective communication. Some digital technologies of various types of training (lectures, practical exercises, assessment tools) have been analyzed from the point of view of their impact on developing graduates' modern competences.

**Keywords:** Pedagogical technology, competences, communication, rhetoric skills, project communication, project management.

## **Introduction**

The importance of project training in polytechnic universities is widely recognized. Currently, the economy has formed a number of industries, whose work is built primarily on a project basis. This is the pharmaceutical, aerospace, information and communication industries and many others – “all these industries work on the basis of projects, and they are all notable for technological developments that have changed the way we live and work” [1]. At the same time, under the conditions of digitalization of economy and production, project training acquires additional properties and additional requirements to graduates' competence, and most importantly - it allows developing these competences. The main purpose of project training in the framework of the profile is not to teach projects in the specific vocational orientation, but to help students acquire a project approach to any activity.

## **Theory and methodology**

“The field of engineering education is in the process of reinventing itself” [2]. Scientists are conducting discussions about the features of engineering education [3] [4], issues of the transition of engineering education from curriculum reform to fundamental research [5] [6].

Researchers from different countries describe the experience of reforming engineering education in their universities: at Polytechnic School of University of São Paulo, Brazil [7], at Howard University, Rensselaer Polytechnic Institute, University of Maryland (United States) and other [8]. It is specially noted that “engineering is an integrative process and thus engineering education, particularly at the baccalaureate level, should be designed toward that end” [9].

Many scientific works analyze the questions of the need for separating engineering education as an independent direction of training [10] [12], studying the effect of pedagogical training on

teaching in higher education [13] [14], analyzing the recruitment of educational subjects in terms of their compliance with the requirements of modern employers and other issues.

Russian researchers in the process of modernization of engineering education pay special attention to the task of developing general disciplinary competences, students' social competences [15], personnel [16] and professional competences [17] [18]. For example, the works of I. R. Gilmanshin and S. I. Gilmanshina are devoted to the task of developing the competence in the field of energy saving, under which they mean "the competence related to the ability to see, to understand, to sustain energy resources and environment as a source of energy resources; to take into account environmental and engineering knowledge as values; to choose valuable, targetable and meaningful settings for their engineering and technical actions with innovative underground, independently identify technical and environmental contradictions and make decisions on resource saving". They believe that the competence in the field of energy saving is the "way to create technologies of a new generation" [19].

The Russian researchers and teachers suggest intellectual monitoring systems of the process of developing university students' competences [20] [21].

Foreign scientists note the importance of forming engineers' communicative competences in the analysis of modern labor market requirements. The growth of the importance of communications for companies requires the formation of various communication competences among specialist engineers [22] [23] [24] [25] [26]. This requirement of the modern labor market is noted in the works of many researchers. Development of engineers' skills in professional competition is directly connected with these important issues.

A logical modeling is the main method of investigation. Building a map of the interrelationships of individual pedagogical technologies with the competences of graduates demanded by the modern labor market is the result of logical modeling.

The practice of using of digital technologies of practice-oriented educational technologies in Perm National Research Polytechnic University (PNRPU) provides an empirical basis for research.

### **Research and discussion**

Studies have shown that in modern conditions employers increasingly pay more attention to such requirements towards graduates' competences as

- high requirements for skills and abilities of intellectual activity of engineers;
- high communication skills, including teamwork, communication skills and rhetoric,
- high ethical standards, including respect for intellectual work and intellectual property;
- knowledge and understanding of the needs of customers, markets, consumers, products manufactured by the enterprise, not only technical properties and technological features of its production.

These requirements can to a large extent be met in the process of studying at a university. Most of the training programs are directed towards their development.

Educational programs for training engineers of a number of PNRPU faculties fill most of the prospective competences of students, which are necessary for modern engineers and related to research and innovation activities.

The following tools for practice-oriented pedagogical technologies for conducting collective classroom will be the most effective ones in the process of implementing digital technologies in the framework of project training in educational programs for engineers.

Problematic lectures will make it possible to activate the problem-search and research activities of students, teamwork skills and communications. In the course of lectures, students can be asked to raise relevant information and problem issues, including the issues of the industry foresight, the market, and consumers' needs. This technology allows working in a dialogue mode, conducting an express analysis of the situation and collective discourse, putting forward hypotheses and obtaining micro-discoveries that affect both the work of individual students and the group of students as a whole. In general, this technology helps to develop all the necessary competences of specialist engineers (including basic knowledge of professional terms in foreign languages).

The pedagogical technology of the round table will help to attract students of other specialties and training areas to discussing students' problems, which will also allow organizing a collective discourse, advancing interdisciplinary hypotheses and getting answers from other fields of knowledge, etc. Dialogue allows students to enter into a dialogue with both their own "I" and others in the process of project implementation. The application of this technology allows the effective development of the entire range of communication competences, including rhetoric skills.

The pedagogical technology of the defense seminar, which allows future engineers to develop skills in designing scientific research / preparation of the project, justification of the choice of the research method. This kind of technology forms the competence of positive communications and the assumption of leadership qualities. It also promotes the development of rhetoric skills.

Various pedagogical methods for evaluating the results of the educational process are also aimed at the formation of modern competences. Control and evaluation tools should identify not only the content, but also the activity aspects of preparing a future graduate, which involves demonstrating competences or applying them in a specific situation that is not identical to the situations in which these competences were formed.

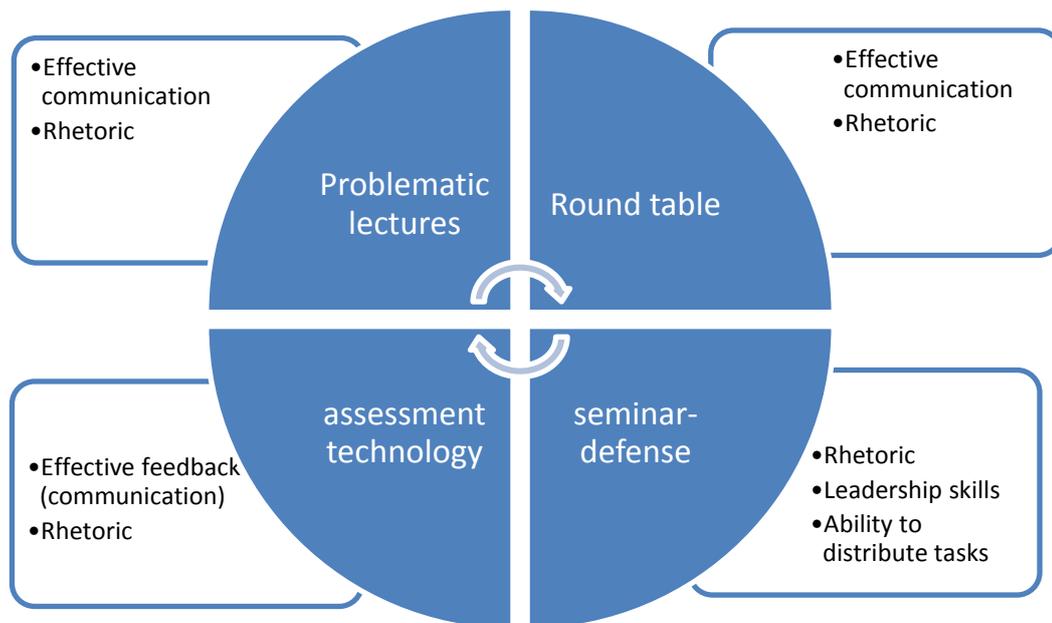
The most effective in our opinion (approved in the course of conducting classes among students of the aerospace, road, mechanical and technological faculties of Perm National Research Polytechnic University) are the following: competence tests (criteria-oriented tests of professional achievements), interviews on the competence of cases, portfolio, etc. This can be achieved by including practice-oriented and situational tasks of a professional orientation in the list of assessment tools. The use of these assessment tools will allow for continuous monitoring of the quality of educational achievements and the formation of students' general and professional competences.

An important competence assessment technology is the so-called "competence interview", applied in personnel management. It can also be successfully used in pedagogical evaluation. This method is close to the case-study method, with the difference that the trainees are offered not hypothetical situations but problematic tasks that have already arisen in the educational process, for example, during their training or production practice. The interviewees' task is to describe how they have coped with the problem in the study process, thereby revealing their level of competence in front of interviewers.

Before conducting such an interview, it is necessary to carry out a comprehensive analysis of the competences to be evaluated with a view to developing a system of issues that correspond to the manifestations (indicators) of the competences being formed.

The use of this educational technology allows not only to reveal the level of the formation of professional competences, but also to check students' communication skills.

The relationship between practice-oriented educational technologies and communication competences is shown in Figure 1.



**Figure 1.** *The relationship between practice-oriented educational technologies and communication competences*

The pedagogical technology for reporting final paper devoted to the development of an engineering project, which is not shown in Figure 1, is also aimed at creating a number of competences. This pedagogical technology allows students to create the competence of “Understanding consumers’ needs”, “Understanding the needs of the enterprise”, “Knowledge of the prospects for the development of the industry”. This is important for the professional work of specialists at specific enterprises when preparing proposals for changing the quality of products, methods and technologies for manufacturing it, modernization of production (proposals for the purchase of new technologies or equipment with justification of their efficiency), etc. In addition, this technology also allows developing communication competence in the form of an oral report and a culture of answers to questions, as well as rhetoric skills.

In the process of project teaching with these pedagogical technologies, students synthesize new knowledge in the course of their search; integrate information from related disciplines; looking for more effective ways to solve the tasks of the project; communicate with each other.

The effective application of these technologies becomes possible if teachers fully utilize the potential of a quality educational environment, which consists of three areas of competence development - educational, professional and social. It is the harmonious integration of the three environments that gives a full and effective education at the exit of education process.

### **Conclusions**

The project activity demonstrates the potential of mono- and polysubject education, individual and group educational routes of project tuition in educational programs for engineers. “The engineering education research is the most effective avenue through which we can address overarching and grand questions” [27].

As a result of the research, it is shown how dedicated practice-oriented educational technologies of project training allow to develop specialists-engineers’ communication competences, including their rhetoric skills, which until recently has not been taken into account at all in the educational programs of engineering universities. These pedagogical technologies rely on the widespread use of digital technologies in the form of seminars, round tables, video conferences, in the process of Internet classes, etc.

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