Experience of using project-organized learning in Tomsk Polytechnic University

Yuliya Rizen
Institute of Cybernetics
Tomsk Polytechnic University, TPU
Tomsk, Russian Federation
yulja_vit@tpu.ru

Alena Zakharova
Institute of Cybernetics
Tomsk Polytechnic University, TPU
Tomsk, Russian Federation
zaa@tpu.ru

Mikhail Minin
Institute of strategic partnership and competencies development
Tomsk Polytechnic University, TPU
Tomsk, Russian Federation
minin@tpu.ru

Abstract—The article shows relevance of the model of effective training of graduates, describes the technology of project-organized learning and experience of using project-based learning in the TPU, set out advantages and disadvantages of this technology and provides necessary conditions for its realization.

Key words: education, competencies, technologies, project, Problem-Based Learning, Project-Organized Learning

I. INTRODUCTION

The rich history of training engineers in Russia contributed to the formation of certain traditions in the development of criteria and requirements for knowledge, skills and competencies of experts "engineers." But there are two interconnected processes today. On the one hand, the globalization of the economy and modern political realities have led to the abandonment of the traditional educational model with the qualification "engineer" of high school graduates. On the other - with the growth of production capacity of the country demand for specialists with qualification "engineer" is growing and will grow in the future [1]. This raises a number of issues that concern not only Russian universities, but also universities in Europe, as in many countries there are major changes in the approach to education: teaching methods changed in the methods of teaching.

In Tomsk Polytechnic University (TPU) are actively used these technologies, as in the preparation of bachelors and masters series of training courses.

In turn, the project activity allows the student to:
- study the complex processes and technical facilities at an affordable level for the understanding, and
- focus on the essentials, essential in the process, and
- to study the phenomenon, simulating the necessary conditions for its occurrence, and
- observe the phenomenon in the dynamics of the real process by modeling,
- to accompany the work of the model of visual interpretation of natural connections between its parameters in the form of graphs, charts, diagrams, and
to carry out operations of forecasting (for example, change of space-time scales of flow phenomena, set and change parameters of the system objects without fearing for her condition, as well as safety and security of environment).

In the current research and for solving real-world problems produce the most relevant work on the intersection of science and technology. Therefore, it is important for graduates of the university also have the ability to self-learning and obtaining new knowledge of the complex, including the new areas. In the TPU is being promoted experience in interdisciplinary projects, which are carried out within the framework of research on the intersection of science. For example, a scientific and educational laboratory
3D-modeling with students of different areas of training and participate in real-world projects associated with the modeling of oil and gas, 3D-visualization of complex technological processes, etc.

It is important that research is carried out on the request of the enterprises. Improving the quality of education (and, consequently, the demand for graduates), especially in technical universities, in modern conditions is possible only if the introduction of the educational process of advanced industrial technology at the highest level. That is why the university should focus on the development of the following activities: educational, scientific, and industrial (technical execution of projects for industrial and high-tech industries).

The implementation of such projects in the real level of production standards and requirements allows you to:

- harness the high-end sophisticated technology, thus enhancing the skills of employees of the University.
- results (knowledge and skills, goal setting) used in the educational process (primary and secondary education), which provides a high level of students in the field of demand and production technologies. Such graduates are able to become a talent pool of universities, research institutions and high-tech industries.
- implement the testing and implementation of the results of scientific research in the solution of practical problems.

An important aspect of the above-mentioned technology is that they interdisciplinary, i.e. the integration of different specializations, the need to bring projects specialists in different branches of production, not always related. Thus, in the real world must be able to work "on the team," and, therefore, are the same skills to impart the art at the stage of learning in higher education. In addition, any knowledge of the abstract becomes popular and useful when it is associated with real processes, events and tasks used in solving them. The effectiveness of this approach in the TPU confirmed by the high demand for graduates, high estimates of their accomplishments in the exhibitions and competitions at various levels, their internships at leading universities and centers.

Engineering education also focuses on project-organized learning. This has changed the content of the training through orientation with the input parameters on the results of training in universities and the organization of the educational process through the participation of the students.

Experience in Problem-Based (PBL) and Project-Organised Learning gained: Australia, city Griffith; Belgium, city Luuven; Russian Federation – Moscow: MADI, Moscow Engineering Physics Institute; Perm, Perm State Technical University; Tomsk: Tomsk State University, Tomsk Polytechnic University; USA: Philadelphia, New York; Australia [3].

Thus, work experience and a TPU showed that the most important conditions for the successful organization of project-organized learning are:

- realism of project tasks (regardless of the level of complexity and the learning phase, the essence of the project should be designed to address the real problem, with clear results and the realization of practical applicability of the results);
- the development of design technology (passing the entire cycle: Understanding and articulating the problem, review and analysis of existing solutions, develop their own solutions, its implementation, testing, processing accounting records, the protection of the result and, if possible, the implementation of the results), from project to project, increasing demands on the results;
- development of technologies that are in demand and used in modern production;
- highly skilled project managers (teachers and researchers of the university) with experience of the real and actual production projects;
- a close relationship with the companies (where possible, involve them in joint projects), employ graduates;
- motivation of all participants in the project activity (finding mutual interest).

III. EXPERIENCE OF USING PROBLEM-BASED LEARNING IN TOMSK POLYTECHNIC UNIVERSITY

Another promising technology training are problem-based learning (PBL). Different countries and universities have their own specific organization and methodological support problem-oriented activities. However, there are some basic principles that are common to all groups of problem-based training, causing the creation of specific case studies that are integrated into the curriculum, and the role of the teacher, the goals and objectives of the student evaluation system, equipment audience. The main difference from traditional PBL training is to organize activities so that students themselves must ask the questions needed to solve the case study and find answers in a search result and analytical assessment of the relevant information and joint discussions.

PBL requires special methodological support. First of all, the drawing up of cases and script writing, presenting detailed guidance for each class. This problem is solved in every university in different ways: for example, at the Tomsk Polytechnic University cases are made based on real situations and are reviewed at regular intervals.

The main objectives of PBL following case study:

- to teach students to formulate the steps to solve a particular problem;
- to develop skills of self-collection of necessary information;
- train the ability to brainstorm problems and joint decision-making;
- prepare to work in a team.
One of the most important conditions for PBL is the active collaboration of students themselves [4] for a more versatile learning problem and make collective decisions. PBL allows you to not only build and reinforce learning skills, but also learn the forms of consensus building, specifics of working in a team. Important advantages of PBL is to develop the ability to navigate the multi-disciplinary situations and the ability to find and process the necessary material through the use of various information sources (lectures, textbooks, dictionaries and reference books, online sources).

This form of communication allows a more successful on all issues (as there is no direct evidence and the instructions, therefore, the students take on more responsibility in decision- making) [5], as well as a better understanding of the material, as work is being done on the real situation, i.e. conditions as realistic as possible.

Despite a rather large and varied experience of PBL gained universities in Europe and Russia, one of the challenges is to find specific situations to create cases. Usually, each university creates its own set of (complex) cases and their support (video clips, articles and publications from the press, research, etc. - it all depends on the subject area). A number of universities (and large companies) even have computer programs for their students (and staff) to mimic a specific situation and thus greatly increase the effectiveness of PBL.

Experience within the technology described Tomsk Polytechnic University covers a range of training courses. As noted above, including in the field of information technology, 3D-simulations and industrial design. Search term partners and creating interdisciplinary teams to design and simulation in education, research and attracting students to the scientific and industrial developments are becoming an integral part of the work of teachers and scholars. Each year, this experience extends as deep (complicating technology and expanding the boundaries of projects), and covering more and more areas of bachelor's and master's degrees.

European Union today devotes considerable attention to the development described in this article educational technology. A significant number of grants allocated for the creation of a bank of virtual programs to benefit from the experience of different countries for educational purposes [6].

IV. CONCLUSION

All the above confirms the high demands of the educational process, the relevance of the use of effective educational technologies and enhance the quality requirements of the graduates.

The program is aimed at the development of TPU human resource development of education and science of providing the level of high-tech sectors of the economy in accordance with the most advanced international standards. To run the program is necessary, first of all, to solve the problem of excellence focused on new, promising and effective processes of world-class view of the diversity of human and national wealth, the creation of intellectual and professional potential of society, able to productive intellectual activity [7].

REFERENCES