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"Journal of Economics and Social Sciences"

Improving the Quality of Education through a Project-Oriented Structure of Engineer Training

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Abstract

The paper examines the way to improve the quality of the educational process through a project-oriented structure of training engineers that provides key competencies for young engineers. The tool for assessing competences is proposed to take a questionnaire, questions will be drawn up in such a way as to assess not a theoretical set of knowledge, but the ability to use knowledge and suggest a way to solve the task. The main idea of improving the quality of education is the ability to work with the sustainability of innovation through design, tests and e-learning. Any process of developing a solution and launching a product must be accompanied by marketing research on real production facilities. To work with innovation, it is necessary to carry out a set of marketing activities.

Keywords: Engineering education, quality of engineering training, project-oriented structure, competencies, the system of marketing innovations*;*

1. Introduction

At present, the Russian Federation faces a number of engineering and technical challenges. There is a change in the package of basic technologies on which modern industry and the economy as a whole are built. There is an imbalance between the quality of engineering training at universities and the requirements of employers. A new class of engineers is needed, they should be able to design systems based on a new package of basic technologies and work in these systems [1].

2. Discussion

According to the RAEE (Association for Engineering Education of Russia) experts, the quality of engineering education is determined by the quality of engineer's training.

The quality of education at the university includes the system of evaluation of the following indicators: program objectives and learning outcomes, program content, organization of the educational process, teachers / faculty, preparation for professional activities.

If you evaluate the program objectives and the results of the training, then it is necessary to check the compliance of the goals with the result, which is carried out through the control of knowledge - tests, answers to questions on tickets, questionnaires, interviews.

When assessing the content of the program, it is important to check it due to FSES (Federal State Education Standards), to check a list of disciplines that meet the requirements of employers and the inclusion of dual education.

Assessing the organization of the educational process, it is important to have active learning technologies with the use of educational resources, work with e-learning courses, practices and internships.

Teachers / faculty members are assessed due to their practical experience in the discipline that they are taught, occupational studies and internships, the implementation of an individual plan.

The preparation to the professional work is checked by the following factors: mastering interdisciplinary modules of the educational program, conducting research, apprenticeships, implementing course projects and final qualification work, and having a portfolio of students.

Evaluating the resources of the program, it is necessary to have a library containing the materials necessary for teaching, including educational, technical and reference literature, as well as periodicals, Internet access for teachers and students to the world information resources, including to domestic and foreign databases of the newest scientific publications, as well as to domestic and foreign databases of research results and technological developments, modern equipment.

New perspectives are needed for teaching and learning in the field of higher engineering education, which provide opportunities for working in a dynamically developing environment.

To improve the quality of the educational process, we offer a project-oriented structure for training engineers, which provides key competencies for young engineers.

At the moment, there are a number of competencies that a graduate of the future must have:

	Competencies	**Elements for teaching skills**
Professional and methodological competences	○ Entrepreneurial type of thinking (project management); ○ Client-oriented; ○ Knowledge of procedures, methods and tools for finding solutions, for sustainable value creation, for product development and business models; ○ Lean production; ○ IT skills; ○ Interdisciplinarity.	○ The project theme is focused on the development of sustainable innovation and the creation of a start-up company; ○ E-learning courses; ○ Application of specific engineering methods and tools.
Social competencies	○ Intercultural competence; ○ Opportunities for teamwork and management of people, cooperation; ○ Communication ability and persuasion; ○ Willingness to resolve conflicts.	○ Intercultural and interdisciplinary team composition; ○ Work of the project in small teams and with working packages; ○ Periodic presentations and progress reports.
Independent competencies	○ Cross-border mobility; ○ Leadership and self-confidence; ○ Formation of facilities and development of training skills; ○ Interaction and	○ Mobility phases in each partner university; ○ Independent work in an intercultural and interdisciplinary team; ○ Presentations and

	conscientiousness (reliability), awareness.	discussions in teams.

According to a study carried out by Tim Stock and Holger Kohl, the key idea of improving the quality of education is the ability to work with the sustainability of innovation through design, tests and e-learning. Three phases of training are offered

1. Stage of acquisition of students and preparation of the project by teachers;
2. Working phase of the project, aimed at monitoring and developing a sustainable startup;
3. The phase of e-learning with specific lectures, focusing on the development of sustainable innovation [2].

It is necessary to assess the knowledge and skills before the project, the instructor should work out the tasks in detail, collect students into teams, give out assignments and after the report s/he should assess the changes in competences. The tool for assessing competencies should be a questionnaire, where the questions will be drafted in such a way to assess not a theoretical set of knowledge, but the ability to use knowledge and suggest a way to solve the task. Based on the obtained scores, it is possible to construct a polygon of competencies (Figure 1).

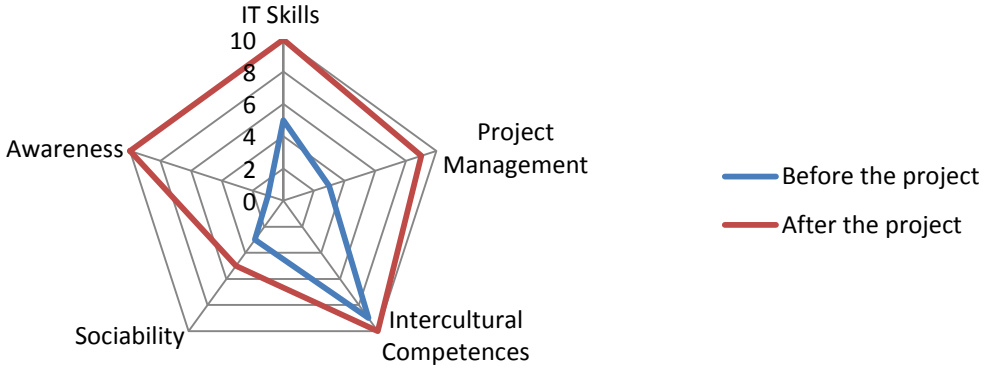

Figure 1. Example of constructing a competence polygon

From the chart, you can see the result that shows the changes in skills before and after working on an innovative project.

It is important to note that any process of developing a solution and launching a product must be accompanied by marketing research on real production facilities. To work with innovation, it is necessary to carry out a set of marketing activities. The innovation marketing system can be seen in Figure 2 [3].

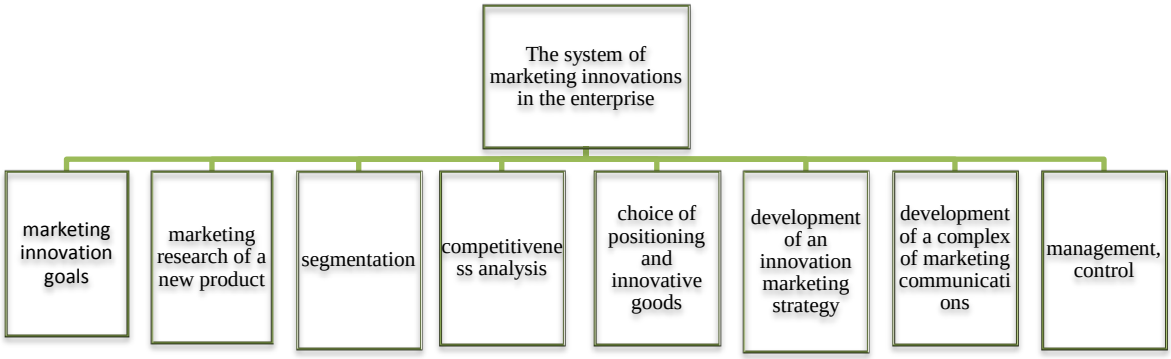

Figure 2. The system of marketing innovations at the enterprise

According to the presented scheme it can be seen that the marketing goals for innovation sould be established, research should be conducted, client portraits should be created, positioning should be chosen, strategies and communicate must be developed for students, and all these activities must be regularly monitored.

It should be noted that systematic development of skills is necessary not only in their professions, but also in other spheres of activity. The modern market requires the graduate of knowledge beyond his/her profession.

3. Conclusion

The paper proposes a methodology for a project-oriented learning structure that helps to improve key competences for young engineers. To ensure the required competencies for young professionals, it is necessary to develop focused concepts aimed at achieving an entrepreneurial goal through the development of innovations, which provides an important social and independent competence.

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