

# Competence-based System of Pedagogical Professionalism Development of Teachers in Engineering Universities

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**The article deals with the problem of continuing development of teachers' pedagogical professionalism in engineering universities in the context of contemporary state of higher professional education. It justifies the necessity to modernize the existing retraining system of the teaching staff. The formation of competence-oriented modular-based retraining system of the teaching personnel is discussed. It also describes the experience in implementation of modular-based component of the retraining system.**

**Key words:** *engineering education, professional and pedagogical teacher training, the certification of teachers, training, modular-based retraining system, competence-oriented training system.*



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The strategic aim of engineering education in context of Russian economy transition to a new level is to train competitive in-demand engineers capable of independent goal setting and problem solving [1,2].

An important factor that determines graduates' professional training quality is high level of teachers' pedagogical professionalism. To train graduates who can meet the requirements of society, teachers should be ready to design and implement basic educational programs satisfying FES HPE (Federal Education Standards, Higher Professional Education) requirements.

Taking into account the transition to the multi-level structure of higher education and competence-based approach, a modern instructor of engineering university is imposed with high requirements in pedagogical design, efficient use of modern pedagogical technologies, monitoring of learning

results, development and application of e-learning and etc. Thus, the problem of continuous development of teachers' pedagogical professionalism in engineering universities is becoming crucial.

TPU, as national research university, is to make a significant contribution into the staff potential development of Higher School, including retraining of Russian universities' teaching staff.

A complex system of continuing development of teachers' pedagogical professionalism (hereinafter referred to as System) has been developed and is being successfully implemented in TPU. It meets both Russian and international standards such as:

- State requirements to the instructor of Higher School [3].
- Engineering and pedagogical competencies of the instructor of Higher School approved

by International Monitoring Committee IGIP [4].

The System includes the following components:

- Additional education program “Instructor of Higher School”.
- Professional retraining program “Pedagogic metrology organization”.
- Program “Instructor of Higher Technical School” certified by Russian Monitoring Committee IGIP.
- A complex of short-term retraining courses (72 hours).

The short-term retraining courses aim at developing a number of professional teacher’s competencies, such as:

- ability to develop basic education programs (BEP) to meet the FES HPE requirements;
- ability to implement effectively BEP modules of new generation to ensure students’ achievement of competency-oriented learning results;
- ability to develop and apply on-line educational resources for students to learn independently by means of Internet;
- ability to implement effective project learning in the structure of integrated curriculum to develop students’ problem-solving skills in professional activity;
- ability to design, implement and evaluate the quality of students’ independent learning activity in student-centered environment.

Under the condition of new generation BEPs implementation it becomes necessary to enlarge the list of educational services for teachers’ retraining and to improve the technologies of its implementation. According to BEP TPU Standard, “while being certified university teaching staff should prove their qualification according to the requirements of Regulations on Teaching Staff Competencies Evaluation” [5].

The Regulations distinguish a set of teacher’s competences to be developed that are of prior interest for National Research Tomsk Polytechnic University. The competence requirements enumerated in “TPU teacher’s passport” take into account specific character of current stage of higher professional education development. They include such teacher’s ability as-creating student-centered educational environment with priority of students’ independent cognitive activity, managing project and research work of students, designing educational programs and discipline modular etc.

The regulations provide that teachers’ competence evaluation is conducted in the frame of their certification. Terms and type of retraining are determined on the basis of complex evaluation (including self-evaluation) of teacher’s professional and pedagogical competence level.

A complex of competence-oriented training modules has been developed for practical methodical support of teachers involved in the design and implementation of new generation BEPs. This is a significant component of the system of teacher’s pedagogical professionalism development.

Along with the content development, there is modernization of implementing procedures of teacher retraining system. In this context, a modular technology is considered to be promising because it is oriented on principles of productivity and experience accumulation.

The project of modular-based retraining system (MBRS) for the university teaching staff was developed in several stages.

The first stage was intended to develop the structure and content of training modules focused on professional and pedagogic competencies included in “TPU teacher’s passport”. This stage required well coordinated team work of teachers, psychologists and specialists in pedagogic metrology.

Special attention was paid to the modules that ensure the development of the following competencies:

- ability to manage learning process in student-centered educational setting where learning prevails over teaching (C3).
- ability to design educational programs and modules (disciplines) according to the FES HPE and TPU BEP standards, to define their targets and objectives, to plan learning outcomes and choose the most effective strategies for their achieving in collaboration with employers and the University's strategic partners (C6).
- intention to apply modern educational technologies that combine different organizational forms of learning and educational process to achieve the planned outcomes in an effective way (C9).
- ability to use modern IT means and technologies for learning/teaching process management (C10).
- ability to apply adequate and objective assessment and control methods to evaluate student learning outcomes including graduates' professional and basic competencies (C11).

There are the following modules that are focused on the development of teachers' ability to design education programs and to manage education process in a student-centered setting:

- "Basic education program design".
- "Design and implementation of competence-based modules of basic education program".
- "Individual education program management".
- "Competence-based approach to the planning of learning outcomes control in a studied discipline".

- "Management of students' independent learning activity".
- "Pedagogic design of new generation manuals".

The following modules ensure the development of competencies 9 and 10 that determine teachers' ability to create and implement possibilities of University's modern educational setting:

- "Modern media-technologies in teaching process".
- "Use of interactive demonstration equipment in teaching process".
- "Interactive teaching technologies".
- "Html-format manual development".
- "Flash-technology development and application in teaching process".
- "Teaching material development in "Moodle" environment" etc.

The ability to apply adequate and objective assessment and control methods to evaluate student learning outcomes (C11) is developed during studying the courses that are based on modern theories of pedagogical metrology (the theory of control material construction, the theory of text modeling and parameterization, the theory of adaptive testing):

- "Development of assessment tools fund"
- "Design and development of assessment tools for independent student activity".
- "Test material development".

The distinctive features of the modules are goal orientation, logical content completeness, and efficient feedback. Methodical cases of the modules include data base, lecture-presentations, questionnaires, tasks, examples, samples of the trainees' works.

The second stage of MBRS design included the development of teaching process management model based on student-centered approach, productiv-

ity and accumulation principles, that imply summing up labour intensity of the retraining modules.

According to the developed model, the teachers are offered to construct their individual long-term retraining pathways that are based on preliminary questionnaire of teachers. The questionnaire procedure implies teacher's self-assessment of the competence development level and specialist's consulting on the retraining module choice and the development of individual plan structure formation.

The retraining pathway construction includes the development of individual plan for retraining with labour intensity of 2 credits (72 hours). It consists of training modules chosen by a teacher in accordance with the character of problems that arise in the process of education program implementation (module labour intensity is 0.4-0.5 credit).

The MBRS implementation stage started in 2011, when modular program "Basic Ways of University Education Process Improvement" was launched.

The basic unit of the program includes the following modules: "Education Program Design Based on Specialist's Competence Planning", "Teaching Process Management Based on Credit and Rating System", "Competence-Based Training Module Design".

The elective unit consists of 11 modules, such as: "Pedagogical Design", "Pedagogical Tolerance in Teacher's Professional Culture", "Social and Psychological Aspects of Students training", "Creation of positive communicative education environment", "Development of Assessment Means Fund", "Individual Education Program Management", "Electronic Teaching Material – Teacher's Personal Education Environment", "Web2.0 Technologies in BEP" etc.

The university teachers were given an opportunity to form an individual pathway of the program acquisition by

choosing the modules from the elective unit and setting a problem to research in the qualification project. Such model implementation experience proves that the trainees are more motivated and productive. At the same time it is necessary to pay more attention to differentiated treatment in the retraining process.

In the regulations of TPU teacher staff retraining [6] the MBRS is regarded as a possible alternative to the traditional way of university teacher retraining.

At present, the MBRS in TPU includes 30 problem-oriented educational modules for teachers' retraining. A list of the modules with their short descriptions is available online Department of Engineering Pedagogy, TPU. The modules are supported by methodical cases including data base, lecture-presentations, questionnaires and tasks.

The teaching staff of all the TPU departments is retrained in the frame of the MBRS. The modular program completion is confirmed by a standard certificate. By now, 150 certificates have been awarded.

The project result analysis shows that the MBRS is effective in terms of implementation of trainee-centered approach to individual retraining plan development, their problem orientation and practice-oriented tasks.

The ways of the MBRS improvement have been determined. It is planned to enlarge the number of educational modules and to develop their methodical support.

In the context of implementation of the President's program for engineering staff retraining a complex of special training modules is developed. It is done for teachers who teach retraining courses for engineers [7]. There are modules devoted to the problem of adult teaching ("Didactics of Adult Teaching", "Psychological Aspects of Androgogics") as well as trainings to develop the scenario of interactive training activities.



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