

# Development and Implementation of Basic Educational Programmes in Engineering and Technology

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- In 2011 all Russian universities have to adopt the two-cycle Bachelor (4 years) – Master (2 years) system of education. This situation dramatically changes the approach to learning content. Development of new educational programmes, introduction of active learning methods and technologies, retraining of university teachers are required. Under such hard conditions, it is particularly important to develop the university staff career development system properly. New educative process should include the following:

- it should be focused on a student's acquisition of both subject and non-subject skills.
- the teacher is to be convinced that educational process is more than collecting and (or) passive memorizing information given – it is personal knowledge creation.

The above difficulties can be overcome within the implementation of educational programmes development made by trained teachers.

The transition from the existing qualification-oriented BEPs of the State Educational Standard of Higher Professional Education (SES HPE) of Second Generation to the competence-oriented educational programmes that meet the Federal SES HPE of Next Generation requires solving the interrelated analytical and design task complex .

The priority tasks include development of educational programmes competence-oriented educational content, appropriate teaching and learning technologies that ensure competencies development and assessment.

Educational process effectiveness is largely determined by adequate choice and professional implementation

**The article reflects the inherently systemic character of organization of work on development and implementation of the basic educational programmes (BEP) of next Generation in National Research Tomsk Polytechnic University (NR TPU). the principal feature of the described experience is that a BEP is treated as a project concentrating all “input” and “output” parameters of educational process: from objectives of professional education to objectives of a specific class, from development of teaching and learning technologies to choice of assessment methods.**

of specific educational technologies. Commitment to the teacher's method of engineering and creativity combination teaching should be based on the following criteria: accurate educational objective formulation (what to teach and what to do it for) is to facilitate the content selection and development (what?), organization and management of educational process (how?), teaching methods and means (with the help of what?), considering necessary qualification level of teachers (who?) and methods of obtained result assessment (is it right?).

Within the implementation of the Innovative Educational Programme (2007-2008) Tomsk Polytechnic University has gained quite great/ solid experience in the BEPs of Next Generation development and implementation. 25 innovative Master educational programmes within the frame of the Standards of Next Generation and with the use of advanced education principles have been developed and implemented. The basic document of BEPs development process is the Standard of the Basic Educational Programme of Tomsk Polytechnic University (TPU BEP Standard) oriented in accordance with the requirements of the SES HPE to the graduate competence model formation, implementation of the two-cycle system of education (Bachelor, Master), use of the credit system of evaluation of BEP modules workload [1].

To ensure quality of education, the TPU BEP Standard considers the requirements of international standards ISO 9001:2000, national and international professional organizations (the Association for Engineering Education of Russia, the Washington Accord, EN-QHEEI, ENAEE) as well as the criteria for international certification of professional engineers (FEANI, VVFEO, the APEC Engineering Register, EMF).

In order to provide methodological support for the development teams, the university staff prepared the recommendations for Master programmes development on the basis of graduates competencies planning [2] and organized workshops "Competence-Based

Approach in Educational Programmes Development" [3].

Development of BEP began with credit evaluation of graduate competences as planned training/educational outcomes [4]; the results of evaluation were used in the curriculum development, considering contribution of academic disciplines in formation of the graduate competence model.

Development of competence-oriented work programmes of academic disciplines is an important and time-consuming stage in BEP development.

The competence orientation of academic discipline work programmes (modules, courses) as a part of the BEP of Next Generation includes:

- planning the results of discipline study that are consistent in content and form with the results of BEP training series mastering;
- development of content and education technologies ensuring achievement of expected learning outcomes, development of cultural and professional competence;
- development of assessment tools and procedures appropriate to stated learning outcomes.

The experience of TPU in BEP development within the implementation of the competence-based approach is valuable because it reveals specific features of difficulties encountered by programmes developers.

Forward estimate/ Primary analysis of the developed BEPs shows that adjustment of such sections of the Educational Standard as "Requirements for learning outcomes of basic educational programmes", «BEP structure», «Terms of BEP implementation" is needed. In particular, in the section on "learning/ training outcomes" results of educational programme mastering in the form of competencies are not reasonably stated. In the section "Terms of BEP implementation" characteristic of learning technologies that ensure achievement of planned BEP results causes difficulties.

Analysis of the developed work programmes of disciplines and other documents of the educational and methodical complex shows that programmes of self-study and materials of educational results monitoring should be completed within the context of the competence-based approach. The recommendations for correction of the BEP documents are developed. The results of the developed documents complex analysis are taken into account while forming the support system of educational and methodical activity of teachers in development and implementation of the BEP of Next Generation.

The support system includes a range of refresher courses and internships in three priority orientations of education modernization:

1. Technologies of training modules development based on the FSES of Third Generation.
2. Modern teaching and learning technologies.
3. Information and instructional setting of the Next Generation educational programmes.

The career development system in these orientations is module-based (see Table 1).

**Table 1**

Modules	Modules Objective
1 The competence-based approach to development of educational programmes <a href="http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-3-1.html">http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-3-1.html</a>	Acquisition by participants of the skills for graduate model development in the competence format
2. Development of the fund of assessment tools taking into account the requirements of the FSES HPE <a href="http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-3-2.html">http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-3-2.html</a>	Improvement of participants skills in the development of different forms of learning tasks in the structure of the BEP of Next Generation
3. Organisation of educational process on the basis of the credit and rating system	Use of the rating system for quality assessment of students achievements in academic subjects
4. Development of test materials <a href="http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-3-3.html">http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-3-3.html</a>	In-depth training of participants in development of test materials, their assessment and use in educational process
5. Modern teaching and learning technologies <a href="http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-1-1.html">http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-1-1.html</a> <a href="http://portal.tpu.ru/departments/centre/imc/otzivi">http://portal.tpu.ru/departments/centre/imc/otzivi</a>	Training of teachers in development and implementation of teaching and learning technologies that ensure formation of the competence model of graduate.
6. Problem-based learning in the structure of BEP of Next Generation <a href="http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-1-2.html">http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-1-2.html</a>	Training of teachers for effective use of technologies of problem-based and project-organised learning in educational process
7. Basic information competence of university teachers <a href="http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-2-1.html">http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-2-1.html</a>	Development of ability of teachers to use ICT in their professional activities
8. Electronic books <a href="http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-2-4.html">http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-2-4.html</a>	Training of participants for development and effective use of electronic books in the educational process of university
9. e-Learning Management System <a href="http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-2-2.html">http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-2-2.html</a>	Effective increase in degree of virtuality of learning technologies implemented in the university, development of the competence of teachers in use of computer-networking teaching and learning technologies

TPU faculty and staff have an opportunity to plan an individual content trajectory of training.

To support the project scientific and methodological activities of participants, the complex of intra-university regulatory methodical documents is prepared, the fund of e-learning resources is formed and continually replenishing [5].

Modern methods and forms of learning organisation such as trainings, imitating games, case method, and discussion are widely used in the educational process with traditional ones.

The experience of TPU teachers' refresher courses implementation and the experience of other Russian universities during 2008-2010 shows the demand for this form of methodical support of BEP developers, high level of teachers' interest, productivity of learning outcomes.

Generalized development and implementation of the Next Generation educational programmes experience

suggests need for the preparatory stage including the following work package:

- Correction of the regulatory methodical documents of educational process organisation within the context of the competence-based approach.
- Formation of BEP developing/ developer teams in the main areas of Bachelor and Master training.
- The information and methodical support formation of the BEP developer teams project activity.
- Organization of university teachers training for development and implementation of the Next Generation BEP.

It is believed that the accomplishment of the above work stages connected with the development and implementation of the basic competence-oriented Bachelor and Master educational programmes will facilitate successful transition of the HEP educational system to the Third Generation FSES HEP.

## REFERENCES

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