ENGINEERING EDUCATION
6'2010

Editorial board

DEAR READERS,

According to the Bologna Declaration a two-level higher education system has been introduced in Russia. Instead of training experts in various professional fields, who were awarded diploma of Specialist, universities as a rule will prepare graduates with Bachelor or Master Degree.

The whole engineering education system got a certain level of shock because of this transition, as neither universities, nor labor market was prepared for it. Those business leaders, who have recently graduated themselves with engineer (specialist) diplomas have not heard "hide nor hair" of such qualification as a "bachelor".

The Russian Federation joined the Bologna Declaration and the country authorities "brought pressure" on universities in order to expedite the switch to a two-level higher education system. However, it seems that they have forgotten about the crucial need to develop simultaneously new educational standards for bachelors and masters, as well as to provide vacancies for graduates with new educational skills in the staff lists of enterprises. Obviously, this situation plays the role of the inhibiting factor for the reforming process in higher education system. Universities and teachers working there do not clearly understand for whom and for what they are preparing graduates with Bachelor and Master Degree. Employers, for example, find it difficult when assigning newcomers to engineering positions. Graduates also face a lot of problems especially when applying for a job.

Nevertheless, technical universities that have leading positions in the transforming process express profound concern over improving the quality of training professionals in the field of engineering and technology. Professors and researchers from many universities have been studying the ways and tools to assess and improve the quality of engineering education. Among these tools the most common and effective are quality management systems at university, public and professional accreditation of educational programmes and certification of engineering qualifications.

It is no less important for improving the quality of engineering education to apply new approaches in designing educational programmes, using the competence models, to organize engineering practices, to develop the advanced education system.

In this issue you will find the articles exploring and revealing current processes and problems that take place in the system of engineering education in Russia. Some of the presented articles are debatable and it makes them even more valuable. This opens space for creativity in such important area as improving the system of engineering education in Russia.

Dear readers, I am happy to inform you that starting from this issue, Journal "Engineering Education" has become a eviewed journal, and its English version will be available on our official website www.aeer.ru.

Sincerely,
Editor-in-Chief,
Prof. Yury Pokholkov

Contents

Mechanisms of Independent Learning Quality Assurance Based on the Analysis of Demand for University Graduates at Labour Market and Recommendations on Their Practical Application

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INTRODUCTION

The Concept of the Federal Target Programme of Education Development for 2006 - 2010 approved by the RF Government Executive Order of September, 2005 № 1 340p has stated the necessity of adjustment of learning content, techniques, and methods of quality learning assessment in accordance with the requirements of modern society and development of regulation mechanisms relevant for problems of education system development [1, p.1-3]. To ensure the learning quality one needs the institutional improvement of education system on the basis of efficient interaction of educational institutions with labour market.

The modern Russian education system is characterized by lack of universities' responsibility for the final outcomes in learning activity. The independent forms and mechanisms of citizens', employers' and professional associations' participation in solving the problems of educational policy including the processes of independent public quality learning assurance has not been developed sufficiently. [1, p. 1-3].

Modernization of education system is reported to be one of the basic priorities for the government development over the long term up to 2020.

One of the main problems in modernization of education system is formation of quality assessment mechanisms and education service demand assessment with participation of consumers in international comparative investigations by means of development, including:

- clear, open information system of educational services providing complete, accessible, reliable and timely information;
- mechanisms of involving consumers and public institutions in regulation and assessment of learning quality [2, p. 4],[3, p. 7].

In this connection design and implementation of efficient learning quality assessment mechanisms at all levels of the Russian education system are urgent governmental tasks.

MODEL OF INDEPENDENT QUALITY LEARNING EVALUATION ON THE BASIS OF UNIVERSITY GRADUATES' DEMAND ANALYSIS AT THE LABOUR MARKET

Investigation made by the Employment and Practical Training Center «MADI-PROFI» in 2008 - 2009 allowed developing Russian system model for independent assessment of higher profes-

ENGINEERING EDUCATION 6'2010

sional education quality based on analysis of demand for university graduates' at labour market called «PRO-vuz» (Fig.1).

PROvuz is aimed at the university professional learning quality assessment according to the results of educational activity. For such results demand for university graduates at labour market, their career successes are taken as indicators. The basis for the PROvuz model is the research of graduates' employment process and revealing the factors responsible for its efficiency.

University quality learning assessment by the PROvuz model includes 5 stages:

1. Preparatory stage;
2. Collection of preliminary information;
3. Processing the preliminary information;
4. Result analysis;
5. Preparation of analytical report and its submission, ranking of universities and submission the rating.

At the preparatory stage preparation and production of questionnaire as well as training of interviewers are arranged. Implementation of PROvuz programme suggests application of face-to-face poll technique i.e. at the presence of interviewer.

The given technique allows increasing in reliability of information due to the interview of all university graduates.

Collection of preliminary information by means of interview question involves completing an anonymous questionnaire containing the following set of questions:

- Information on education;
- Information on employment;
- Information on learning quality in university;
- Processing the preliminary information consists of 4 sequential operations: development of preliminary data matrix;

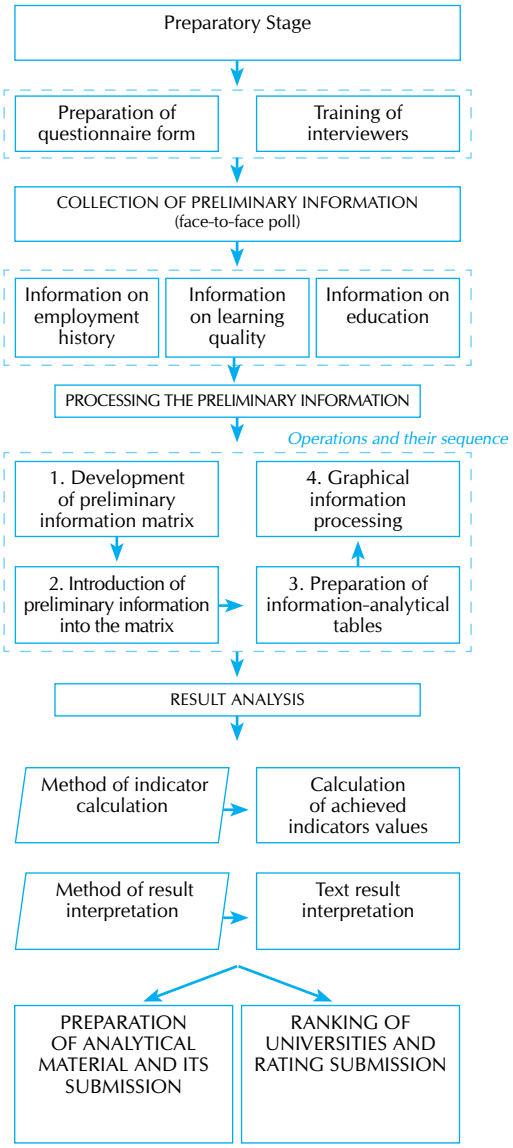

Fig. 1. Model of Independent Learning Quality Evaluation «Provuz»

The article states the necessity for development of independent quality assurance mechanisms. The description of independent university learning quality assessment model is presented on the basis of demand analysis model «Provuz» for university graduates. The indicators of university quality assessment and factors responsible for graduates' employment efficiency are given. The examples of application of university quality assessment results are shown.

- Introduction of preliminary information into the data matrix;
- Preparation of analytical tables, graphical information processing.

As processing of such significant data volume requires software, at the stage of processing of preliminary information it is necessary to «convert» the questionnaire data into electronic form – matrix. The matrix cannot be completely unified, since different universities train in different specializations and present different structures of subdivisions (departments). This fact implies the necessity of matrix development for every university individually.

Introduction of preliminary information into the data matrix may be done either by interviewers with special software or graduates autonomously with special electronic forms (questionnaires).

The preparation of information-analytical tables is followed by the operation of data graphical processing. Structure and content of information-analytical tables are defined by:

- the structure of professional training in a university including the number of specialities;
- the scheme of preliminary information processing.

Graphical processing is necessary for the subsequent analysis of assessment results and suggests their visualization in the form of graphs, charts, and histograms.

It is possible to simplify the procedure of preliminary information processing by development of special programme for data processing.

The result analysis includes calculation of reached indicator values, text interpretation of evaluative results which is made on the basis of calculation techniques of indicators and result interpretation. The reached indicator values are included into the indicator chart that contains indicating items and units of measurement; the reached indicating value; the list of factors influencing the indicator values.

Text interpretation of the researched results is presented in the form of report that contains the analysis for influence of educational activity process on demand for graduates' at labour market. Such conditions could include:

I. Learning process – actions aimed at the increase in graduates' demand at labour market:

- practical training and probation (compulsive actions included in curriculum) as an assistance in employment;
- conditions for combination of work with studies as well as their efficiency (schedule of class attendance, information about vacancies on terms of part-time etc.);
- university system of quality management for students' learning the subjects included in curriculum.

II. Career guidance in university – a set of actions aimed at formation and development of students' patriotic attitude to the chosen job, their ability to analyze the conditions and main trends in labour market development, skills of independent job search. Open classes «Introduction to speciality», courses of additional professional training, conferences and workshops on employment problems etc. could be taken as such measures.

III. Arrangement of university interaction with employers – a system of special actions taken by university together with engaged employers to increase the level of demand for university graduates at labour market. The following measures can be considered in this case:

- target contract training;
- graduates' employment on request of employers;
- recruitment actions (career fairs, company presentations, etc.);
- students' construction gangs.

INDICATORS OF LEARNING QUALITY ASSURANCE BASED ON THE ANALYSIS OF DEMAND FOR UNIVERSITY GRADUATES AT LABOUR MARKET

University graduates' employment efficiency is characterized by the following indicators:

1. The level of demand for graduates (LDG) by which the number of graduates having a job and (or) job experience at the date of graduation from university of the total number of graduates is meant.

2. The level of professional demand (LPD) by which the number of graduates having a job in speciality and (or) partly in speciality trained in the university of the total number of graduates employed at the date of graduation from university is meant.

3. The level of salary (LS) by which the average salary of graduates employed at the date of graduation from university is meant.

4. The level of professional self-identification (LPS) by which the number of graduates planning to work in speciality and (or) partly in speciality trained in the university in the mid-term out of the total number of graduates employed at the date of graduation from university is meant.

5. The level of employee'expected income (EEI) by which the average salary of graduates employed at the date of graduation from university, offer of which by employer serves as a reason for job change is meant.

6. The level of applicants'expected income (AEI) by which the average salary of graduates not employed at the date of graduation from university the offer of which by employee serves as a reason for graduate's employment.

7. The level of career support (LCS) by which is meant the number of graduates out the number of employed graduates who got a vacancy in one of the following way:

- Obtaining information via mass media of university (site, advertisement etc);
- As a result of target contract training completion;
- According to the results of internship (training, field, pre-degree practice);
- According to the results of participation in career fairs, career days arranged by university;
- By means of application to the university employment centre;
- On recommendation of a teacher.

LCS shows the degree of university assistance in building the graduates' successful career, namely: quality of university interaction with field-specific employee including quality of task-oriented work in employment assistance.

8. Efficiency of career support (hCb) by which is meant the graduates' average salary of the number of employed ones at the date of graduation from university who got the vacancy by one of the following way:

- Obtaining information via mass media of university (site, advertisement etc);
- As a result of target contract training completion;
- According to the results of internship (training, field, pre-degree
- practice);
- According to the results of participation in career fairs, career days arranged by university;
- By means of application to the university employment centre;
- On recommendation of a teacher.

9. Correlation of professional requirements (CPR) by which the character of demand for graduate dependence on academic progress during the course of study is meant. CPR allows estimation of relationship of requirements for students' learning made by university to the requirements for professional training made by an employer.

As the factors influencing the efficiency of graduates' employment in the course of research are taken:

- Graduates working experience got within the period of study;
- Graduates' salary;
- Academic progress in the course of study (estimated in average score of diploma assessment sheet);
- Ways of employment (obtaining information about vacancies) used by the graduates in the employment process.

IV. Application of learning quality assurance results based on analysis of demand for university graduates at labour market.

The results of assessment may be presented in the form of analytical report or universities' rating. University learning quality assessment results derived from PROvuz model application allow:

1. For consumers (potential consumers) of educational services - to choose a university to enter, the degree to get (bachelor, specialist, master) and course to be taught consciously and reasonably on the basis of employment data (demand) on graduates of the particular university, speciality, department etc.
2. For employers - to arrange the interaction with universities taking into account the university's real results in demand for its graduates at labour market, to determine the possible directions in investments of educational process including target contract training.
3. For executive government bodies, management education units, founders of universities - to make an administrative decision aimed at:
   - optimization in the network of higher education institutions depending on the results of their educational activity;
   - correction of target figures for enrollment of students depending on the demand for graduates at labour market;
   - making personnel decisions;
   - improvement of education content of some university curricula;
   - development and realization of employment programmes based on the results of young specialists' employment.

For rectors of universities - to use the designed system for in-university monitoring of current condition in bachelors', specialists', masters' training quality including assessment of units' (faculties, departments etc.) efforts in communication with field-specific employers.

Thus, the system of independent university learning quality assurance based on PROvuz analysis model of demand for university graduates at labour market makes possible to meet all education service consumers' requirements in acquiring reliable information on the quality of higher education in every university and to become in demand in universities as an element of in-university system of learning quality monitoring increasing the potential of self-assessment in this way.

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Students and Employers about the Two-level Education System and Their Assessment of Quality Assuarance at University

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According to the Federal law of 24.1 0.2007 №232-FZ 'Concerning the Introduction of Amendments to Certain Legislative Acts of Russian Federation (concerning the degree system of higher professional education)' all Russian universities should transfer educational programmes to the two level degree system (Bachelor and Master degrees) from 1 September 2009. The main objectives of the reforming strategy of Russian higher education system include:

- adopting a system of comparable documents on higher education, including the introduction of a single application form to the diploma for graduates in Europe for European citizens employability and the international competitiveness of European higher education system;
- transition to a two-level (Bachelor, Master) higher education system and further the three-level system (Bachelor, Master, PhD);
- implementing a system of credits that can be easily transferred (European Credit Transfer System - ECTS) as a means of promoting academic mobility of students, free access to all educational services and expanding opportunities for teachers and researchers to participate in European research and education;
- promoting academic mobility by overcoming obstacles that prevent effective mobility of all stakeholders;
- cooperation in quality assurance with a view to developing comparable criteria and methods. Evaluation will be based not on length or content of courses, but on the knowledge and skills that graduates have acquired. At the same time standards for transnational education will be set;
- increasing the prestige of European education by promoting inter-institutional cooperation, mobility schemes and joint educational programmes, practical training and research.

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The article provides students' and employers' opinion review of higher education reform and importance of developing common cultural competences among graduates. The employers' opinion about graduates of Viatka state university is also cited.

Introduction of a two-level system of education in Russia has risen questions not only among high school teachers, but also the employers and students. Many business representatives do not clearly imagine competences of the future bachelors, perceiving them as "dropout professionals." [1]

This article provides students' and employers' opinion review of the switch to a two-level education system, as well as the quality of education at university. A special questionnaire covering the issues was designed. In April and May 2010 students of the fourth year in Applied Mathematics and Computer Science of Vyatka State University, as well as the 10 largest companies - employers took part in the survey. When designing the questionnaires for students, materials developed by the Higher School of Economics and Yaroslavl State University were used. Before completing the form all students were given instructions and an explanation about the evaluation criteria.

At first, students had to define their understanding of "education quality". The majority define "education quality" as education, that provides students the opportunity to acquire good theoretical knowledge and practical skills that enable them to be competitive in the labor market. It should be noted, that in fact students point out a competency based approach, although as it will be shown below, not all of them know or understand the goals and purposes of the Bologna Process.

On the question about students' awareness of the aims and objectives of the Bologna Process, 1 5% of respondents said they are well informed, 31 % - know in general terms or do not know, 23% find it difficult to answer. But 100% of the respondents know about the transition to a two-level education system bachelor-master. For successful employment and career development 85% of students choose a 5-year educational programmes, 4-year- and 6-year programmes are supported by 7,5% of the respondents each one. As for the diploma in "Applied Mathematics and Computer Science", none of the students named a bachelor's degree as the most attractive for employers, 69% chose specialist degree diploma , 24% - Master's degree, 7% said that the diploma degree does not play any role. 78% of those who took part in the survey plan to work in the professional field, 23% rather do not plan and 1 5% find it difficult to answer. To the question "Are you ready to study at Master degree programme paying a fee if you do not pass the competition for a state-funded place (assuming that the cost of training will be equal to the cost of bachelor programme)?" 62%of respondents said they are not ready to continue their education, 8% - said they are ready and 20 % find it difficult to answer.

To the question "Do you think that there should be a system that enables a student to study at least one term at another university? (Select all variants that apply) 62% of respondents said that all universities should adopt a system when a student is required to spend one term at a foreign university while studying, 23% chose one term at Master programme of another high school, 8% chose another Russian university, 8% - such opportunities should be available only for the best students and 38% responded that such system is desirable but not essential.

From the outlined above statistics it is clear that the students do not quite understand - who is the bachelor and they considere more acceptable and understandable a 5-year-tion educational programmes and qualification of "specialist". Also, the major part of students do not want to continue studying to obtain Master degree, that could also be caused due to misunderstanding who is the master and what are his/her functions. But at the same time, most students are willing to spend one term studying at another university, preferably at foreign ones. The list of counties, where students would like be trained includes the U.S.A, Korea, Germany, Great Britain and France. The issues concerning motivation and choice of the country for training require further investigation.

One of the important ways to control the quality of the learning outcomes

is the implementation of competence-based approach to the modernization of curricula.

It is important to identify several essential characteristics of the competence widely recognized in scientific literature. They are:

- Effective use of graduate skills, allowing to carry out professional activities in accordance with the requirements of the workplace;
- Acquiring knowledge, skills and abilities necessary for professional work with simultaneous autonomy and flexibility in solving professional problems, cooperation with colleagues and collaboration within professional interpersonal environment;
- An integrated set of knowledge, skills and attitudes that are required to carry out activities in a modern industrial environment.

Taking into account the above given definitions become apparent the following features that distinguish the competence from the traditional concepts - knowledge, skills and experience: its integrative nature, correlation with the value-semantic characteristics of the individual, practice-oriented focus.

Competence should not be opposed to professional qualifications, but should not identify with it. The term "competence" is used to describe the characteristics of the integrated quality of the graduate and category of learning outcomes. [2]

In the questionnaire students were offered a question: Please assess the degree of importance of the following general competencies for the graduates in your field of study (knowledge, skills, abilities, i.e. learning outcomes). The development of competence is not important - 1 point, the development of competence is very important - 7 points.

The results of the survey are presented in Table 1.

The following competencies scored the highest means:

- ability to acquire new knowledge, using modern educational and information technologies - 6,62.
- ability to master the basic techniques, ways and means of production, storage, information processing, apply computer skills as a means of information managing - 6,23.
- ability to apply basic knowledge in computer science and modern information technologies, skills in using software tools and computer networks, ability to create databases and use Internet resources in research and professional activities - 6,1 7.

The following competencies scored the lowest means:

- ability to apply basic knowledge of humanities and economics in research and professional activities - 3,85.
- ability to apply basic methods to protect people and operating personnel from the possible consequences of accidents, natural disasters - 3,92.

The following conclusions can be drawn from the presented survey:

1. At this stage, the students position themselves as experts in the field of applied mathematics and computer science, who are able to acquire new knowledge in information technologies, i.e. students as they are in fact.
2. The students view humanities and economic sciences, as well as the ecology and life safety fundamentals of minor importance, which they think will not be much useful in real life. This implies that their training is rather theory, than practice focused. And more students consider themselves engineers rather than managers who are prepared to be responsible for the personnel.

In May 2010, a survey about satisfaction with the quality of graduates was conducted within the project "Development and testing of system aimed at monitoring the level of employer

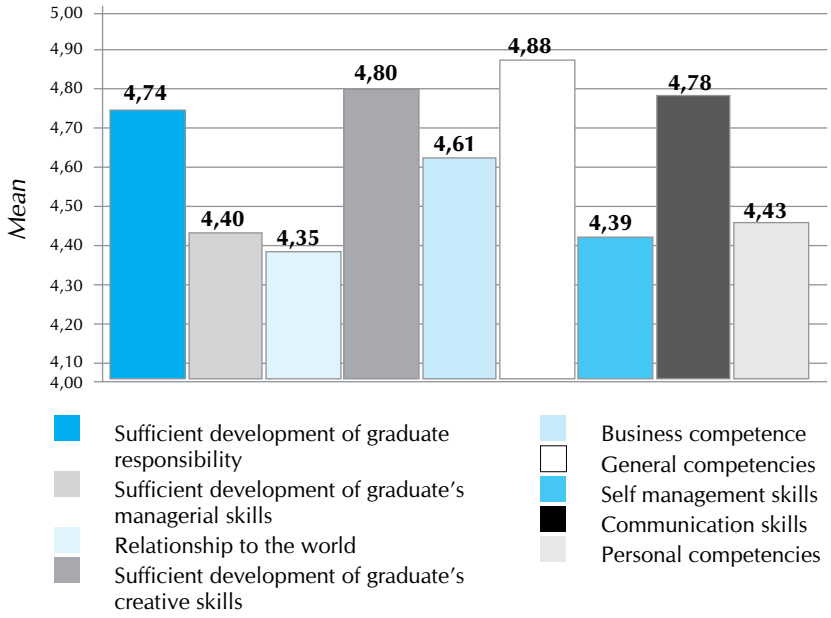
Table 1.

Competency title	Mean
ability to apply basic knowledge of mathematics and natural science in research and professional activities	6,08
ability to apply basic knowledge of humanities and economics in research and professional activities	3,85
ability to acquire new knowledge, using modern educational and information technologies	6,62
ability to collect, process and interpret data needed to form perceptions on relevant social, scientific and ethical issues using modern information technologies	5,69
ability to develop and implement perspective lines of intellectual, cultural, moral, physical and professional self-development and self-improvement	5,33
ability to achieve stated objectives	6,23
critical thinking, ability to change the profile of professional activities when needed	6,15
ability to follow ethical and legal norms, tolerance, capacity for social adaptation	4,92
ability to work as a team leader and a team member, manage people and be subordinated	5,46
ability to think critically about social experience	4,83
ability to follow socially important ideas about healthy lifestyle	4,23
ability to master the basic techniques, ways and means of production, storage, information processing, apply computer skills as a means of information managing	6,23
ability for written and oral communication in native language	5,38
ability to acquire and use in their work foreign language skills	5,75
ability to acquire leadership and managerial skills	4,67
ability to apply information from various sources in research and professional activities	6,08
ability to apply basic knowledge in computer science and modern information technologies, skills in using software tools and computer networks, ability to create databases and use Internet resources in research and professional activities	6,17
ability to apply basic methods to protect people and operating personnel from the possible consequences of accidents, natural disasters	3,92
ability to apply the tools of independent, methodologically correct use of methods of physical education and health promotion, willingness to achieve the proper level of physical fitness to ensure social and professional activities	4,00
ability to use normative legal documents in professional activities	4,77
ability to understand the value and significance of information in the development of modern information-oriented society, to realize risks and hazards arising in the process, to observe basic information security requirements.	5,38

satisfaction with quality of the employed graduates". Top 10 companies of Kirov in the field of mechanical engineering, communications and IT-technology, biotechnology and power engineering took part in the survey. Each company was represented by 2 experts, who had to assess the quality of graduates training on a 7-point scale. The most common assessments aligned in the range 3...5 points.

The results of the survey are presented in Figures 1-4.

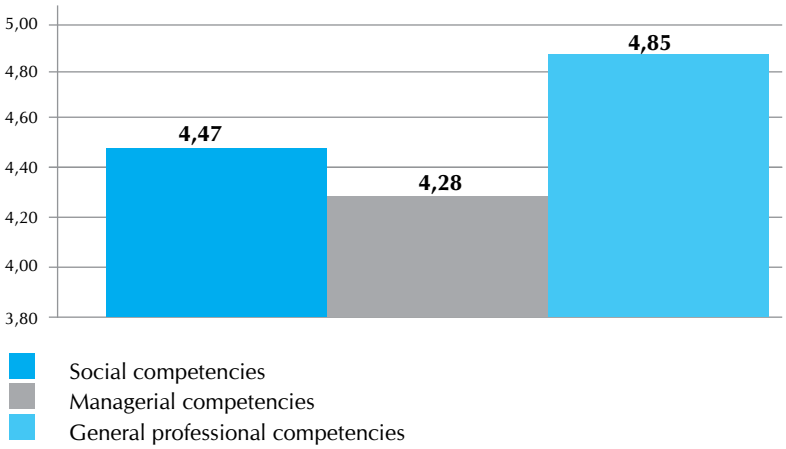
Figure 1. Level of employer satisfaction with graduate personal development.



The highest mean scored "General competencies" - 4,88. They include:

- Good manners - 5,05.
- Cross-cultural communication - 4,95.
- Ability to choose an adequate form for the different conditions - 4,65.

Figure 2. Level of employer satisfaction with graduate professional development.



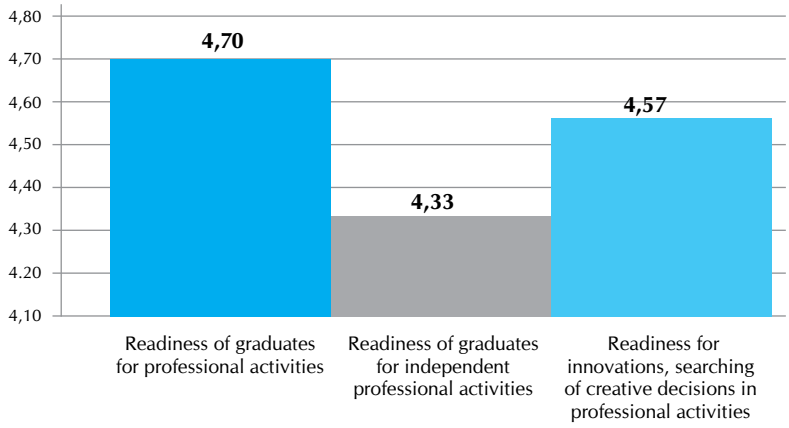
The Figure 2 shows the importance of general professional competencies, that scored - 4,85. In this category the highest assessment was given to:

- Ability to use global information resources - 5,60.
- Higher education in the certain professional field - 5,50.
- Ability to apply skills in using basic software tools - 5,50.

The lowest means:

- Ability to integrate knowledge within the training process and to apply them when solving social and professional problems - 4,50
- Ability to work within the international context - 4,30.
- Foreign language skills - 4,15.

Figure 3. Level of employer satisfaction with graduate preparedness for professional activities.



Preparedness of graduates for professional activities was evaluated by representatives of enterprises by an average of 4.7 points (Figure 3).

The highest average score in the category of "satisfaction with graduate preparedness for professional activities":

- Ability to work independently - 5,15.
- Knowledge, skills and abilities to solve a set of similar professional tasks with specific technology - 4,75.
- The ability to choose materials for use in equipment with regard to the influence of external factors, technological and cost effective requirements- 4,55.

The lowest average score:

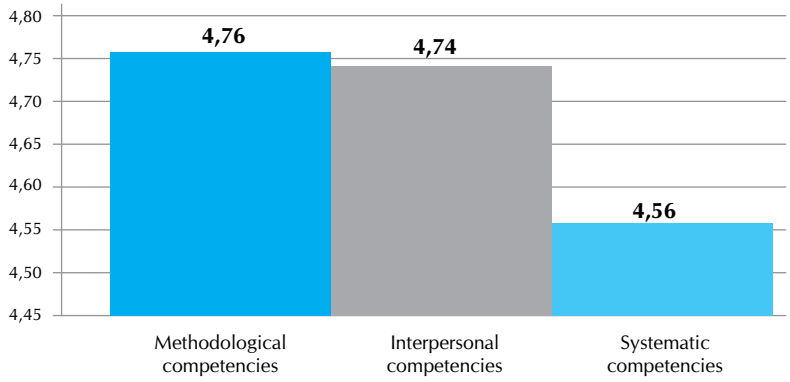
- Ability to take on a moderate risk - 4,35.
- Ability to assess risk and determine the security measures of developed engineering and technology - 4,20.
- Preparedness for planning and forecasting - 4,20.

The Figure 4 shows that methodological and interpersonal competencies scored 4,76 and 4,74. The highest average score in these categories are:

- Ability to use modern equipment- 5,15.
- Ability to use information technologies - 5,35.
- Ability to perceive and take into account a variety of cross-cultural differences, tolerance - 5,10.

ENGINEERING EDUCATION 6'2010

Figure 4. Level of employer satisfaction with graduate competency development.



- Commitment to ethical values, professional ethics, traditions and habits in the team - 5,05.
- Ability to perceive and take into account a variety of cross-cultural differences, tolerance of- 5,10.
- Commitment to ethical values, professional ethics, traditions and rituals in the team - 5,05.

The lowest average score:

- Ability to properly draw conclusions - 4.40.
- Ability to apply knowledge in practice - 4.40.
- Ability to listen and hear - 4.40.
- Ability to organize staff activities - 4,05.

So, if we combine the results of students and of employers survey, we can draw the following conclusions:

1. Students value their abilities higher (from 5 to 7 points), than employers do (3 ... 5 points).
2. Both categories of respondents (both students and employers) highly assess the ability to acquire new knowledge, to use modern information technologies, the willingness to use modern software tools, i.e. professional competences.
3. At the same time, employers indicated low ability to apply knowledge in practice, to use them in the process of solving social and professional tasks, and students find the social and humanitarian block, which includes management, economics, sociology and other issues, non essential or less important.

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The Model of Universal Competences of a Qualified Engineer

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S.I. Gerasimov

S.I. Gerasimov

At the end of the 1970's there was an approach in employers' estimation that found wide application, based on diagnostics of knowledge, skills, and competences. In the 1990's the research on such aspects as motivation, personal qualities, result-orientation and others has been started. As a result there appeared a wider notion allowing for determination of readiness of a man for efficient job performance- a notion of competence [1]. In this work we will observe the following concepts [2]:

- **competence** is an integral qualities of a man combining knowledge, skills, competences, and motivation described in terms of behavior. This or that level of competences is different in a more efficient employee at a definite position from less efficient one. Competences are related to behavior influencing the result of work.
- **competence model -** is a set of competences necessary for an employee at a definite position for a company to achieve its business goals.

In most of works competences are divided into professional (technical knowledge and skills) and universal (personal, cultural) [3]. Different companies assess the rate of validity for such competencies (in Joint Stock Company "The Russian Railway Roads", for instance, 1 and 0,6 correspondency) [4].

Usually professional competences are divided into managing-organizational, design-engineering and project designing ones. Let us consider in detail the most frequently occurring universal competences, the model of which permits for unification of requirements for employees and development of joint standards - a basis for selection, estimation, development and career of employees [5]:

1. Problem solution.
2. Self-development.
3. Result orientation.
4. Communication and team-work.

RULES OF ASSESSMENT

Every competence is broken into 5 levels: advanced level (corresponds to 5), intermediate level (corresponds to 4), basic level (corresponds to 3), introductory level (corresponds to 2), and non-competence level (corresponds to 1).

The characteristics of development levels and indicators of universal engineering competences are considered in the article.

In process of assessment each competence is rated on a scale of 9. The grades from 1 to 5 are possible, in this case the intermediate grades are also appropriate, for instance, 1,5.

1 – is given when behavior described in this level is predominated. 1,5 – is given when behavior described in Level 1 as well some features of behavior described at higher levels are predominated.

2 – is given when behavior described in this level is predominated and there is no features of behavior described in 1 Level as well as features of behavior described in Levels 3, 4 or 5.

2,5 – is given when features of behavior described in Level 2 and higher (3,4 or 5) are present equally, but in this case there is no behavior described in Level 1.

3 – is given when behavior described in this level is predominated, but there is no behavior described in Levels 1 and 2 as well as 4 or 5. 3, 5 – is given when the features of behavior described in Level 3 and higher (4 or 5) are present, but there is no behavior described in Levels 1 or 2.

4 – is given when features of behavior described in this level are predominated, but there are not features described in Levels 1,2 or 3, as well as those of Level 5.

4,5 – is given when all features of behavior described in Level 4 and some features described in Level 5. There are not any features of behavior described in Level 1,2 or 3.

5 – is given when all features of behavior described in Level 4 and 5, but there are no features of behavior described on Level 1, 2 or 3.

CONTENT CHARACTERISTICS OF COMPETENCE DEVELOPMENT LEVELS

5. Advanced level
In addition to Level 4 It means that an employee shows a particularly high degree of the competence. He (she) is able to apply competence efficiently in complex or (and) non-routine) situations, advances the initiative related to the given competence.
4. Intermediate level It means that an employee is completely familiar with the given competence. He(she) doesn't make mistakes in routine situations and shows his skill automatically.
3. Basic level It means that an employee is aware of significance of the given competence and is in process of its mastering. However, he (she) makes mistakes in routine situations. The skill is shown in not all situations, its demonstrations requires conscious efforts.
2. Introductory level It means that an employee accepts the importance of the given competence. However, trying to apply the given competence he (she) makes a lot of mistakes. The skill is absent.
1. Non-competence level It means that an employee does not possess the competence and is not aware of its importance. Employee does not try to apply and develop it. He (she) can act in complete controversy with the given competence.

PROBLEM SOLUTION

The list of indicators related to the given competence:

1. Awareness of the problem stated and striving to solve it.
2. Arranging the work to do the task; self- organization.
3. Collection and analysis of initial information.

4. Selection of techniques for problem solution.
5. Quality of solution, correction of mistakes.
6. Forecast of solution consequences.
7. Solutions in the conditions of high complexity.

5. Advanced level
In addition to Level 4
1. Able to formulate a draft proposal independently and correctly, on the basis of clearly stated problem.
4. Always (even under time pressure) chooses and puts into action the best way of problem solution. Can invent new (highly efficient) methods of problem solution and introduce those methods at the level of his (her) department or/and company.
6. Accepts the responsibility for consequences of solutions developed by the team.
7. Solves the most complicated, extraordinary problems. In case of highly complicated problems, under time pressure gets priorities right (for instance, determines what problems are necessary to solve in the first place, what can be postponed).
4. Intermediate level
1. Aware of problem stated correctly. Considers it as a whole (sees it as a part of product; understands its place in other products). When necessary, is able to specify/work out in detail the problem correctly.
2. Plans the job according to problem - predicts the deadline and results in problem solution accurately. Tries to observe the schedule. In case of possible failure to meet a date and/ or essential troubles in work informs the administrative authority promptly. Possesses the tools of project planning.
3. Collects the information necessary for problem solution. Able to use different sources of information (including addressing to colleagues). Able to search for those sources if necessary. Analyses the collected information thoroughly, makes conclusions correctly.
4. Analyses various ways of problem solutions. Chooses the appropriate way of solution. If necessary invents the new solution methods. In this case able to avoid stereotypes, offer a non-standard way of solution.
5. Performs the stated problem solution with the proper quality. Impatient to the mistakes (his and others'), tries not to make mistakes; Identifying the mistake tries to eliminate it. Checks his (her) job independently. If corrected the mistakes, identifies and eliminates its causes. Prevents the situation of new mistakes (in his(her) job or related department, decrease in quality of the product.
6. In development of solution predicts its influence on the function of related departments, the entire product (provides the proper compatibility). Takes into account the possibility of further product development, creates the conditions for such development. Predicts the consequences if his (her) solution. Accepts the responsibility for the consequences.
3. Basic level
1. Aware of the problem correctly, but not as a whole. Solves a concrete problem, but not aimed at the goal of the whole project.
2. May make a significant mistake in predicting the problem solution deadline. Does not informs the authority in case of possible failure to meet a date and/ or in case of significant troubles in job: authorities learn about the trouble too late. Familiar with the tools of project planning, but does not use it in practice and find some difficulty or does not try to use it.
3. In one variant tries to find information necessary for solution, but uses a limited set of sources. If they do not assist, may be at a loss. In other variant analyses the collected information superficially and/ or makes wrong, unreliable conclusions.
4. In one variant does not consider different ways of problem solution (for instance, follows common standards). Finds difficulty in invention and application of a new method of problem solution. In other variant chooses inefficient way of problem solution (for instance, not optimal way of task solution (for example too complicated or too simple).

5. Does not alway perform his (her) job qualitatively - makes mistakes regularly; solves problem in such a way that it needs to be re-done / optimized. Does not try to reveal the mistakes in his (her) job independently. In one variant when correcting mistakes does not take into account the consequence for the colleagues' job, the entire project (for example, as a result of error correction new errors can appear, deterioration of product quality). In other variant corrects the concrete mistake, but not its cause.
6. Does not always predict the consequence of his (her) solution. Does not take into account its influence on the work of related department, the project result. Does not predict the possibility for the product to be developed in his (her) proposal. Accepts the responsibility for the consequences of problem solution only partly. Shifts the responsibility to the circumstances and other people (authority, colleagues) partly.
2. Introductory level
1. Tries to solve the problem stated. But in one variant may understand it inaccurately (for example, neglects the elements of problem, understands its objectives and quality criteria incorrectly) In other variant treats the problem pro forma: does not try to specify and improve it, understand its goal (having stated the unclear problem, starts to solve it at once).
2. Disregards the deadline of problem solution regularly and significantly. Does not possess the tools of project planning.
3. Does not try to collect information necessary for problem solution: relies on his (her) knowledge even if it is not enough.
5. When solving the problem makes numerous mistakes (as a variant often does not manage to solve the problem in time with the appropriate quality).
6. Does not predict the consequence of his (her) solution. Accepts the responsibility for the consequences of problem solution only partly. Mainly shifts the responsibility for circumstances on other people (authority, colleagues and others).
1. Non-competence level
1. Does not try to solve the problems stated: deviates from the goals stated.
5. Does not try to perform the work qualitatively: ignores mistakes.
6. Avoids the responsibility for the consequences of his actions / solutions completely.

STRIVING FOR DEVELOPMENT

The list of indicators related to the given competence:

1. Interest in profession.
2. Study of new tendencies, innovations.
3. Initiative, ambitions.
4. Adequate self-assessment.
5. Learning ability, striving for self-development.
6. Readiness for feedback.

5. Advanced level
In addition to level 4
2. Arranges the work of collecting information on latest tendencies and innovations.
5. Systematically develops himself (herself). The goals of self-development correlates with those of company, perspectives in its product development. Helps colleagues in leaning new trends, in development of their professional level.
4. Intermediate level
1. Shows interest in his (her) job, is dedicated to it.
2. Follows the tendencies in branch development. Studies new achievements (product innovations, methods, techniques etc.).
3. Shows ambitions in career and professional growth. Shows the initiative in working situations and out work. Has an active stand.
4. Assesses his (her) professional level realistically. Sees his (her) strengths and weaknesses as a specialist.

5. Accepts the responsibility of his (her) professional self-development, takes effort for self-development. Uses different ways of self-development (reviews the literature, shares experience with colleagues etc.). Acquires innovations quickly and tries to apply theoretical knowledge in practice.
6. Open for feedback (from clients, colleagues, authorities): collects it independently, reacts to the critics constructively. Taking feedback into account changes his (her) behavior to achieve better job results.
3. Basic level
1. Shows interest in his (her) job and given company. But is motivated mostly by money reward, stability or other factors.
2. Interested in new trends and innovation in his (her) professional field, study new techniques but only when necessary, yielding to circumstances.
3. Does not show ambitions in career. Seldom takes initiative, mainly taking a backseat.
4. Makes mistakes in assessment of his (her) strengths and weaknesses. Admits importance of his (her) further development, but develops only yielding to circumstances or under authority's instructions.
5. Does not show consistency in development. Uses too limited methods of development. Shifts the responsibility for his (her) development partly to the authority. Learning new methods and techniques can require sufficient effort and time from him (her). Applies new information in practice with difficulty.
6. Open for feedback from clients and colleagues insufficiently; doe not collect it at his (her) own initiative, not always uses this information to correct his (her) actions.
2. Introductory level
1. Shows low interest in his (her) profession, job in the given company.
2. Does not search for information on new trends and techniques in his (her) professional field, doe not study innovations.
3. Does not show initiative in job and outwork: does only things that are said.
4. Has some troubles in assessment of his (her) strengths and weaknesses (makes sufficient mistakes in their assessment).
5. Does not deny importance of his (her) further development, but does not take his (her) own efforts for this. Shifts responsibility for his (her) development to the authority Does not strive to use new information in practice.
6. Is poorly open for feedback: accepts it only from authority and other authority figures. As an exception (for example, under pressure) uses this information to correct his (her) actions.
1. Non-competence level
1. Does not show interest in job in the given field and/or given company.
4. Denies the necessity of his (her) development (for example, believes that he (she) has reached the potential in his (her) profession. Is satisfied with the current level of his (her) professional development completely.
5. Negatively accepts new ideas and experience. Insists on impossibility to use innovations in his (her) job.
6. Does not accept feedback (can react to it indifferently or aggressively). Resists to colleagues' or authority's efforts to correct his (her) behavior.

RESULT ORIENTATION

The list of indicators related to the given competence:

1. Goal-orientation, ability to set goals.
2. Activity, persistency and flexibility in reaching goal.
3. Assessment of success in results.
4. Acceptance responsibility for result.

5. Advanced level
In addition to Level 4
1. Able to set clear, ambitious goals both for himself (herself) and for others.
2. Shows persistence in reaching results despite resistance and doubts of others. Suggests and takes measures for reaching outstanding result not only for him (her) but also for colleagues. Searches for the ways of improving the result.
4. Intermediate level
1. Understands the goals set by authorities clearly. Geared to these goals in the course of the works. Sets clear, achievable goals independently.
2. Makes/ expends great efforts to obtain the result. Facing the troubles shows persistence and insistency. Does not give up the task without having performed it. Ready for hard and extraordinary problem realization. Believes in the possibility of their realization. Considers job problems to be "the challenge" for his/ her abilities. Stress-resistant and can stand long, monotonous loads (does not decrease rate and quality of work). In case of time pressure finds forces to increase the efficiency. Flexible in reaching the result: does not get stuck on the only (or planned) version of reaching the set goal.
3. Assesses the success in performed work according to the achieved results. Believes that an important criterion in result assessment is company profit.
4. Makes him/herself responsible for the educt/ results obtained (aware of the direct dependence of the obtained result on his (her) abilities.
3. Basic level
1. Does not always understand the goals set by authorities clearly. Set not clear enough or not real enough goals.
2. Does not make/ expend great efforts to obtain good results. Can decrease rate and/ or quality of work in stress situation, long loads. Facing job problems can feel at a loss and delay the task performance. Not flexible enough: facing obstacles finds it difficult to invent the new way of reaching a goal. Change of approach takes him much time and great efforts. Expresses discontent in case of changing requirements for the result or the way of its obtainment.
3. Assesses success in performed work both by the result obtained and by the amount of expended efforts, by the working process characteristics etc. Does not believe that company profit is an important criterion in the result assessment.
4. Makes him/herself responsible for the educt/ results obtained partly (or not always). Shifts the part of responsibility to circumstances and other people.
2. Introductory level
1. Can not set the goals in work independently – needs friendly instructions. Can be insufficiently geared to the goals set (for example, deviates from them in the course of the works).
2. Makes few efforts to obtain the result (initially works in low rate with poor results). Inflexible in work: recognizes the only way of the goal realization. Committed to it strictly even if it is absolutely insufficient. Facing the obstacles can give up the work begun. Sets to perform only easy tasks (avoids difficult tasks, initially doubts in their performance).
3. Assesses success in performed work not by the obtained result but by the amount of expended efforts mainly, by the working process characteristics.Satisfied with low results..
4. Shifts responsibility for obtaining the result to circumstances and other people mainly.
1. Incompetence level
1. Not geared to the set goals. Geared to the process performance but not to the result obtainment. Enthusiastic about avoiding punishment for low efficiency but not about obtaining success.
2. Needs constant regulations and «cheering». Can give up the work begun even without facing the obstacles.
3. Assesses success of the work done by the amount of expended efforts but not the result obtained. Relucts against authority efforts in introduction of measurable criteria to assess his work.
4. Shirks responsibility for the results: shifts it to circumstances and other people completely.

COMMUNICATION AND TEAM-WORK

The list of indicators related to the given competence:

1. Attitude to team-work. Ability to cope with colleagues.
2. Participation / role in group discussion.
3. Presentation / assertion of ideas.
4. Perception of an interlocutor's point of view.
5. Meaningful position in discussion. Conflict behavior.

5. Advanced level
In addition to Level 4
1. Makes contacts with other people easily. Can find an individual approach to troublesome interlocutors.
2. Manages the course of group interaction.
5. Relieves stress even in complex situations and shifts the discussion to the constructive course/ way.
4. Intermediate level
1. Understands significance of team work. Tries to solve problems by means of group discussion. Feels comfortable in making contact with colleagues and authorities...
2. Able to arrange group discussion, involve colleagues, distribute the roles and tasks among them. Forges constructive relationships in the team.
3. Expresses his (her) ideas clearly and structurally. Able to present strong arguments to support them. Answers questions confidently, does not feel at a loss in this case. Tries to maintain his/ her attitude in the discussion. In doing so can change his (her) opinion under the pressure of interlocutor's arguments.
4. Listens to his (her) interlocutor attentively, understands the arguments properly. If necessary, asks clarifying questions.
5. In the discussion course takes up friendly constructive station towards an interlocutor. Shows respect to the other's opinion. Tolerant to the opposite opinion. Does not conflict with other members of the discussion. Tries to free up conflicts in team. Stays calm in the discussion course.
3. Basic level
1. Admits the importance of team work, but seldom interacts with colleagues on his/ her own initiative.For example, cannot find common language with all colleagues: contacts with some of them easily, but finds it difficult to communicate with others.
2. If necessary tries to arrange a group discussion, but does it inefficiently. Can not involve (alternatively) related people into the discussion.
3. Does not always express his / her ideas clearly (for example, can loose the narration neatness in the course of argument). Uses insufficiently solid/ satisfactory arguments to support his (her) position/ viewpoint. Can either be at a loss and find it difficult to prove his (her) ideas facing critics, or can support his/her ideas/ viewpoint too obstinately and does not want to change it despite solid arguments.
4. Can listen to an interlocutor carelessly (for example, interrupts him, misses part of statement). Does not ask clarifying questions. Tries to understand his point of view insufficiently, does not try to reveal the cause for objections. As a variant does not defer to some colleagues' opinions, but defers to the others'.
5. In the course of the discussion takes up initially a constructive station towards an interlocutor. But in disputes can behave a bit unconstructive, lose emotional well-being (but is not aggressive towards an interlocutor). Does not conflict with other members of the team, but when conflicts does not try to free it up.
2. Introductory level
1. Does not deny the importance of team work, but does not interact with colleagues on his / her own initiative. Finds it difficult to make contact with colleagues.

2. Does not try to arrange team discussions, but does not reluct against being involved in team work.
3. Finds it difficult to express his/her viewpoint clearly. As a rule does not give reasons for it. Facing critics can either retreat immediately, or can get into an unreasoned argument, can bring pressure on the opponent.
4. Sensible to colleagues' opinions only if they correspond to his / her own ideas.
5. In the course of the discussion takes up a bit unconstructive station towards an interlocutor. Does not provoke conflicts, but conflicts if it is initiated by others.
1. Incompetence level
1. Opposes himself / herself to other team members. Denies the importance of team work. Prefers to work on his / her own.
2. Can back out of team interaction.
3. In the course of the discussion can take up absolutely passive station, does not try to express his / her viewpoint.
5. Initially can take up unconstructive station in team work (being aggressive, provoking conflicts, showing disrespect to others).

Defining an employee's recommended activity type, you should assess it in 3 stages: 1st stage is concerned with managerial and universal competences, 2nd stage is concerned with engineering and manufacturing and universal competences, 3rd stage - with design-and-engineering and universal competences. Then you should take a decision on his/her preferable activity type or his/her being sent to competences training assessed at the lowest grade (4).

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Professional Training in Information and Communication Technologies Within the Implemention of the Grading-Rating System (GRS)

Kabardino-Balkarian State University named after H. M. Berbekov
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Professional training of engineers in ICT under conditions of implementing the grading -rating system (GRS) is considered in the following paper. Such issues as an employment market survey for computer technology engineers, review of the perspective training strategies for Ict engineers are discussed. Organization of the learning process based on an up-dated grading system in determining the quality assurance of a student's knowledge, skills and professional.

Since the Russian Federation educational institution updated to 3G educational standards the requirements for student training results formulated as a competence have changed. This innovation concept invokes not only significant changes in the academic grading system of the students and graduates, but also includes newer and newer target problems. This underlines the fact that existing grading systems should be systematized - from designing essentially new strategies to the method development of indexes which would provide reliable and comparable information about the student's learning level of professional competence.

CHARACTERISTIC FEATURES OF PROFESSIONAL TRAINING IN INFORMATION AND COMMUNICATION TECHNOLOGIES

Professional training of engineers in Information and Communication Technologies (ICT) is occurring under the conditions of an accelerating development of the information-oriented society foundation, namely, based on knowledge. According to statistics, more than 350 000 ICT graduates are required to meet the demands of the national economy per year, while at present there are only 30 000 young professional engineers, i.e. significantly less than the stated needs. This implies that ICT student participation rate in higher education will considerably increase in the near future.

However, the professional training of ICT students is impeded by the following factors:

1. Accelerated changes in train ing of ICT specialists, including:
   - fast-moving civilization progression into a new development era (globalization era);
   - significant increase of global information resources;
   - rapid development of Information and Communication Technologies
2. ICT market embraces an acute increasing demand in IT engineers with intimate professional knowledge and oriented skills.

As stated by B.G. Nuraluev:

- It is extremely important to increase the number of ICT graduates several times;
- teach what is really in-demand;
- and provide the opportunity in gaining not only a University degree (graduation diploma), but also a certificate in software production design.

According to A.A. Fursenko;
"In coordinating education activities, one must consider the interests and desires of the ICT- community."

APPLICATION OF INTEGRATED EDUCATION METHOD

In our opinion, this rather challenging problem could be solved through ICT tools, based on e-learning principles. Nowadays, this prospective education process is European Learning Space (ELS), known as e-Bologna, i.e. creating synergy network in e-learning, eventually leading to an ELS. ICT medium of e-Bologna embraces the following characteristics:

- e-teaching materials;
- e-testing elements;
- e-Portfolio (personal student competence information).

E-learning supports:

- virtual mobility and implementation of up-to-date knowledge and high- quality teaching materials, independent of the geographical and social conditions of the student;
- professionalizing teaching materials through electronic platform applying including easy access to multimedia resources, i.e. their publications, delivery and modernization;
- stimulating the student's career development through individual schedules, terms and teaching progress rates;
- reconciling mass higher education and personalization through flexibility in-terms of contents, pedagogical approaches and combination of study planning (advanced training and refresher courses) without increasing roomage and the staff itself;
- improving the professional performance of the highly-qualified staff.

Today, more than 90% of the students in Europe are involved in e-learning processes, while 85% of all universities and colleges include distance learning courses and curriculum, as well.

The learning quality assurance level should include a combination of traditional and innovative methods. Built-in quality assurance criteria and procedures applied during the whole on-line learning and automatic control of student autonomous learning activities is based on the principles of the grading-rating system of student's knowledge assessment it self.

GRADING-RATING SYSTEM(GRS) OF STUDENT'S KNOWLEDGE ASSESSMENT

The grading-rating system (GRS) of student's knowledge assessment is one of the four principles of the e-Bologna process introduced into the Russian education system. It is targeted on increasing the quality of the learning process by [1]:

- improving the professional performance of the highly-qualified staff.
- improving objectivity of performance rating and the results of final tests;
- regulating measurements of midterm exams for each specific academic course.

The introduction of GRS principles into the higher professional education system, based on standard requirements and application of a uniform assessment criteria for the results of student's activities, provides openness and transparency of the learning process and develops conditions in learning process planning, staff selection and student e-Portfolio designing [2].

However, the grading-rating system itself includes several selection and use objective problems:

- specification of accessible design and index evaluation scale for GRS;
- further flexible and " painless" modification of the learning process, adaptation of existing control methods and the implementation of modern ones, overview of traditional evaluation principles, methods and procedures;

- lack of simple and comprehensible grading-rating procedures, which include not only calculation criteria and student grade-rating determination, but also rating estimation mechanism for testing;
- influence of grading-rating system on the quality assurance of the student's knowledge and skills, by improving the learning motivation;
- grading-rating evaluation of competencies within the framework of 3G State Education Standards (SES).

There are many disadvantages of today's grading-rating system, one of which is the fact that existing grade-rating scales are incomplete. A questionnaire was produced to establish the student term assessment and exam result ratios. The following results are: 48 % of the respondents indicated that this ratio should be 70 to 30 credit points, respectively; 37% of the teachers showed 60 to 40 credit points, respectively; while 15% could not give an exact answer.

According to the 3G State Education Standards (SES), the grading-rating system of competence acquisition should:

- evaluate engineer-specialist's knowledge, skills and professional competence;
- determine strategies of ICT involvement in different professional areas;
- define and solve different applied problems by ICT;
- design, implement, manage and maintain IT system and
- design business and management processes for information and knowledge acquisition.

In this case, testing should not be the only grading-rating evaluation method.

APPLICATION OF GRS IN STUDENT KNOWLEDGE ASSESSMENT (KABARDINO-BALKARIAN STATE UNIVERSITY)

GRS in the quality assurance assessment of a student's knowledge, skills and professional competence has been entirely implemented and is now successfully being applied in Kabardino-Balkarian State University n.a. H.M. Berbekov [3].

During the term, the teacher's evaluation of a student's learning activities should include the following factors:

- compliance with schedule of the subject studied;
- attendance record of lectures, laboratory research, hands-on seminars;
- performance activity at classes and seminars, testing results;
- participation level in teamwork discussion;
- execution level of reports, quality performance of laboratory research, tasks for autonomous learning activities and term papers;
- test results and other monitoring types.

To evaluate testing procedures in grade scores within the framework of one discipline, the following formula is used:

2uBj ■ K/ + П + Э = 100 scores

where,

B - maximum grade of a student during testing procedures;

K - number of testing procedures;

i - type of testing procedure (testing, discussion, reports, lab research, and others);

П - maximum grade for class attendance;

Э - maximum grade for exams and credits.

There are the following types of testing procedures: testing, colloquium (discussion groups), tests, debating (forum), summary papers, reports, laboratory research and others.

The grading-rating exam scale should be determined beforehand and students should be informed in the following ways: (1) procedure organization at deparments, including testing -type selection; (2) choice of procedure; (3) working-out schedule plan; (4) testing material preparation; (5) working out of student grading-rating criteria; and (6) monitoring [4].

Electronic platform procedures could be the following: (1) testing in computer classes or on-line; (2) written or e-tests; (3) tutorial or topic discussion; (4) survey or discursive chat; (5) individual tasks (reports, situation analysis) and others.

Based on department information testing procedure schedule plan for each discipline consists of the following: (1) the procedure itself; (2) procedure start and

expiration dates; (3) time duration; (4) material content; (5) maximum and pass grade.

Before starting the term students should be informed about the future grade-rating criteria for each discipline. These might include the following standards:

Current performance progress monitoring - laboratory research and tutorials, which are evaluated as the total grade sum of all provided tasks and based on 20-grade score scale.

Tests or colloquium (discussion) - there are three procedure activities, as a forum. Each forum includes 5 questions; each answer equals 1 grade score. The answers should be precisely formulated. Maximum grade for each question - answer is 5, while minimum - 3.

Testing - according to the schedule plan (during one term) there are three tests. Each test includes from 20 to 30 questions. Maximum grade is 5, while minimum - 3.

Individual tasks - involve specific tasks for students, for example, a report. Besides confirmed report topics, the teacher can include other specified topics. Maximum grade for each report is 5. Report requirements are the following: report topic stated clearly, with logical, credible pattern of development; supported by effective references; stated precise conclusion of results; designed as a presentation or Word format; content volume: 7-10 pages (8- 12 slides).

Student's attendance record and performance activity, which includes a maximum grade of 10.

Grade for **other monitoring types** is 5. Thus, the maximum total grade-score throughout the term is more than 70, while the minimum limit is 36. Those students, who have less than 36, are not allowed to take either the exams or credit-tests and must take retesting in the same course.

Monitoring procedure could include teacher's commentaries; result grades; intermediate discussion of the results; monitoring journal of students' performance; openness of results.

The existing grade-rating system at Kabardino-Balkarian State University n.a. H.M. Berbekov differentiates the student's learning performance during the whole term grading period. The next stage in GRS is the State Exam to evaluate the student's knowledge and competencies. The above-mentioned factors evolve that differential and versatile information of academic progress results and personal achievements for further moral and material incentives of a student (i.e. recommendations for Master and post-graduate degree programmes, scholarships, internship, academic scholarships, and others), as well as, successful employment for future graduates on this or that profession.

Table 1.
Grading-rating scale of a student's test-paper answer

Grade-rating in 4- scale	Grade-rating in 100-scale	Answers to test-paper
Excellent	26-30	Answers - complete, correct
Good	21-25	Answers - complete enough, correct
Satisfactory	15-20	Answers - incomplete for all questions or some of them
Unsatisfactory	0-14	Answers - fragmentary or non-complete

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Development and Implementation of Basic Educational Programmes in Engineering and Technology

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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.

– 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

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, ENQHEEI, 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
1The competence-based approach to development of educational programmes http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-3-1.html	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 http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-3-2.html	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 http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-3-3.html	In-depth training of participants in development of test materials, their assessment and use in educational process
5. Modern teaching and learning technologies http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-1-1.html http://portal.tpu.ru/departments/centre/imc/otzivi	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 http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-1-2.html	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 http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-2-1.html	Development of ability of teachers to use ICT in their professional activities
8. Electronic books http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-2-4.html	Training of participants for development and effective use of electronic books in the educational process of university
9. e-Learning Management System http://portal.tpu.ru/departments/centre/cdp/img/UP_PPS/programm-2-2.html	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.

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Topical Issues of Personality-Centered Professional Education Quality Management

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Comprehensive and harmonious individual development has always been declared as an educational system objective. At the same time, in the last two decades we have observed a considerable rise of interest to the conception of student individuality in the sphere of the theory of pedagogy. There appeared such pedagogical concepts as «individual development path» which underlines the uniqueness of every life journey and acknowledgement of every individual's singularity. The research conducted in the last decades shows that it is a student's individuality and capabilities that matters more than age and personal background. The individual approach is based on the individual characteristics which include individual orientation, values, expectations, mindset, dominant motives of activity and behaviour.

The pedagogical research and experiments conducted at the beginning of 1990s (programmed education, problem-based learning) caused the appearance of the term «personality-centered education». It involved streaming of students (i.e., strong, average, weak), teaching materials (depending on the level of complexity), requirements concerning the material acquisition, as well as subject differentiation. The appropriate didactic models were developed and a lot of them included the individual approach in teaching.

At the same time pedagogy still recognized the leading role of a teacher in the learning process. In this situation differentiated forms of pedagogical influence defined the content of individual development. However, the subject differentiation determined the standards of cognitive activity taking into account the peculiarities of academic knowledge, but it did not reveal the nature of student's activity as an

Establishment of government system of education quality management is one of the major issues in government educational policy. Priority of personality development also belongs to these major issues. However, existing approaches to management of educational systems cannot provide the implementation of personality-centered education concept. Engineering education quality management systems should be developed not only in the engineering subsystem but also in psychoeducational, organizational, methodological and other subsystems.

owner of individual experience, commitment, preferences in the field of education content, type and form. In other words, the pedagogy that was described as having personality-centered objectives and content, in fact, was not like that at all. It could be seen both in teachers' activity and in federal educational objectives and its improvement trends.

According to A. Pligin, the disregard of spiritual differentiation not only hampered the education system reform but also often caused a formal approach to knowledge acquisition - the gap between remembering the «right» knowledge and using it, the urge to conceal individual values, expectations, mindset and intentions, to replace them with social clichés. He states that in 1990s the term «personality-centered education» entered the practicing teachers' lexicon only as an instinctive separation of accepted approaches and individualization methods used in teaching process from new emerging principles of individual development in education [1].

This is the reason why the first personality-centered education models were often focused on cognitive (intellectual) abilities development. All these models share the following characteristics:

- acknowledgement of education as a primary source of individual development;
- forming an individual with preset abilities;
- understanding development as accumulation of knowledge and skills (adding both to their amount and level of complexity) together with obtaining socially important behaviour patterns;
- classification of individual characteristics, based on presumption that individuality is a product of sociocultural environment;
- defining interiorization as a basic mechanism of learning digestion.

As a result, until recently personality-centered pedagogy has been limited to acknowledgement of inequality of cognitive abilities, which were defined as a complicated mental complex, specified by interrelated genetic, physiological and social factors. Individual abilities were considered as depending on the capacity to study, which can be defined as ability to digest knowledge. The better was knowledge system organization (theoretically), the stronger was capacity to study. Being dependent on the content and design of teaching materials, capacity to study was considered as a standard individual characteristic (theorists, empiricists, eye-minded, people with verbal-reasoning aptitude, etc.).

This is the reason why we support professor A. Khutorskoj in his belief that lately there has been noted a discrepancy between the new meaning of the term and the old one [2]. Only 10-15 years later the attention brought to the term «personality-centered education» resulted in actual changes of education objectives, tasks, forms and methods as well as in development of appropriate teaching tools. Presently, another approach to understanding personality-centered education has emerged (V. Slastenin, V. Serikov, I. Yakimanskaya, etc.). It is based on acknowledgement of individuality and uniqueness of each person and his/her personal experience.

Individual subjectness is manifested in selectivity of the the reality perception (its content, type and form), steadiness of this selectivity, ways of studying teaching material, emotional attitude towards objects of cognition (material and ideal). Thus, shifting focus from teaching as a strictly regulated process to studying as an individual student activity, its correction and support, is predetermined. At the same time teaching and studying stand together taking into account cognition mechanisms, peculiarities of student's intellectual and behavioural patterns, and relations between a teacher and a student are based on the principles of collaboration and freedom of choice. Herein, education process is not directed from a teacher to a student, but, on the contrary, ways of teaching influence contributing to student development depend on students themselves.

This approach makes students obtain personally and socially important knowledge and skills in connection with actual objects of study. In this situation student's emotional attitude towards

these objects becomes compulsory. That is why in the framework of personality-centered education the task of professional training changes from planning a universal and compulsory development trajectory to helping each student to develop individually and improve his/her personal abilities using the gained experience.

At the same time, changes in understanding personality-centered education do not mean their all-round implementation. Individual orientation and inner subjectivity of educational conceptions and techniques are poorly developed theoretically and are rarely implemented in teaching practice. According to A. Pligin, an educational system where teaching and studying processes are coordinated still has not been presented adequately in contemporary didactics and teaching practice. Almost all existing educational techniques are still about knowledge and skills, and they do not contribute to student's individual development.

According to V. Leschinskij, practically all research in the sphere of personality-centered education is focused on teaching and educational process and yet the results are never implemented in day-to-day practice. Reviewing the research conducted by I. Yakimanskaya, he notes that «exceeding the bounds of the teaching process is hardly possible, it all comes down to cognitive abilities and, in the context, the common objective is not development of an individual on the whole but of a learning individual («self-realization through learning»)». At the same time, he states that «process» parts of almost all research in the sphere of personality-centered education show that «the concept of personality-centered education is «disseminated», implemented into traditional educational process, where what counts is still obtaining knowledge and studying , not individual development, and this is true for the whole country». So the gap between the research in the sphere of personality-centered education and pedagogical techniques based on the sociohistorical knowledge predetermines the fact that this research is not actually implemented [3].

According to A. Khutorskoj, «alongside with personality-centered education techniques, non-personality-centered ones are actively progressing as well. They include, for example, Unified National Exam, which has to do with economical, political and other issues rather than with students' individual development» [8]. In the sphere of higher professional education this «non-personality-centered» approach is manifested in all-round implementation of testing which was introduced by the government as one of major tools for monitoring higher education quality.

According to V. Leschinskij, predicaments in the sphere of personality-centered techniques implementation are caused by government control of education. In this way, «Russian schools are now moving to profile education strictly regulated by external differentiation and this situation is caused by state management aimed at academic approach in education, and - what is even more important - never aimed at individuality. In these conditions, when assessment is based on traditional approach, it is extremely hard for humanistic education to survive» [3].

Therefore, V. Livshits is absolutely correct stating that «social institutions are considerably behind the actualities of the new century» [4]. E. Kurkin states that in spite of arising tendencies of «regionalization», democratization, and humanization, educational institutions control system in modern Russia preserved its traditional features of multilevel, centralized and bureaucratic organization... This system is a huge break on progress and, particularly, for personality-centered education development» [5].

We presume that this is the reason why the advantages of personality-centered education have not yet been used in development of up-to-date professional training quality management systems. Moreover, the direct transfer of successful quality management systems (oriented on the finished product quality standard) into the education sphere resulted in the "technologization of production of specialists", whose professional training quality is defined by the licensing and accreditation results

(i.e., in case the HEI does not complete research work for 1.5 mln roubles per year, or a student completing a test fails to identify the author of a famous quotation, the education quality of this HEI will be considered low). That is why nowadays we can observe the gap between the personal approach development in professional training (characterized by such concepts as creativity, self-realization, etc.) and the development of education quality management systems (characterized by such concepts as standardization, testing, etc.).

Erich Fromm's antithesis "to have or to be" proves this contradiction. Here, the paradigm "to have" in education is common in the situation when the education is "given" and there is a corresponding "giving" pedagogy: a teacher "gives", students "take" and, therefore, "have" this very education. The results of this strategy are far from perfect - students grow up to be dependent consumers and tend to say "I was not given the proper education".

At the first gaze, even the first principle of the ISO 9000:2000 Standard has the same meaning: higher education must "give" the professional training which is specified by consumers in a shape of an "order" or a model. As a result, contemporary educational systems tend to evaluate the outcomes with the help of certain unified requirements or standards. And such concepts as "educational service", "satisfaction of customer's needs", "quality of rendered services" just move the conception of education quality closer to the "to have" paradigm.

The paradigm "to be" brings up the opposite meaning in the sphere of education. To be means to act without waiting for someone to come and give you the knowledge and skills you need. This approach implies the presence of efficient reference points, competence-centered content, and the use of heuristic angle in education.

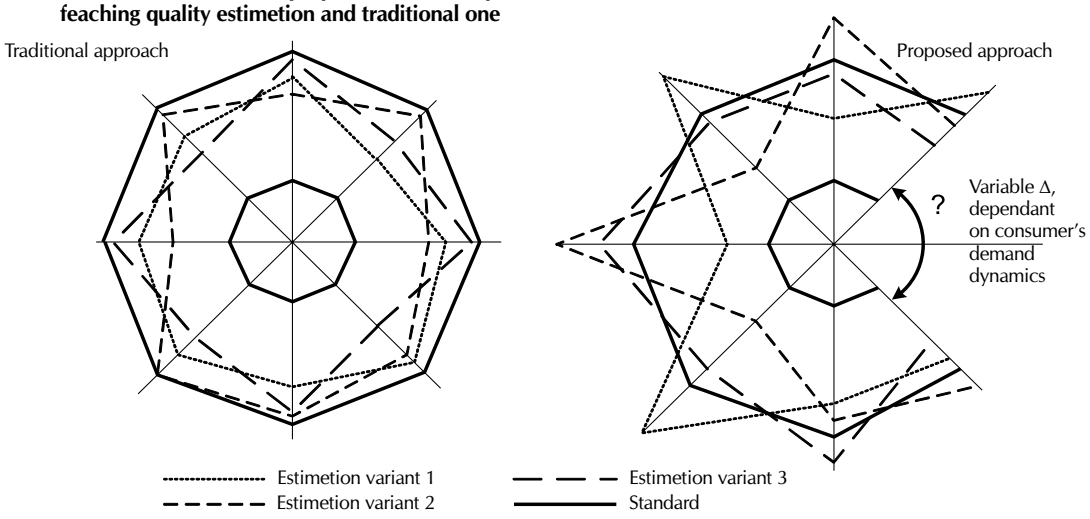
That is why the realization of developments made in the sphere of personality-centered education in contemporary education quality management systems is hampered by the fact that its effect cannot be expressed in traditional dimension of knowledge and skills just by adding graduates individual characteristics (V. Leschinskij notes that "the thing is not even about the complexity or even impossibility of measuring individual characteristics. The thing is that sometimes it is not even necessary" [3]).

On the other hand, however, we presume that it is personality-centered education that can provide the professional training quality required by "consumers". It is clear that the starting point of personality-centered education is not a pursuit of certain professional training results but rather development of individual cognitive abilities of every student and establishment of teaching process required for it. But we have to admit that contemporary "consumers" demands go in this very direction in today's social and economical framework. And it is personality-centered education that can provide the required intuitive thinking that helps to operate effectively in the new environment and in unconventional situations. It is personality-centered education that counts necessary socially important knowledge and skills and evaluates student's individual characteristics in the first place. Here the key competences are oriented to assist a student in entering society and operating successfully in it.

"Consumers" are interested in creative individuality able to adapt to changing social and economical conditions. However, education management systematization aimed at satisfaction of consumer's needs strives for achieving this result not with the help of personality-centered education implementation, but with the help of formalization of "finished product" quality standards and "technologization" of professional training process. I. Zimnyaya underlines the need to solve this contradiction: "Education strategies polarize around its two features: manageability and training students to accumulate knowledge without assistance. It is clear that presently none of the strategies exists per se, instead, they interpenetrate" [9].

As a result, the engineering higher education quality management is presently a topical issue. This situation complies with today's government educational policy with its priorities lying in establishment of education quality assessment state system and

Fig. 1.
Differences beturen the proposed method of professional feaching quality estimetion and traditional one



personality development. That is why up-to-date research should be focused on solving the contradiction between the new content and the old form, between personality-centered education and technologization of its quality management.

All elements of educational process should participate in achieving this goal, as the educational content update will not bring the required results without changing other elements as well. According to I. Yakimanskaya, to establish a model of personality-centered education it is necessary to apply system approach, embracing all education levels [10]. Therefore, we cannot but agree with V. Leschinskij on his opinion that personality-centered education "should go for such ways of "incorporation" with traditional education which could allow them to coexist, and even more, to achieve good results in study and ensure individual development (self-development)" [3]. He gives us an example of Borton's three-phased development model which is all about approaching to students as individuals, giving them a push, motivating them "as human beings" and still teach them in traditional systematic manner.

At the same time, we believe that personality-centered education cannot be "incorporated" or "embedded". New technologies are effective not when they are incorporated in the existing educational system but when they enter the new educational system as an integral element. This is all about educational process modernization on the whole, not just particular technical decisions. Higher education pedagogical issues should be addressed in the framework of professional training management systematization [11]. Such an approach to solution of the contradiction between technologization of professional training quality management and personality-centered education can lead to a transfer from struggle of opposites to cooperation, thus, creating a mutual enrichment effect - synergy.

Our research [12] is an attempt to systematize the elements of professional training quality management in order to ensure such an educational outcome as individual development. Knowledge and skills still are considered to be of great importance but as a means of goal achievement, not as a goal itself. And this goal is a thorough professional training of graduates.

At this point we support suggestion of the group of authors of Bauman Moscow State Technical University [13] to use the principle of pentagonal content structuring in designing systemic changes in educational content. According to this principle, all goals and means of their achievement, quality standards and estimated figures should be structured in a pentagonal format.

In case of using this approach the maximum attention should be paid to the student's abilities and individual features, thus, the educational process must be based on continuous feedback. That is why one of major issues of our research is development of system for evaluation of graduates' readiness for further professional activity. Presently, there still remains a discrepancy between professional training quality evaluation criteria in the industrial sphere (where the main criterion is the ability to solve professional tasks) and in the educational institutions (where the main criterion is the level of accumulated knowledge and skills). Our research is an attempt to establish a unified plausible method arranging the existing evaluation methods and coordinating them with the innovative techniques which meet the requirements of educational service consumers.

The difference between the method of evaluation of graduates' readiness for professional activity and the traditional one is that the former allows and motivates a student to strive for self-improvement continuously and without trying to reach some certain model of a specialist. Besides, the amount of directions can be changed in order to reflect the trends of needs (for example, "consumer" needs). All these factors add to the difference between the proposed method and the traditional model of a specialist (see Figure 1).

The principal differences between the proposed method of evaluation of graduates' readiness for professional activity and the traditional one are the following:

– shifting the emphasis from professionally important knowledge and skills to the ability to use them in practice;

– integration of university traditions and "customer" needs in graduates' education quality evaluation.

On the whole, the method of evaluation of graduates' readiness for professional activity allows to:

- consider objective necessities of graduates' readiness for professional activity in a dynamic and plausible way;
- evaluate them sufficiently and clearly;
- characterize them comprehensively;
- use different combinations of incentives in order to provide the required motivational pattern;
- bring up the required potential incentives in order to promote student's outcomes;
- strengthen students' motivation for reaching short- and long-term goals;
- avoid both students' outcomes equalization and branding students as "capable" or "narrow-minded" ones;
- use all the advantages of students' lifestyle to increase their readiness for further professional activity;
- complete the set of existing professional training quality characteristics and arrange the professional training quality evaluation criteria;
- correct flexibly of the evaluation elements depending on the internal and external environment changes;
- use it in the shape of electronic worksheets providing the required systemacy of implementation in different university departments.

So, the research shows that government educational policy with its priorities lying in establishment of education quality assessment state system and personality development provides for further development of engineering education quality management systems, aimed at solving the contradiction between the new content and the old form, between personality-centered education and technologization of its quality management.

It is also necessary to take into account that modernization of professional training quality management systems can ensure the system approach to implementation of personality-centered education. Therefore, we cannot abandon the results of research in the field of management, including the new version of international ISO Standards. But implementation of these principles in the educational system must concern not only the techniques, but also psychoeducational, organizational, methodological and other subsystems. At the same time implementation of personality-centered education cannot be restricted to the pedagogical subsystem, it should change the management system, required managers' qualifications, approaches to evaluation of HEI's officials activity and HEI's activity on the whole, stimulation system, etc.

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Experience in the Short-term Educational Engineering Program Realization at Kabardino-Balkarian State University

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One of the priorities of higher professional education for future ten years is a life-long learning, as it was noted in press-release of the Conference of European Ministers, responsible for higher education (Louvain-la-Neuve, Belgium 28-29th April 2009). It involves degree gaining, broadening knowledge and comprehension, getting new skills and competence, personal professional carrier promotion. Life-long learning implies that qualification can be obtained through flexible methods of learning, including sort-term and in-place training.

At Kabardino-Balkarian State University (KBSU) one of such methods is further education of KBSU college postgraduates in accordance with the short-term program of higher professional education (HPE). Successful strategy of extended engineering training involves basic principles and procedures of previous college engineering training acceptance. Higher professional short-term engineering educational program mastering is realized at KBSU in conformity with:

- Higher educational establishment of professional training standard regulations, authorized by Russian Federation Government Decree from 14th February 2008, № 71;
- Order of Russian Federation Ministry of Education from 1 3th May 2002 № 1725 «About conditions affirmation of basic educational professional programs mastering in short period»;
- Russian Federation Ministry of Education Letter, from 23rd May 2001, №14-55-307 «Methodological instructions in developing basic educational programs for those who continue higher professional education or obtaining second higher professional education».

BSU has done a great work in developing such a continuous enginee-

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In the article the following issues are considered:
- engineering professional specialist sort-term training in accordance with the program of higher professional education, among the college postgraduates who master the program of secondary professional education.
- regulatory system and methodological support.
Successful results are shown in terms of Kabardino-Balkarian State University n. a. H. M. Berbekov

ring education. HPE program developing foundations, mastered during short-term training (STT), for those who have secondary professional engineering education, are the state educational standards (SES) of higher and secondary professional education (SPE) as a part of state requirement to the content and level of postgraduate preparation in SPE and HPE specialties of engineering and technical profile, as well as KBSU curriculum. [3].

In terms of short-term education program implementing at KBSU, individual curriculum (for the group of students) was developed and approved on the basis of existing standard educational program considering former secondary professional engineering education.

Developing short-term professional educational programs combines:

- comparative analysis of specialists with secondary and higher engineering profile education professional functions (competence characteristics);
- comparative analysis of state requirements to the content and level of postgraduates' preparation in SPE and HPE specialties, current curriculum and subject programs in the system of secondary and higher professional engineering education;
- higher professional education content development in accordance with secondary professional education.

Factors influencing standard educational terms shortening:

- re-assessment of humane and socio-economical subjects;
- re-assessment of mathematical and common science-natural subjects;
- re-assessment of close context common professional subjects;
- educational and industrial training terms shortening.

Contents of higher and secondary professional education vary in several educational items:

- equal in title subjects of SPE and HPE can differ in assignment and their equal academic hours volume can have different application in higher and secondary educational establishments;
- proportion of theoretical and practical training differs in SPE and HPE (in SPE practical and theoretical training either equal or theoretical part amounts 60%, in HPE theoretical training dominates over practical and amounts 80%);
- significant part in HPE (about 50%) is taken by common scientific subjects: humane subjects, socio-economical, mathematical and common science-natural subjects, but in special secondary educational establishments this is only a science basis;
- peculiarity/specific character of academic activity (volume of the class work in SPE structure is higher than in HPE structure).

University has developed teaching support, teaching materials, examination test materials, individual schedule, academic ranking, tutorial hours for students' autonomous work.

College students willing to continue education according to HPE program, have entering benefits - not participating in common entering competition. They can also undertake free pre-entry courses.

Total amount of students studying according to the higher professional engineering program is 959 for the period of 2005-2010. Proportion of short-term educational programs to total amount of standard educational programs provided by KBSU in all engineering, science-natural and humane subjects, amounts 25%.

At present KBSU provides the following methods of engineering subjects teaching according to short-term HPE program on the base of college postgraduates acceptance (Table 1).

University has two forms of short-term engineering programs mastering:

1) training in separate groups according to special schedule, academic ranking and consulting hours of the student self-work;

2) training in a group with the standard teaching period.

Training in separate groups is a basic form of the short-term HPE learning due to the student enrollment.

The type of student enrollment for the six years in separate educational full time programs is shown in Table 2.

It's obvious that the amount of students choosing the short-term programme has decreased in comparison with the previous years.

We consider it is the result of the following:

- moving from full- to part-time training;
- Russian Federation Military Forces Draft;
- Voluntary University leaving.

The main educational quality indexes are the academic progress and the number of dismissed students. Academic progress for the last three years in percentage is presented in Table 3.

Student academic progress for the period of 2007 - 2010 in standard educational programme is 67,7%, in short-term educational programme - 63,4%.

The amount of the dismissed students studying according to the short-term educational programme for the period of 2007 - 2010 is 86, that is 2,2 times less of the amount of the dismissed students studying according to the standard educational programme.

Major problems of the higher professional engineering short-term programme learning at KBSU are:

1.Enrollment decrease due to the natural decline in population; moving from full- to part-time training; Russian Federation Military Forces Draft; voluntary dismissal; college postgraduate unwillingness to continue training according to the short-term HPE programmes, due to the training time (two or three years) shortening.

2. Complete lack of short-term training methodological support.

3. Decreasing of the present short-term training ways due to:

Table 1
Short - term engineering educational programmes in 2010-2011

SPE subjects	College	HPE subjects	Department
- Automation of technological processes and production; - Computer complexes, systems and network; - Micro- and solid-state electronics; - Technical service and electronics repair.	Polytechnic college of KBSU	Micro- and solid-state electronics, Home electronics	Microelectronics and Computer technology
- Computer complexes, systems and network - Computer and automation system	KBSU Polytechnic College KBSU College of Economics and Information Technologies	Automation system of data processing and control. Computer and automation system software	Information Technologies and Management
- Construction and building operations	KBSU Municipal Engineering College	Industrial and civil engineering	Engineering Technology

Table 2
Sort-term HPE enrollment for the past 6 years

№	Subject	Year					
		2005	2006	2007	2008	2009	2010
1	Micro- and solid-state electronics	47	45	67	71	40	38
2	Home electronics	48	49	41	38	26	15
3	Automation system of data processing and control	42	36	13	0	0	0
4	Computer and automation system software	25	41	61	67	64	52
5	Industrial and civil engineering	0	0	10	11	6	6
	Total	162	171	192	187	136	111

Table 3
Academic progress in professional engineering HPE programmes

№	Program	Training	2007/2008 academic year		2008/2009 academic year		2009/2010 academic year
			Winter term	Summer term	Winter term	Summer term	Winter term
1	Micro- and solid-state electronics	STT*	52	42	49	86	67
		ST*	74	65	75	58	53
2	Home electronics	STT	77	88	82	62	75
		ST	73	70	69	47	47
3	Automation system of data processing and control	STT	68	-	-	-	-
		ST	50	28	44	42	58
4	Computer and automation system software	STT	35	29	49	34	63
		ST	46	35	58	36	66
5	Industrial and civil engineering	STT	55	25	57	21	42
		ST	71	27	78	65	35

STT* – short-term training ST** – standard training

- moving to the 3rd generation standards of HPE and SPE;
- approval of new SPE discipline range and HPE specialization;
- approval of Standard Higher Educational Provisions by the Decree of Russian Federation Government of 14th February 2008, №71.

Standard Higher Educational Provisions (section III, item 36) stated that: «...a person having secondary professional education of the definite profile can get higher professional education according to the short-term or accelerate Bachelor programmes...», and further: «...obtaining the short-term higher professional Master programme education is not permitted».

By the experience in the short-term training of those having the secondary professional education and undertaking higher professional engineering programmes, can be said that:

- in some disciplines, the academic progress of students undertaking HPE STT is higher than of those who undertake the standard term education, and for the last two years HPE STT postgraduates;
- succeed better than school postgraduates;
- rating which reflects practical training academic progress of the students undertaking HPE STT is also higher than those who undertake standard term education, as secondary professional education aims to develop practical skills and this correlates with the 3rd generation of the State Educational Standards;
- the amount of students who failed to learn one or more subjects of HPE STT is lower than the amount of failed students taught by the standard programme;
- the results of HPE STT State Attestation Commission proved to be good, as the postgraduates show deep knowledge in their professional field application at the state examinations, worse they learn disciplines of natural science and subjects requiring deep theoretical knowledge; quality of their graduation qualification paper is also higher; HPE STT postgraduates are easily employed and have good references.

Drawing a conclusion we can say that the high professional education short-term engineering specialist training programme shows positive results followed by the regulatory system improvement and can be suggested in two-stage HPE system.

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Public and Professional Accreditation of Educational Programmes. Who needs it and why?

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Presently, public and professional accreditation of educational programmes, particularly, of engineering ones, is becoming more and more well-known in Russian and international academic communities [1].

Nevertheless, there are controversial views regarding the necessity of this procedure. These points of view range from total denying to suggesting, for example, that an educational programme should be accredited by several accreditation agencies acting in different countries.

This article is meant to provide some information rather than present a scientific approach. It describes the characteristics of public and professional accreditation of educational programmes; the meaning of this procedure from the point of view of a higher education institution (HEI), students, graduates, employers; Russian and international activity in this area; and the concept of «international accreditation of educational programmes».

First. Presently, the education quality assessment system in Russia includes two types of accreditation: institutional and public and professional. Institutional accreditation concerns a higher education institution as a whole and is performed according to the plan of the Ministry of Education and Science of the Russian Federation under the guidance of the Ministry officials and with the participation of representatives from industry and other HEIs. Although this procedure includes the review of several educational programmes provided by the HEI, the attention is drawn mostly to the HEI's academic resources. In case the HEI receives good ratings for all kinds of academic resources, it obtains accreditation of the Ministry of Education and Science for a five-year period. This type of institutional accreditation is called state accreditation. It implies that all the educational programmes of the HEI hold the state accreditation granted by the Russian education control authority for the next 5 years.

Public and professional accreditation problems of engineering educational programmes, the accreditation procedure in Russia and abroad are being discussed in the article.

ENGINEERING EDUCATION 6'2010

Public and professional accreditation can be provided to educational programmes only. The main focus here is located on future specialists' professional training evaluation. This type of accreditation is voluntary and is conducted by the independent accreditation agencies in accordance with their requirements. Such agencies invite experienced experts representing academic and professional communities. The best experts also take part in establishing accreditation criteria. On a number of occasions independent accreditation agencies of different countries (national accreditation agencies) conclude agreements on the mutual recognition of national accreditation systems. In this case accreditation of an educational programme by a national accreditation agency obtains the status of international accreditation. This means that a programme accredited by a national accreditation agency is recognized by all the member countries of an agreement.

The independent accreditation agencies have been operating in many countries for a long period of time. For example, ABET (Accreditation Board for Engineering and Technology) has been operating in the USA for several decades already. This independent agency provides engineering educational programmes accreditation across the US and can also conduct substantial equivalency evaluations for educational programmes outside the US. This accreditation body was established in 1932 as Engineers' Council for Professional Development (ECPD) and in 1980 was renamed as ABET.

Similar agencies operate in dozens of other countries. Sometimes there can be several agencies acting independently in the same country. Universities are free to choose any of them to conduct accreditation of their programmes. They can also choose any foreign accreditation agency.

International alliances (agreements) in the sphere of engineering educational programme accreditation comply with the coordinated accreditation criteria and procedure. The most famous agreement between engineering accreditation agencies is the Washington Accord (WA) which was signed in 1989 [2].

Signatories

- Accreditation Board for Engineering and Technology (ABET)
- Engineers Canada
- Engineering Council of South Africa (ECSA)
- Engineering Council UK (ECUK)
- Engineers Australia
- Engineers Ireland
- Japan Accreditation Board for Engineering Education (JABEE)
- The Institution of Professional Engineers New Zealand (IPENZ)
- Hong Kong Institution of Engineers (HKIE)
- Institution of Engineers Singapore (IES)
- Accreditation Board for Engineering Education of Korea (ABEEK)
- Institute of Engineering Education Taiwan (IEET)
- Engineering Accreditation Council, Malaysia (EAC)

Provisional members

- Russian Association for Engineering Education (RAEE)
- Fachakkreditierungsagentur für Studiengänge der Ingenieurwissenschaften, der Informatik, der Naturwissenschaften und der Mathematik e.V. (ASIIN)
- All India Council for Technical Education (AICTE)
- Institution of Engineers, Sri Lanka

ENAEE (European Network for Accreditation of Engineering Education) includes 18 accreditation agencies from 15 countries [3].

Full members

- FEANI - Fédération Européenne d'Associations Nationales d'Ingénieurs
- ECUK - Engineering Council UK
- CTI - Commission des Titres d'Ingénieur
- ASIIN - Fachakkreditierungsagentur für Studiengänge der Ingenieurwissenschaften, der Informatik, der Naturwissenschaften und der Mathematik
- Ordem dos Engenheiros
- CoPI - Conferenza dei Presidi delle Facolta' di Ingegneria Italiane
- SEFI - Société Européenne pour la Formation d'Ingénieurs
- ENGINEERS IRELAND
- RAEE - Russian Association for Engineering Education
- EUROCADRES - Conseil des Cadres Europeen
- UNIFI - Universita degli Studi di Firenze
- IDA - The Danish Society of Engineers
- BBT - Bundesamt fur Berufsbildung und Technologie
- MÜDEK - Association for Evaluation and Accreditation of Engineering Programmes
- IGIP - International Society for Engineering Education
- IIE - Instituto de la Ingenieria de Espana
- ARACIS - The Romanian Agency for quality Assurance in Higher Education
- TEK - Finnish Association of Graduate Engineers

Associate members

- CLAIU - Council of Associations of long-cycle Engineers of a University or Higher school of Engineering of the European Union

In case an educational programme has obtained the accreditation of any member country of these agreements, it is automatically recognized by the rest of the agreement members. It is also important to note that these agreements are signed by specific accreditation agencies on behalf of their countries. So, if an educational programme obtains accreditation of an agency which does not participate in any international agreement, it cannot be called international accreditation.

Second. Each university has the right to submit their educational programmes for accreditation by a national, foreign or international accreditation agency. State education control authorities do not have any specific requirements concerning university educational programmes' public and professional accreditation. As we have mentioned before, public and professional accreditation of an educational programme is conducted by a team of appropriately trained and independent peer experts representing professional and academic communities (they cannot participate in accreditation of educational programmes of the university they work for). These teams do not include representatives of any government authorities to avoid the conflict of interests. In other words, the university's job on providing for the educational programme undergoing accreditation procedure cannot be evaluated by a representative of government authorities who are, in fact, responsible for education quality.

Therefore, public and professional accreditation of educational programmes, as opposed to institutional accreditation, is voluntary and independent.

Third. There are at least four reasons why universities can be interested in public and professional accreditation of their educational programmes.

1.Improving educational programmes. A university presents its programme to a team of independent peer experts including representatives from industry in order to disclose its shortcomings and get recommendations on its development and improvement.

2.Ensuring educational programme's recognition. In case of national accreditation, the information about the accredited educational programme is presented in mass media, thus increasing its competitive strength and providing its recognition in professional and academic communities. In case of international accreditation, the programme is recognized in all member countries of accreditation systems' mutual recognition agreement. This significantly widens the opportunities for student academic mobility and developing Double Degree educational programmes in cooperation with foreign partners thus allowing graduates to obtain 2 university degrees. The information about the programme obtaining international accreditation is published in mass media making it more appealing for Russian and foreign applicants and employers.

3.Comparing the educational programme with similar programmes of other universities. In some cases, for example, in the USA there is an educational programme rating based on the results of the public and professional evaluation.

4.Providing graduates with an opportunity to obtain national and/or international professional engineer certificates (this works only for engineering educational programmes). In many countries completion of an accredited programme is a prerequisite for taking part in the registration (licensing) process. In case a specialist graduated an educational programme which does not hold public and professional accreditation, he/she is not allowed to obtain a title of a professional engineer.

In 2010 Russia as well began developing a system of professional engineers' certification.

Fourth. Public and professional accreditation of engineering educational programmes is a part of the Russian engineering education quality assurance system which includes two parts [4]:

1 .Independent international public and professional accreditation of engineering educational programmes.

2.Certification and registration of professional engineers in the APEC Engineer Register (Asia-Pacific Economic Cooperation) [5] or FEANI Professional Engineers Register (European Federation of National Engineering Associations) [6].

Different agencies conduct public and professional accreditation of educational programmes in Russia, the most well-known are the Russian Association for Engineering Education (RAEE) and the Agency for Higher Education Quality Assurance and Career Development (AKKORK) [8].

The RAEE has been conducting engineering educational programmes accreditation since 1999, granting international quality label since 2005. During this period, the RAEE has accredited 147 educational programmes of 26 Russian universities and 12 educational programmes of 4 Kazakh universities. The RAEE is a full member of the ENAEE and has the right to award EUR-ACE® quality label, thus ensuring the recognition of an educational programme in 14 European countries. Since 2005 66 Russian educational programmes received the EUR-ACE® quality label.

The RAEE also holds the provisional status in the Washington Accord. In case Russia (represented by the RAEE) will be accepted as a signatory of the WA, Russian engineering educational programmes accredited by the RAEE will be recognized in all WA member.

Each of the above-mentioned alliances (agreements) has a set of the coordinated requirements (criteria) for the engineering educational programme quality. These criteria concern the following issues defining the educational programme quality.

1. Programme educational objectives
2. Programme content
3. Students and educational process
4. Faculty
5. Professional qualifications
6. Facilities
7. Information resources
8. Finance and management
9. Graduates

Presently, the RAEE criteria comply with the ENAEE and WA requirements ensuring that the educational programme accredited by the RAEE peer review teams is recognized internationally.

Recently, some steps have been made to establish professional engineers' registration system in Russia as a part of engineering education evaluation and quality assurance system. In the last 3-4 years, the Union of Scientific and Engineering Associations (USEA) has laid the foundations of this process by conducting the professional engineers' contests [9]. In 2009 the USEA became a full member of FEANI - European Federation of National Engineering Associations. Thus, it acquired the right to manage Russian Professional Engineers Register and to nominate Russian engineers for obtaining the FEANI Euro Engineer title.

The USEA established the Monitoring Committee to organize and conduct the selection of nominees for FEANI Russian Professional Engineers Register.

In 2010 the RAEE became a member of APEC Engineering Register - the Asia-Pacific engineering organizations alliance. Following this event the Russian Monitoring Committee of APEC Engineers was established, headed by I. Fedorov, member of the Academy of Sciences, the President of the Technical Universities Association, president of Bauman Moscow State Technical University; prof. P. Chubik the Vice-President of the RAEE, rector of Tomsk Polytechnic University was appointed as his deputy.

Russian Monitoring Committee of APEC Engineers has already started to organize and conduct selection of nominees for obtaining the status of professional engineers recommended for enrollment in the Russian APEC Engineer Register.

By now, the Russian Monitoring Committee of APEC Engineers has developed a set of methodological instructions and criteria for the selection of nominees to enroll in the Russian APEC Engineer Register.

To be recognized as a professional APEC engineer it is necessary to meet the following requirements:

1.Complete the engineering programme holding public and professional accreditation.

2.Gain a minimum of 7 years practical experience.

3.Spend at least two years (within the 7 years of practical experience) in engineering positions which require taking responsible engineering decisions (present documented confirmation).

4.Pass two exams set by APEC Monitoring Committee to confirm the engineering qualification in a certain field.

After the review of the presented confirming documentation the Monitoring Committee makes a decision to issue the professional APEC engineer certificate to the candidate and to enroll him/her in the Russian APEC Engineer Register.

The international professional engineer certificate provides Russian engineers with wide opportunities to participate in the major international projects which can be beneficial to the Russian economy.

The establishment of the international public and professional accreditation system and professional engineers' registration system (FEANI and APEC registers) in Russia will make

it possible to conduct the unbiased assessment of the national engineering education quality and to find ways of its improvement.

Summary:

1. Public and professional accreditation of educational programmes is an important tool of the independent and objective quality assessment of the Russian engineering education.

2. The international public and professional accreditation of the educational programmes allows higher education institutions to raise their education quality substantially as well as to promote their activity in the sphere of academic mobility for both students and teachers and to enhance the university prestige in Russia and worldwide, to make it more appealing for Russian and foreign applicants and employers.

3. International public and professional accreditation of educational programmes makes it easier both for the students and teachers to study or take an internship in those countries where their accredited programme is recognized.

4. Graduates of accredited programs obtain an opportunity to receive a professional engineer certificate (license) and to take part in the major and remarkable international projects.

5. The employers hiring the graduates of the accredited programmes get a chance to create teams of professional engineers having international certificates (licenses), which allow them to bid on the large-scale projects and increase their chances to win. This will also enhance and strengthen the company's international prestige.

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Russian System of Professional Engineers Certification and Registration Based on the APEC ENGINEER REGISTER International Standard

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The quality assurance system in engineering education based on the certification and registration of professional engineers has proved its efficiency in a large number of developed countries all over the world. International experience on the matter and the first results in the attempt to develop a similar system in Russia on the base of the international standard APEC Engineer Register are presented in the article.

IINTERNATIONAL EXPERIENCE

The two-tier system of education (Bachelor - Master), as an integral part of the higher education in a number of developed countries rely heavily on the two-level system of quality assurance in engineering education. While the first step implies the accreditation of engineering programmes at universities, the second one deals with the certification and registration of professional engineers by independent, non-governmental public professional organizations (such as ABET in the USA, ECUK in Great Britain, JABEE in Japan, etc.) which use a number of relevant procedures and criteria [1].

As a rule, the basis of such criteria and procedures is a law on professional engineering activities in a country that regulates the rights and responsibilities of professional engineers, establishing the rules of maintaining national register of professional engineers, defining the qualifications of engineers and the procedure for evaluation, certification and registration. In some countries, legislation governing practical engineering activities, does not apply to federal jurisdiction.

For example, in Germany, such laws are within the competence of the particular land (the Law on engineering activities in Lower Saxony [2], Brandenburg [3], etc.) in the U.S. A.-within the competence of the state (normative documents regulating engineering activities in Texas [4] Mississippi [5], etc.).

One of the leading centers for international recognition of professional engineers is the APEC Engineer Register, established by the International Organization for Asia-Pacific Economic Cooperation (APEC) to ensure professional mobility of engineers in member

economies (USA, Canada, China, Japan, Australia, etc.). Until recently, Russia, being a member of Asia-Pacific Economic Cooperation, was not a part of APEC Engineer Register system thereby limiting the competitiveness of Russian experts in the field of engineering and technology.

According to The APEC Engineer Manual the title of "APEC Engineer" is awarded to those applicants, who successfully passed examinations and match the following criteria:

- Applicant should be a graduate of HEI who completed an accredited education.
- Applicant shall have the right to carry out individual engineering activity.
- Applicant should have not less than 7 years of engineering practice dealing with a complex and innovation problem and not less than 2 years of experience working as an executive manager carrying out an engineering project.
- Applicant should continuously develop professional skills and knowledge.
- Applicant shall adhere to the Code of APEC Engineer Professional Ethics.

FIRST RESULTS IN RUSSIA

In connection with the reforms based on a shift to the two-tier system of education in the field of engineering and technology as well, Russia needs to maintain a special status for those engaged in practical engineering activities within the national system of certification and registration of professional engineers [6].

In 2008, Russian Association for Engineering Education (RAEE), acting as the Washington Accord associated member, received an official proposal to join the APEC Engineer Register, which allows it to award the title of "APEC Engineer" to Russian specialists in engineering and technology.

Registration of engineers in the APEC Engineer Register is carried out on the basis of The APEC Engineer Manual procedures and entails recognition of their competencies meeting international standards and complying with the criteria of the APEC Engineer Agreement [7].

To manage the system of certification and registration of individuals involved in practical engineering activity RAEE jointly with the Russian Union of Scientific and Engineering Associations (RUSEA) established the Russian Monitoring Committee of APEC Engineers

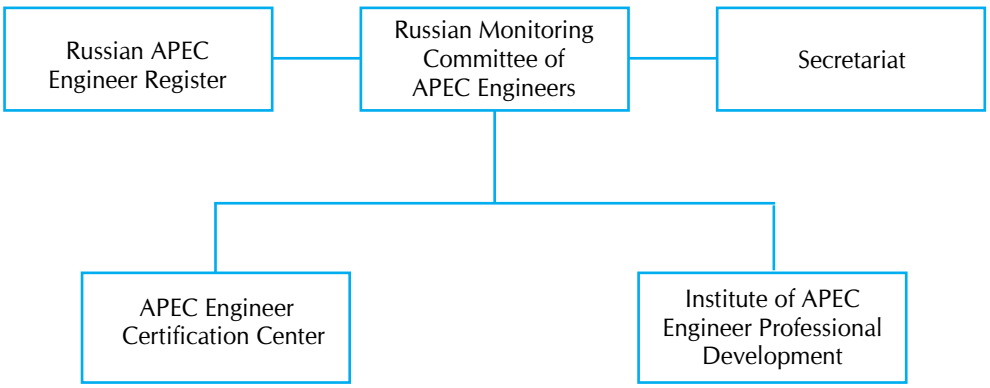

Figure 1. Organisation chart
The system of certification and registration in the Russian APEC Engineer Register

in compliance with The APEC Engineer Manual. It consists of representative legislative and executive authorities, public and professional organizations, universities and research institutions. Figure 1 presents the organization chart of the system.

The Russian Monitoring Committee of APEC Engineers developed and approved guidelines and documents regulating functioning of the system [7]:

- Regulations on certification and registration in the Russian APEC Engineer Register and International APEC Engineer Register;
- List of practical activities of APEC Engineers in Russia;
- APEC Engineer Standard;
- Regulation on evaluation procedure of practical engineering activity indicators for their compliance with the APEC Engineer Standard;
- Regulation on examination of competences necessary for carrying out the individual practical engineering activity in a certain discipline within the framework of the APEC Engineer Standard;
- List of transferable, professional and special competences necessary for carrying out individual practical engineering activity in accordance with the APEC Engineer Standard;
- Form of APEC Engineer Certificate;
- Form of presenting personal data and indicators of practical activities of the Engineer in the Russian APEC Engineer Register;
- Regulation on suspending and termination of engineer's registration in the Russian APEC Engineer Register and the International APEC Engineer Register;
- Code of APEC Engineer Professional Ethics;
- Application form for registration within the Russian APEC Engineer Register and the International APEC Engineer Register;
- Regulation on the apec Engineer Certification Center;
- Regulation on the Institute of APEC Engineers Professional Development.

Certification and registration of a person involved in practical engineering activity on the territory of the Russian Federation is carried out according to the following 12 areas agreed with The APEC Engineer Manual:

- Aerospace Engineering
- Bioengineering
- Chemical Engineering
- Civil Engineering
- Environmental Engineering
- Electrical Engineering
- Geotechnical Engineering
- Information Engineering
- Mechanical Engineering
- Mining Engineering
- Petroleum Engineering
- Transportation Engineering

The web site of the APEC Engineer Certification Center was created within the web portal of National Research Tomsk Polytechnic University (www. tpu.ru), where all regulating documents and the description of the certification and registration system are available. The possibility of the active communication with the stakeholders - applicants who seek certification and registration in the Russian APEC Engineer and the International APEC Engineer Register is foreseen.

In accordance with the APEC register Regulations an applicant for the title of "APEC Engineer" fills in and sends an application form to the Secretariat of the Russian Monitoring Committee of APEC Engineers together with the electronic copies of the accompanying documents confirming indicators of his/her professional competence and engineering practice. The Secretariat verifies the accuracy of the presented information and compares it against the criteria of the APEC Engineer Standard and sends the documents to the APEC Engineer Certification Center. The Certification Center sets the Examination Boards

to check transferable, professional and special competencies in various disciplines of engineering activity. The examination consists of two stages – written and oral (interview) forms.

The results of the written examinations are sent to the Certification Center, which decides whether engineering practice indicators of the Applicant comply with the APEC Engineer Standard. The decision of the certification is approved by the Russian Monitoring Committee of APEC Engineers. If the decision is positive, the personal data and indicators of practical engineering activity of the Applicant are recorded in the Russian APEC Engineer Register. The Applicant is given the certificate on awarding him/her the title of APEC Engineer.

An Applicant should meet one of the main requirements and follow The Code of APEC Engineer Professional Ethics. In line with the Code of Ethics APEC Engineer shall:

- act for each employer or client in a polite, fair and faithful manner, as well as maintain confidentiality and avoid conflicts;
- provide moral incentives to colleagues and handle any fair criticism in a positive way;
- have an unbiased attitude to all clients and colleagues irrespective of their ethnic belonging, religious views, age, mental and physical abilities, marital status and nationality;
- publish the outcomes of his/her work, as well let their subordinates and colleagues do so;
- strive for continuous professional development, knowledge enrichment, acquisition of professional skills and competences, enhancing general communication culture and amenity;
- act in organized and disciplined way of thinking and behavior;
- be responsible for assumed obligations, ideas implementation and consequences of engineering activity; open acknowledgement of his/her errors.

RESULTS OF PILOTING

In accordance with the Agreement on joint activities between the Russian Union of Scientific and Engineering Associations (RUSEA) and the National Research Tomsk Polytechnic University it has been decided to establish the Center for International Certification in the field of technical education and engineering profession on the base of Tomsk Polytechnic University. In May 2010 a pilot project on practical implementation of all components of the system of certification and registration in the Russian APEC Engineer Register and International APEC Engineer Register was carried out within the Center. In particular, the examinations for applicants from Zheleznogorsk and Tomsk were organized and set by the Center.

There were 42 candidates who took part in the pilot project. All of them are engaged in practical engineering activities in different areas (aerospace engineering, electrical engineering, mechanical engineering, chemical engineering) in several enterprises: Information Satellite Systems after Academician M.F. Reshetnikov (Zheleznogorsk), Tomsk Vakhrushev Electromechanical Plant, Sibelektromotor (Tomsk) and others. On May 26, 2010 according to the decision of the Russian Monitoring Committee of APEC Engineers, 27 applicants who successfully passed the test were certified and registered as first Russian Professional APEC Engineers.

The meeting of the APEC Steering Committee took place on 24 June 2010 in Ottawa, Canada within International Engineering Alliance Interim Meeting 2010. Russia represented by the Russian Association for Engineering Education was unanimously accepted to APEC Engineering Register, that significantly increases the competitive opportunities for local professional engineers, as well

as enterprises which economic interests are connected with the Asia-Pacific region.

CONCLUSION

Certification and registration of Russian engineers in the APEC Engineer Register is a part of the activities aimed at creating internationally recognized national frameworks of engineering occupations. An important step towards a comprehensive solution of the problem of increasing "de facto" and worldwide recognition "de jure" the training quality of Russian engineers was made. It will definitely encourage: development of engineering education and engineering profession in the country and enhancement of their attractiveness,

- improvement of quality of graduates' training within engineering educational programmes in Russia higher educational institutions,
- promotion of continuous professional development and improvement of professional competencies among practicing engineers,
- education of highly qualified engineers for further development of production and national economy,
- improvement of international prestige, competitiveness and mobility of Russian engineers.

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ENGINEERING EDUCATION 6'2010

European Engineer Qualification for Russia

The Russian Union of Scientific and Engineering Associations
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EUROPEAN FEDERATION OF NATIONAL ENGINEERING ASSOCIATIONS AND RUSSIAN UNION OF SCIENTIFIC AND ENGINEERING ASSOCIATIONS

The history of engineering education standards began in June 1949, when 340 European engineers met for a congress "The role of the engineer in the modern society". The participants decided to establish an international organization, whose aim would be to strengthen the role of engineers in all national and international movements of economical and social dimension.

The Federation of international and national engineering associations was created in September 1951. Seven European countries - Austria, Belgium, Switzerland, Germany, France, Italy and Luxembourg - were the founders.

In 1956, due to the increase of member countries, the organization's name was changed to European Federation of National Engineering Associations (FEANI).

Today associations from 29 European countries, including Russia [1], are represented in FEANI, uniting more than 350 national engineering associations and about 3.5 million engineers. The Federation has a consultative status with UNESCO, UNIDO and the Council of Europe; it is officially recognized by the European commission as an expert in engineering education. It is also among the members of the World Federation of Engineering Organizations (VVFEO) which represent s approximately 8 million engineers around the world.

FEANI's objective is to affirm the professional status of engineers in Europe by:

- ensuring the high professional qualification of European engineers and its recognition around the world;

The article contains the requirements for obtaining the European Engineer (Eur Ing) title by Russian engineers. This title can place Russian engineers at the international level, and the preliminary accreditation of educational programmes allows universities' leaders to evaluate their educational process against the European standards.

- asserting the status, role and responsibility of engineers in society;
- promoting the professional interests of engineers and facilitating their free movement within Europe and worldwide;
- developing professional connections with other international organizations in the sphere of engineering;
- representing the engineers of Europe in the international organizations and other decision-making bodies.

FEANI's activity, especially with the attribution of the European Engineer (EUR ING) professional title, facilitates the recognition of high qualification certified engineers in Europe and strengthens their position, role and responsibility in society.

FEANI has one national member representing national engineering education of each member country. Russia is represented by the Russian Union of Scientific and Engineering Associations (RUSEA).

The Russian Union of Scientific and Engineering Associations is a successor of activity and traditions of Russian Technical Society, established in 1866 [2]. In December 1990, at the Founding Conference dealing with reorganization of existing public organizations, the RUSEA acquired its present name and the status of non-governmental independent public association.

RUSEA is comprised of 25 scientific and engineering public organizations established in different fields of science and engineering and uniting scientists, engineers and specialists on the basis of their professional interests. It also includes 49 regional unions of scientific and engineering organizations.

In 1991, the RUSEA became a member of the World Federation of Engineering Organizations (WFEO).

FEANI European Monitoring Committee (EMC) is a body consisting of independent experts.

The EMC makes decisions on registration of specialists as Eur Ing and supervises the work of the National Monitoring Committees (NMC) in order to maintain European educational standards. The EMC approves accreditation of schools and educational programmes.

The National Monitoring Committee is a national body, established in every FEANI member country, composed of representatives from national engineering associations, industry and education. Russian National Monitoring Committee was established in April 2009. It is headed by Yu. Gulyaev, member of the Academy of Sciences.

The Committee is composed of three boards: methodological board, accreditation board and registration board.

Among the members of the NMC there are leaders of Russian largest universities, industrial enterprises, design and construction organizations, public and professional engineering associations, as well as the representatives of government authorities.

It is the task of the Russian National Monitoring Committee:

- to facilitate licensing of educational programmes;
- to provide the EMC with the information on the structure of engineering education and the standards of individual schools and educational programmes;
- to review the professional engineering experience of an applicant before proposing his/her registration as Eur Ing.
- to review any changes or additions to the approved list of schools and programmes and notify the EMC about them.

THE EUR ING TITLE

The principal objective of the Eur Ing project is to develop a framework for engineering programme accreditation in the European higher education area in order to afford a means for comparing different qualifications, thus, promoting mobility and increasing career options for graduates.

Accreditation involves a periodical assessment of an engineering educational programme against the accepted

standards. It is conducted by independent peer review teams consisting of practicing engineers and educators.

The evaluation process normally involves both reviewing of data about the programme and a visit to the higher education institution in order to review its educational process organization.

The accreditation standards can be used in the evaluation of Bachelor and Master degree programmes in all branches of engineering according to the European Qualification Framework. The European Commission finances the EUR-ACE project [3], aimed at the establishment of European engineering education accreditation system, as defined by Bologna declaration, in order to establish the European Higher Education Area.

The establishment of a European accreditation system for the entire engineering sector is a major tool for engineering education quality improvement and assessment, as well as for the support of engineering qualification recognition and engineers' mobility within Europe.

The proposed European accreditation system is based on a set of common European Framework Standards for the engineering programme accreditation that includes:

- a common standard which will provide European status to all existing national accreditation procedures;
- guidelines for implementation of accreditation procedures in those countries where they do not yet operate, in order to assure the engineering education quality and to coordinate national and international requirements.

FEANI has established and maintains a list (the FEANI Index) of schools and educational programmes which meet educational standards set out by FEANI and are accredited or officially recognized on the national level. This Index defines the exact duration of study, academic title and characteristics of each programme.

The FEANI Index also includes the non-member countries having agreements with FEANI on the mutual recognition of their accreditation systems. The list includes information on the national body responsible for accreditation system and the list of accredited schools and programmes.

It can also include lists of independent schools and programmes from non-member countries, accredited by a member country.

FEANI maintains a Register to which the Eur Ing candidates are admitted provided they meet the established requirements [4]. The purpose of the Register is as follows:

1) To facilitate the practicing engineers mobility inside and outside the FEANI ambit and to establish a system of qualifications' mutual recognition in order to allow engineers willing to practice outside their countries present a certificate confirming their professional competence without any additional nostrification.

2) To provide a prospective employer with the sufficient data about the professional competences of the engineer.

3) To support continuous improvement of engineers' training quality by monitoring innovations and reviewing quality standards.

4) To provide a source of information about the variety of employment in member countries.

Educational and training systems in Europe vary considerably. Their value is estimated by FEANI and is based on the high standards of engineer's professional competence. Engineering education and engineering experience together define the professional competence level. European Engineer's professional competence includes:

- willingness to serve society and profession according to the code of professional conduct;
- a thorough knowledge of engineering principles based on mathematics and science as an essential element of profession;

- good engineering practice in a certain field of engineering;
- an ability to apply different theoretical and practical methods to analyze and solve engineering programmes and to use existing and new technologies in a certain field of specialization;
- knowledge of economical, quality assurance and equipment maintenance issues and ability to use technical information;
- an ability to work in teams on multidisciplinary projects;
- leadership skills including managerial, technical, financial and personal aspects;
- commitment to maintaining competence by continuous professional development;
- fluency in European languages sufficient for communication with colleagues throughout Europe.

There are two ways of a European Engineer registration:

- registration on the basis of higher professional education (takes place on the national level under the guidance of the FEANI National Monitoring Committee).
- registration on the basis of professional status (takes place on the European level under the guidance of the FEANI European Monitoring Committee).

The elements of engineering education are B, U and T, where:

"B" represents a high level of secondary education validated by one or more official diplomas awarded at the age of 18.

"U" represents a year (full-time or equivalent) of approved university programme provided either by a university or by the other university-level recognized organization, accredited by FEANI and included in the FEANI Index - "The List of Schools and Programmes".

"T" represents a year (full-time or equivalent) of training aimed at accumulating practical skills through work within technical fields, for example, in a factory, laboratory or other organization supervised and approved by a university as a part of the engineering programme.

The minimum standard for registration on the basis of education is:

B + 3U.

It means that an engineering programme must last at least for three years and comply with the condition B.

The elements of the professional status are the completed engineering education with the elements B, U, T and the professional engineering experience E.

"E" represents a year (full-time or equivalent) of engineering experience approved by FEANI.

For different categories of education FEANI considers different standards of professional status.

1) Education (school and program) is listed in FEANI Index.

The minimum standard for engineering status is 7 years. FEANI considers the specific educational programme duration (the number of U and T years).

The balance up to 7 years can be covered by an appropriate number of years of professional engineering experience according to the following scheme:

B + 3U + 2(U/T/E) + 2E.

2) Education outside the FEANI area.

For applicants whose engineering degree was obtained outside the FEANI area the school or the programme must either be in the International Section of the Index or be officially recognized in any of FEANI countries as equivalent to those listed in the Index. In this case the minimum standard is

B + Education + 4E.

Applicants holding a university degree in mathematics or natural science are eligible for registration in case their schools are listed in the FEANI Index.

If their country is outside the FEANI area, the programme must be equivalent to one listed in the FEANI Index. They are eligible for registration if they can prove a minimum of eight years of professional engineering experience and therefore meet the standards according to the following scheme:

B + Education +8 E (at least 35 years old).

In such a case a very strict evaluation of their professional engineering experience takes place in order to ascertain that the eight-year engineering experience meets all the requirements.

In some cases professional engineering experience has been gained on the basis of the education that does not meet the above-mentioned requirements. Nevertheless, it is still possible to consider this alternative. However, very strict procedures will be applied to evaluate the professional status of such a candidate. The applicant must be at least 35 years old and must have no less than 15 years of professional engineering experience:

15E (at least 35 years old).

The FEANI European Monitoring Committee is in charge of the Eur Ing registration and of standard modification in the light of technological or other developments. These standards are reviewed at intervals of not more than 5 years.

Individuals can apply for registration if they are members of the engineering association represented in FEANI. Applications must be submitted to National Committees, not directly to the FEANI.

Individuals can apply to be registered on the basis of their education and professional status either at the same time or separately - on the basis of education first, and then on the basis of professional status.

The application form must be filled out in one of the three official FEANI languages - English, German or French. All required documentation must be attached and the fee set by the National Committee must be paid.

Russian Monitoring Committee (RMC) checks whether the school or programme successfully completed by the candidate are in the FEANI Index or are equivalent to those listed in the Index.

It also checks that the duration of the professional engineering experience meets the minimum requirement or that the candidate can be expected to achieve the required professional engineering competence.

Professional engineering experience should include the following elements:

1. The solution of engineering problems in such fields as research, development, design, production, construction, equipment installation and maintenance, sales and marketing.
2. Management of technical staff.
3. Management of financial, economical and other aspects of engineering tasks.
4. Management of industrial and environmental problems.

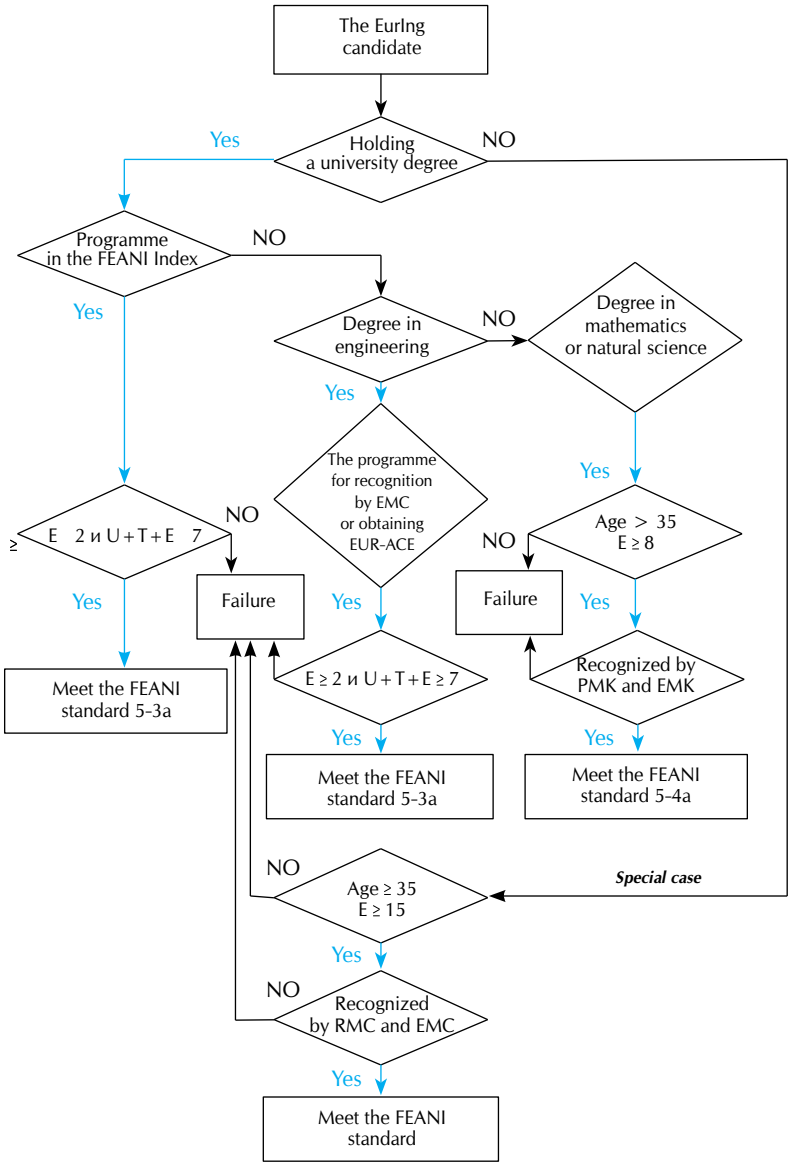
In order to enable the RMC to review the applicant's professional engineering experience, the application should be accompanied by its appropriate description. The purpose of this description is to assess the applicant's professional experience since graduation and the level of his/her professional competence in the chosen specialization. It should demonstrate how this experience gave him/her the opportunity to reach the level of professional competence required of a Eur Ing. In case there still are disputable issues, this analysis should include an interview held by the experienced engineers.

The RMC makes a decision upon directing the application to the EMC for registration and issuing certificates to successful candidates. Individuals registered on the basis of education must follow the FEANI Code of Conduct. The Code of Conduct contains ethical norms of professional engineers' conduct.

It does not substitute any ethical norms operating in the applicant's own country.

The main requirements of the Code are as follows:

All individuals listed in the FEANI Register as European Engineers must be conscious of the importance of science and technology for humanity and of their own social responsibility in their professional activity. They commit



themselves to follow the common European rules of conduct respecting the professional rights and the dignity of their colleagues.

The decisions and actions of engineers have a huge impact on the environment and society. The engineering profession imposes an obligation to work in the public interest and with regard for health, safety and sustainability.

Engineers are obliged to act with integrity, in the public interest and to exercise all their skills in carrying out their work.

Thus, they must:

- maintain their competence at the necessary level and only undertake tasks within the scope of their
- not misrepresent their educational qualification or professional titles;
- give an impartial judgment to their employer or clients, avoiding conflicts of interest, and observe the confidentiality requirement;
- take full responsibility for their work and the work carried out under their guidance;
- respect the personal rights of their colleagues and the legal and cultural values of societies in which they work;
- be prepared to public speeches on technical issues in the field of their competence.

The possible ways for Russian engineering specialists to obtain Eur Ingtitle are presented in the picture below.

The registration as Eur Ing is attested by a certificate prepared by the Secretariat General and signed by the President of FEANI. This certificate provides information on the duration and type of education.

Rejected applications are returned to the National Committee with the reasons explained. The registration should be renewed every 5 years through the RMC.

In July 2010, first Russian specialists were registered as Eur Ings at the meeting of the European Monitoring Committee in Dublin (Ireland).

The Eur Ing Certificates are awarded to successful Russian candidates by the Russian Monitoring Committee of FEANI.

CONCLUSION

Taking into account the need for engineering educational programmes public and professional accreditation system in Russia and entering the European Federation of National Engineering Associations which is officially recognized by the European commission as an expert in engineering education, the Eur Ing registration of Russian engineering specialists is an important step forward. This title places Russian engineers at the international level. The activity in this field is supported particularly by the Presidium of the Moscow Council of Rectors.

The principal objective of the Eur-Ing project is to develop a framework for engineering programme accreditation in the European higher education area in order to afford a means for comparing different qualifications, thus, promoting mobility and increasing career options for graduates.

The requirements for the Eur Ing registration allow the leaders of Russian universities to evaluate their educational process against the European standards and, in case they meet these requirements, to address the Russian Monitoring Committee of FEANI* on the matters of accreditation of engineering educational programmes and Eur Ing registration.

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IGIP Russian Monitoring Committee Activity and Development of Academic Mobility

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The globalization process that affects all spheres of life is strengthening in the society. In this connection, despite the rapid development of electronic means of information exchange, the problem of academic mobility in training of highly qualified specialists remains topical. High rates of scientific-technical progress make it especially important for engineering education. Meaning the strengthening of global partnership, the RF President D.A. Medvedev said on 1 9 March, 2010 in Kremlin that Russia stands for "mobile activity development" [1].

As social experience shows, scientific and technical specialists provide advantages for each country in the global economy. In all countries technical specialists are always significant and important driving force of economic changes so their training should be given priority. The Proceedings of the IX Congress of the Russian Union of Rectors (March 2009) quote the RF Minister of Education and Science A.A. Fursenko: "- Russian engineering education can be refered to the Russian brands - competitive, internationally recognised, with which the country can enter the world market as a full member" [2, p.7] In order to retain the achievements, systems of highly qualified specialists training, their retraining and professional development should be given much attention.

The processes of education internationalisation are reflected not only in scientific research but also in practical steps. The striking example of pan-European cooperation of Ministers of Education of different countries is the Bologna Declaration that began the Bologna Process to establish European Higher Education Area.

The International Society for Engineering Education IGIP could be named as an example of public organisation aimed at international cooperation in the sphere of engineers training. It was founded in 1972 in Austria [3, p.65]. At present it is an authoritative organisation uniting academic-pedagogical community of engineering universities of many countries in the world. The IGIP developed and approved the "International Engineering Educator ING-PAED IGIP" register, it formulated and regularly updates the qualification requirements for technical university teachers. To be awarded the title "International Engineering Educator"

This article examines the activity of the Russian Monitoring committee of the International Society for Engineering Education (IGIP) aimed at engineering education improvement and academic mobility development. It also highlights the development of TEMPUS projects by Russian technical universities in collaboration with foreign partners.

and to be included into the ING-PAED IGIP register, a candidate should:

- have the engineer qualification that meets the FEANI "European Engineer- EUR ING" requirements;
- pass engineering and teacher training in one of the accredited Training Centres for International Engineering Educators in the amount of not less than 204 hours (20 ECTS credits) on the approved IGIP curriculum;
- have at least one year of teaching experience.

The IGIP International Monitoring Committee (IMC) is responsible for compliance with the qualification level of "International Engineering Educator (ING-PAED IGIP), quality of the basic standards. In turn, coordination of the IGIP activity in each country is carried out by so called National Monitoring Committees (NMC). The IMC keeps the register, decides on individual applications for register and the ING-PAED IGIP title award that are submitted by National Monitoring Committees. In addition, it decides on applications of National Monitoring Committees for accreditation of Training Centres for International Engineering Educators that provide the ING-PAED qualification recognised by the IGIP.

The title "International Engineering Educator" plays a positive role in the professional activity of teachers. Inclusion in the register guarantees them ongoing professional development, control of their qualification profile, theoretically and practically grounded in the international framework. Awarding of the ING-PAED IGIP title increases the responsibility of engineering university teacher and enhances his/her prestige in society. The teachers who have the ING-PAED IGIP qualifications are the main reserve for the staff of Training Centres for International Engineering Educators that in turn ensures the quality of candidates training at the international level.

Inclusion in the register ensures the competence of engineering university teacher and provides his/her free professional activity not only in the country, but also abroad. The register provides a potential employer with the detailed information on education and professional experience of the registered person.

Former socialist European countries were not initially involved in the activity of this Society. They actively joined in its work only twenty years later.

The Russian Monitoring Committee (RMC) of the International Society for Engineering Education (IGIP) was established in 1993 at Moscow Automobile and Road State Technical University (MADI). Its activities are aimed, first of all, at solving the urgent problems of engineering education improvement, training of engineering teachers at a new quality level in correspondence with the conditions of Russia's economy modernisation.

So far, the Russian Monitoring Committee as the IGIP subdivision in the Russian Federation has become one of the most authoritative National Monitoring Committees within the IGIP structure.

The RMC practically uses the developed Complex of engineering university teachers training, further disseminates it in Russia and implements the procedure of international certification of teachers applying for inclusion in the ING-PAED IGIP register. It coordinates the receipt of applications from the accredited Training Centres, conducts the initial examination of applications and cooperates with the IGIP governing bodies in the process of applications assessment and approval. The RMC forms databases of the IGIP certified teachers, and keeps records of educational (universities) and professional development institutions that meet the IGIP requirements. The IGIP Russian Monitoring Committee controls training content in the accredited Centres, its compliance with engineering teaching model and curriculum, qualification of teaching staff.

One of the RMC objectives in formation and enlargement of a network of the Russian Training Centres for International Engineering Educators is the planning of their optimal geographical distribution. It is necessary to take into account the real needs of engineering universities in different regions of the country

in training and professional development of teachers of general and specific engineering disciplines.

Up to now, 308 teachers from 30 Russian universities have the IGIP title "International Engineering Educator". Teachers of higher educational engineering establishment from such countries as Ukraine, Kazakhstan, Belorussia, Uzbekistan were trained with the subsequent ING-PAED IGIP certification in the system of the Russian Training Centres for International Engineering Educators supported by the RMC.

Training of highly qualified engineers in the period of Russia's entry into the world educational space requires the formulation of clear requirements for teachers of engineering disciplines based on a single basic standard-minimum. The basis for international certification of teachers trained in the Training Centres for International Engineering Educators forms the system of formation and recognition of the status of engineering university teacher developed by the International Society for Engineering Education. Representatives of Russia are members of the IGIP Executive Committee (V.M. Prikhodko) and the International Monitoring Committee (V.M. Zhurakovsky).

The IGIP Russian Monitoring Committee performs the main functions of dissemination of advanced technologies in the field of engineering education in the Russian Federation and outside it. In addition to coordinating the network of the Training Centres for International Engineering Educators at Russian universities, the RMC conducts active international activity. With organisational and methodical support of the RMC, the National Monitoring Committees were established. The Training Centres for International Engineering Educators were opened at universities of such CIS countries as Ukraine, Kazakhstan, Uzbekistan, and Bulgaria.

In addition, the RMC provides information support for university community: wide dissemination of information about the IGIP, the ING-PAED IGIP register and conditions of the title award. It supplies the Training Centres for International Engineering Educators with educational, methodical, reference, regulatory and other materials; the Russian information portal www. rmcigip.madi.ru was created.

The results of this work are regularly published in specialised collections of scientific papers and, mainly, in the annual collection "Engineering Pedagogy" published in MADI since 2000. 1 3 collections have been published by now. There are works both of the leading experts in the field of higher engineering education and of young. The collection materials are used by teacher in their professional activity for scientific and methodical support of educational process, lectures and practical training, enhance pedagogical competencies of teachers.

The main way of informing about the results of this work at the international level is the RMC participation in the annual Symposia of the International Society for Engineering Education and their organisation. These Symposia are a way for wide international public to discuss the most pressing issues of engineering education, to promote development of academic mobility. By the efforts of the IGIP Russian Monitoring Committee three international Symposia were organised and conducted in the Russian Federation: in 1998 and 2008 in Moscow in MADI, and in 2002 in St. Petersburg (in St. Petersburg Mining University). The 37th Symposium in 2008 in Moscow was attended by over 300 representatives from 23 countries.

The RMC actively uses Report, the press organ of the International Society for Engineering Education, for press coverage of their activities in the dissemination of state-of-the-art methods in engineering education. Since 2006, the Russian Monitoring has been the editor-in-chief of Report Committee. It collects materials, prepares, edits, publishes and distributes the journal in the National Monitoring Committees. In addition, on the RMC initiative the journal Report is translated and published in Russian for Russian higher education community to get acquainted with its materials.

Significant contribution to development of academic mobility was made by the TEMPUS projects financed by the European Commission, in which the RMC members actively participated.

From 2002 to 2010 several consortia of universities of Austria, Germany, Sweden, Russia and Ukraine were established. They successfully implemented four TEMPUS projects focused on the problems of teachers training system improvement in Russian and Ukraine engineering universities:

- project DIERUU NP-22265-2001(2002 - 2004) "Dissemination of pedagogical Innovation for Engineering education in a regional network of Russian and Ukrainian Universities";
- project TREM PP- SCM-T081A04-2004 (2005 - 2006) "Teachers training in the development of electronic learning materials";
- project MULTICEP CD-JEP 24006-2003 (2004 - 2007) "Curriculum development of multimedia course for Russian and Ukraine engineer-pedagogical education";
- project ILAN CD-JEP-27119-2006 (2007 - 2010) "Innovative Language Curricula in Technical Universities".

In these projects the participants put and solved the following tasks(problems):

- development of learning and methodic materials of new generation for teachers training, including multimedia educational materials;
- training of trainers - specialists possessing the qualification for teaching on the improved teachers professional development courses;
- formation of a network for dissemination of engineering and pedagogical innovations.

The national network of dissemination of engineering and pedagogical innovations created through the TEMPUS projects unites 13 higher educational institutions from different regions of Russia, including universities of Moscow, St. Petersburg, Novosibirsk, Krasnoyarsk, Tomsk, Barnaul, Perm, Tambov, Kazan.

The basis of the network is the Training Centers for International Engineering Educators. They operate in most of the participating universities or in the respective region that provide training by prepared trainers. At the international level the network involves three Ukrainian universities in Kharkov and Odessa as well as a number of technical universities in Austria and Germany. This kind of international partnership allows effective cooperation in the area of implementation and use of unified training courses and teaching materials in order to raise the level of engineering discipline teachers training. The established network operates at the national level through experience exchanges within each of the countries participating in the project, and at the international level through cooperation between universities of Russia and Ukraine, as well as by strengthening the connections between the Russian-Ukrainian network and the EU universities.

Significant result of the consortia activities in the projects on development and improvement of curricula, courses and teaching and learning materials is the training of qualified specialists in use, implementation and dissemination of the developed courses and materials in universities of Russian and Ukraine. As a result, each network university has the team of trainers with advanced teaching skills. They use modern methods and have necessary qualification for teaching the developed courses for other teachers. Qualification of 32 trainers from 16 Russian and Ukraine universities of the network is confirmed by awarding of the ING-PAED IGIP diplomas and the title "International Engineering Educator". Teachers who received the qualification of trainers pass on their skills of working with the teaching and learning materials of new generation to teachers studying in the Training Centres for International Engineering Educators. Thus, the mechanism of development of external as well as internal academic and professional mobility of highly qualified engineering specialists is realised.

Within the frameworks of the TEMPUS projects, the Centre for academic mobility was established in MADI to organise engineering and teaching exchange of university teachers from different countries whose level of training depends on their possibilities to acquire knowledge in the universities of their

country as well as in Europe. It works in close cooperation with the RMC. The objectives of the Centre are development of programmes of study abroad, support of joint programmes, expansion of contacts with foreign universities, preparation and organisation of international projects.

The described above activities of the IGIP Russian Monitoring Committee allows to conclude that, along with financial support of governmental organisations for development of academic and professional mobility in order to improve engineering education and reach the strategic objectives of Russia's economy modernisation, the activity of public organisations is necessary and useful.

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Some Problems in the Development of Engineering Ideas in Russia and Advanced Life-Long Professional Engineering Learning

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Over the last decades a new industry type - research-industrial or innovative is playing more important role in developed countries. It means that science has become an integrated part of the industry itself.
The existing scientific- engineering level in Russia, which "cannot be a model for other countries "[1] has several serious problems in advancing into an innovative course of development. The major problem is lack of engineering staff with creative mentality. When considering this problem from the global viewpoint, it is necessary to take into account the national characteristics which affected the long-term development of home engineers under conditions of isolation. The result of it was Soviet engineering training system that made a Soviet engineer class. After the USSR collapse and introduction of market paradigms, this generated class and system began to fade away, but their past features, though weaker, are still dominant nowadays. However, besides the specific problems of home engineering, there are problems of the countries where knowledge-based economy is being developed. It is obvious that the development of such economy should alter its orientation as compared to the past. Innovative orientation of the new economy depends on the future young engineers-university graduates. At the same time, invariable engineering innovations can make any engineering education inadequate,no matter if it is good or bad in its content. For example, a 30-year old electronic- engineer graduate can observe the design of a chip to have changed more than 100 times, while the number of transistors in microprocessors has increased fourfold for the last 25 years. Training within the framework of one technology, an engineer-graduate can lose his\her competence when an enterprise proceeds to new up-dated technology, which, in its turn, shows the fact of necessary constant advanced training.

Implementation of innovation activities can have global troubleshooting problems in future engineering education, even if this

The article underlines the general problems of engineer training with creative mentality. Specific problems associated with the development of domestic engineering under conditions of isolation, reasons of its low creativity are described. Perspective development of engineering is mainly connected with the system of advanced life-long professional engineering learning at different enterprises, engaged in innovation activities, such as Joint Stock company (JSc) "Information Satellite Systems"

education itself is highly-qualified. Many foreign researchers state that engineering creativity is impeded by the contradiction between engineering internship at an enterprise and oriented university courses. Today's student personality is quite different from his \ her predecessor, but teacher-instructors continue to teach as they were taught years and years ago. Nowadays, as before, engineering education is basically oriented on engineering knowledge acquisition, excluding highly-qualified professional skills.

The process of engineering professionalization is impeded by the engineering science dominance to the disadvantage of other courses, which also play an important role in the future engineer's profession. Thus, such studies are considered to be only the acquisition of "discursive identity", i.e. learning those specific competencies for this or that engineering community; for example, reading and writing technical documents, applying symbolic system instrumentation for this discursive community, exhibition of typical engineering medium behavior stereotypes, etc. Although one gains all required engineering skills, there is evidently a contradiction between the university "engineering discourse" and engineering training [2].

Due to overall mathematization and computerization, a number of serious methodological difficulties have emerged within the engineering activity itself, where quantity performance aspects prevail over quality ones. The subject-matter of engineering activities is not only calculations, but also engineering design, which includes such important items as creativity and transparency and openness, i.e. all possible multiple-technical solutions for one and the same problem. However, in teaching mathematics and sciences, it is presupposed that the solution of an engineering problem has only one exact answer, as a rule,a digital one [3].

The computer has been converted from a support aid into a central terminal, where all creativity activities of an engineer are rotating, which, in its turn leads to distinctive (peculiar) one-dimensional engineering mentality. Such an engineering "one-dimensionality" usually has an inappropriate affect on complicated engineering situations. During engineering activities an intrinsic personalized project reality is formed, while the engineering process itself only executes a definite function. When desig-ning, describing and analyzing the engineering process, the character data is insufficient, because such an essential engineering activity concept as function (procedure) is not a mathematical concept.

During university training of engineer-personnel it is difficult to provide the complete set of competencies for further implementation of innovation projects. Besides definite engineering competencies (identifying, formulating and solving engineering problems; applying research approaches; designing systems, components and processes to achieve target-tasks; planning experiments; analyzing obtained data, etc), in-demand competencies involve a wider spectrum than those of engineering activity aspects. These competencies include teamwork, flexibility, responsibility, negotiating and others. However, the above-mentioned troubleshooting problems are not only methodological ones.The engineering profession itself is becoming less attractive.

All over the world, assorted procedures are being used in improving the university education training quality and increasing student motivation in future engineering professions. These procedures are aimed to show students what the teaching content and its significance are; to learn how theory in solving practical problems is applied; and what role engineering has achieved in post-industrial society, etc. Students are involved in different activities- science days, excursions to advanced regional enterprises. Engineer-instructors of such enterprises tutor university classes, etc. Nevertheless, this progress is invisible, and it becomes evident that no university education in training engineers for future innovation activities could substitute "on-site" training. The more predominate the industrial knowledgeable component is, the more important life-long professional engineering learning becomes.

Above-mentioned problems of engineering training in future innovation activities could be interrelated with the existing problems in home engineering institutes, including not only global problems, but also specific ones. Only through a detailed historical examination of both the formation of home engineering training system and characteristic features of the engineering development as a product and medium of

engineering itself could these mentioned problems be comprehended.

Although the pre-revolutionary engineering developed apart from the European civilization, namely, the European approaches were used in the solution of most engineering problems. The most significant figures of Russian engineering were creative and apt to implement complex innovation projects, for example, two worldwide famous inventors-Zworykin, inventor of the television and one of the founders of helicopter engineering - Sikorski. Highly- developed Russian engineering level was ensured through the pedagogic-organizing framework in the existence of several elite technical (engineering) education institutions, while the pedagogic- ideological framework in the nature conformity principle [4].

After 1917 the government followed not so much the nature conformity principle rather than the revolutionary practicability principle, where priority was to the working-peasant class. This resulted in two facts - the first one was that many creative first-rate engineers, including the so-called "generators of engineering ideas", who determined the development target in many engineering spheres during decades, for example, Zworykin and Sikorski, were forced to work and implement their ideas beyond the USSR. The second fact is that under such new conditions the engineering science could not develop normally and engineering European-type schools could not be established to involve all the prominent engineers.

The Soviet engineering developed otherwise, i.e. centralized, mass and systematically as in a totalitarian country. To solve the problem of increasing the small engineering sections, an effective system of mass engineering training was constructed which exists in the same form even now. This system excluded the basic disadvantages of the tzarist engineering system, i.e. much prominence was given to practical skills of future engineers. Thereof, according to some quantity parameters, this engineering system surpassed the engineering training systems of more advanced countries.

As a result, the newly-based engineering class emerging in the 30's, developed further, in the 50's of the last century, into a class that was characteristic of the technologically-developed countries of that time. At this time, the category "Soviet engineer" was revealed, a particular class which functioned only by instructions. "Instructive" engineering orientation totally corresponded to the principal development trends of the Soviet society and was to some extent progressive for this survival development stage. At the same time, it subsequently disguised potential negative consequences, for example, initiative judgment, restraining engineering ideas, copy-development of Western engineering, etc.

The corresponding organizational legalization of this elite class developed simultaneously as "a conductor" of innovation. The major organizational legalization included the collaboration of numerous Research Institutes, engineering-design offices, other secret closed cities (MBX) - organizations working in military defence, as well as, the so-called notorious "shady businesses", where, to the mid-50's of the 20th century, convicted scientists and engineers worked. Subservient engineering labor could not exist within a bourgeois society itself, but even if the Soviet organizations were structurally similar to those of bourgeois ones, their content was quite different, which, in its turn, hindered the development of engineering.

Their engineering profession was extremely ideologized which was the result of not only Party and government decrees and resolutions, but also the illusion of most employees that an intellectual engineer could be any capable person. This illusion (even existing up to now), arising from visible successes during mass engineering training, inspired the Soviet engineers that they could solve any problem, even the most complex ones. Many of these engineers did not even realize that all their engineering activities were controlled and issued from different authorities. Under such conditions the organization of normal engineering schools was impossible, and those that were established or existed as relicts were quickly degrading.

Thus, after 1917 the development of engineering slackened, even though the governmental ideology ensured the fact that "generators" of engineering ideas could be cultivated in the same way as of those ordinary engineers working under instructions. However, up to the USSR collapse, this problem was not as acute as it is nowadays. First of all, not all "idea generators" and simply creative engineers could emigrate or not and continued to work more or else effectively up

to a certain moment. Secondly, there were even some intellectual ("thinking") individuals in such a totalitarian country. Thirdly, the state itself focused on mass labor in some particular spheres, and this was a quantity index, but not a quality-skill index.

Gradually, in the Soviet and post-Soviet period "an idea deficiency" emerged into the research and engineering spheres and growing troubleshooting problems became obvious in creating and providing one's own foundation for intellectual innovation projects and ideas. Thus, the solution to this main problem-engineering creativity- was to import the research and engineering ideas, engineering solutions and technology from highly technical-developed countries. During many decades, this invisible, all-embracing phenomenon, i.e. importing foreign scientific-engineering intellectual products and being approved by the authorities, extended throughout the USSR and had a negative effect on the development of home engineering and science.

Importing ideas, techniques and technology from highly technical-developed countries, adapting them into closed organizations, implementing them as material projects within the USSR itself, and only then, nationally submitting these as Soviet achievements in science and engineering included a whole range of negative consequences. These consequences were the following: the foremost one being the mythologizing of the Great Soviet Science which is even extendible nowadays. This fact resulted in the decrease of engineering creativity, degradation of scientific and engineering mentality, irreversible formation of "instructive" engineering orientation, decline of prestige engineer profession, etc. Another significant consequence is the despairing deceleration of domestic engineering and technology in comparison to global level, increasing year to year.

According to above-mentioned factors, one should have a rather critical viewpoint on those technical and engineering innovations which were the implementation of Soviet engineering ideas in closed research institutes and engineering-design offices. As a rule, these achievements were not the results of the intellectual property of Soviet engineers, but only the up-dating of secret materials from highly-technical developed countries. Such a system was typical of the cold war, which included powerful and efficiently-developed technology espionage. This system involved leading USSR scientists and CEO of closed organizations as the promoter, while the executives were employees of relevant Soviet intelligence service.

These materials through external channels included different items- not only information and abstract ideas to be implemented as "hardware", but also ready-made products which were dissembled and assembled on the basis of domestic components. Such an "innovation activity" showed a rather high development level of Soviet engineering in comparison to the global one. Otherwise, it would have been impossible to design the analogs of foreign technology –a phenomenon which can even be observed today in practically all home industrial spheres. At the same time, that system being involved in such an innovation – type would be nonplussed.

Actually, importing ideas, techniques and technology can lead to certain consequences which are interrelated to the increasing contradictions between the domestic and global engineering development level. Due to two global revolutions - scientific-technological revolution (beginning in the mid- 50's of the previous century) and technological revolution (occurring nowadays) there was a backward development of domestic technology and engineering in comparison to the global development level. Thus, the above-mentioned development procedure has become non-effective. In other words, under today's modern conditions all necessary material - from information to products- can be legally purchased to implement any innovative projects.

Although the situation has changed drastically, there are some significant circumstances preventing the implementation of this or that innovation. The raw material source orientation has been increasing in home economy, while engineering cooperation with other developed countries has tailed away. The integration between science and production, without which innovation activities are impossible, has changed on the contrary [5].The collaboration with other research establishments abroad was suspended, home scientific centers were practically destroyed, while existing ones could not function even when all provided material for innovation was reliable and on-

time. As a result, even defensive products (equipment and enginery) which were of great significance in all times, are now uncompetitive. "...Even those few cases when defense technology was sold abroad, confirm the fact that this defense potential hasn't been completely destroyed or diffused...." [1].

"The outdated system of engineer training exists" so far and "had been only convenient under conditions of Soviet economy planning and operated excellently in totalitarian regimes" [1]; but this could not promote the further generation of an innovative -oriented individual and the development of creative mentality. If a Soviet engineer, being trained in such a system, could possibly become an innovator with a store of all necessary external - obtained materials, then, today, the same engineer with the same store of materials, including schemes, diagrams, etc. could hardly implement all this into home production. There are several reasons: (1) the gap between the actual level of global scientific-engineering achievements and its individual limited possibilities in the perception and assimilation of these achievements themselves; (2) the realization of engineering ideas within the Russian reality which is rather complicated as a result of the destruction of high-technological sectors and practically no material basis to develop a sophisticated electronic network within any technology.

The community of young engineer-specialists is declining from year to year- not only the number of graduates working in different enterprises, i.e. "engineers show minimal dependence between obtained and factual specialty (35.9%)" [1], but also the decrease of engineering quality. The quality of engineering education is a rather painful topic. However, many admit the fact of its total decrease, especially during the last few decades, including not only the relative global level of quality, but also according to certain absolute parameters. Even though the fact that "the new generation is much more well-informed and adapted to solving contemporary problems" [1], the issue is mainly not only their education, but also their training which is more or else crucial. Nevertheless, it is said that the quality of engineering education and the necessity of definite changes are vital.An example of this fact is that on the basis of a problem research in life-long professional engineering learning, SEFI Committee (European Society for Engineering Education) declared that in the near future American educators would have to implement new models for life-long professional engineering learning adopted from other countries (Alborg Conference) [6].

Based on above-mentioned facts it would be difficult to presuppose the forthcoming large number of engineers apt to innovative activity through the existing engineering education system [7]. To change this system "a new training personnel system could be considered, where there are cardinal changes in the engineering education system itself" [1]. At the same time, there could be the development of engineering ideas within the framework of existing life-long professional engineering learning system, which can be found in different enterprises engaged in innovative activities. An example of such a high-tech enterprise in space could be Joint Stock Company "Information Satellite Systems"(JSC ISS) [8].

Therefore, the problem of life-long professional engineering learning system development with all its vital characteristics for generating innovation activities cannot be solved within only one separate enterprise. Only the establishment and development of knowledge-based economy could make it possible to properly interpret and exactly solve this problem [9]. Not only different forms of skills (even from abroad) are applied, but also such skills as production of advanced technology products, highly-qualified services and experimental products and education are developed within the economy where life-long innovations and professional engineering education system are interrelated.

Countries, where professional engineering activities are legally regulated, promote the development of life-long professional engineering learning to develop knowledge-based economy. European Federation of National Engineering Associations publishes a guideline describing all professional requirements, excluding specific criteria. And the engineer selects the level of professional development which is characteristic of the country where he is living. For example, in Great Britain where life-long learning is supervised by different industrial sectors, the development-progress of an engineer is not specified, but it is implied

throughout his career. In Japan the engineers annually spent 50 hours devoted to professional training which doesn't include any specific requirements to the content and type of studies. In Canada there are more restricted requirements; however National Organization of "Canadian Engineers" doesn't specify the obligatory requirements in the professional engineering development.

In Russia there is no common government approach to life-long professional engineering education, but such a development could exist within the corporative system, for example, Joint Stock Company "Information Satellite Systems" (JSC ISS). Much attention is paid to the development of life-long learning within the enterprise itself to provide on-site engineering personnel, who are capable of working under conditions of consistent innovation development [10]. Life-long education system including a prevailing pre-university, target university and engineer training interrelationship develops as an essential component in the personnel policy of this enterprise. Within the framework of this new personnel policy, an integrated education space concept was designed, where life-long professional engineering learning of the enterprise personnel is confirmed to be the innovation basis of the development of this enterprise itself [11].

This concept is that the innovative approach in economic growth is based on life-long professional engineering learning of the personnel which, in its turn, is established on the advanced integration of all education stages within the enterprise and includes a concentric organization content principle of the professional requirements in the differential personnel training and developing approach. This concept can be implemented within one functional personnel management center and aimed at the development of an innovative- oriented creative individual for the aerospace industry [1, 2].

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Humanitarian Medium in an Engineering University: Is the Implementation of World-Leading Experience into Domestic Engineering Education Possible or not?

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Moral qualities of an outstanding personality are probably more important for this generation and the whole course of history than purely intellectual accomplishments. The latter depends more on the greatness of a person's character than what really is.
(Albert Einstein)

The society contemplates on the fact that the humanistic principles of an engineer-student's professional mentality will be formed within the framework of the higher engineering education itself. The national security and civilization sustainable development depend on future student career. One more fact is that the application of scientific-technical activity results is within the range of human preferences.

However, this target is rather difficult to achieve. It is the opinion of most engineering students that humanitarian subjects are not only secondary (minor), but also optional ones. This was promoted through the Soviet higher education experience by teachers of the older generation. The ideological dogmatism of such humanitarian courses as CPSU (Communist Party of the Soviet Union) History and Scientific Communism entirely discouraged many generations of future engineers to be flexible to "changes", which, in its turn, should not be considered.

However, in the past Soviet reality, the Soviet engineer profession, including the increasing difficulties in the domestic production sphere, formed a stable medium of technocratic mentality – short-sightedness and narrow- professionalism. This fact excludes such items as conscience and humanity, and further understanding of the consequences of the destructive human intelligence forces in terms of the civilization development itself.

Lack of humanitarian guidelines, including all the modern society demands, is a serious pedagogical and management problem in the education of the future engineer. Most educators consider that humanization of the learning process [1, 2], introduction of more sophisticated teaching methods in existing humanitarian courses [3, 4] would exempt the engineering education from the above-mentioned technocracy.

The humanitarian medium of an engineering university could be the specific target application of new management strategies. Humanitarian medium structure, based on traditional and historical experience, is a system of sustained relationships and associations, determining the unique university professional-education and cultural space. The humanitarian medium, developing the socialization process of student, post-graduate or academic teacher

personality, includes an integrated combination of social, humanitarian, scientific and specific knowledge and skills, emotions and feelings, opinions and behavior. Being within the humanitarian medium of one's university for some time, a person is involved in a definite communication intercourse, acquires orientation skills in life and a set of priorities in practical activities, and distinguishes specific corporate culture characteristics [5, 6].

Adequate humanitarian medium is the required component of any professional education.The humanitarian constituent helps to overcome one-dimensional highly-specialized training through the learning process, social-cultural activities and everyday communication. It is also the basis for the further development of the humanitarian outlook for harmonious adaption of a professional in the society.

The described research indicated that the leading higher engineering education systems provide a well-developed humanitarian medium, where in each particular case there is a unique set of different characteristics.

For example, Ecole Politechnique has developed such a humanitarian medium that can be noted in their traditions of military training. Formal discipline structure does not entirely hinder the viewpoint of graduates in social life and industrial sphere, open and transparent implementation of innovations [7].

The freedom and urge for creativity of the students, irrespective of their social characteristics, is stimulated in the distinct humanitarian medium at MIT. Negligence of social conditions, prononess of conflict development, priority of new ideas, and unestablished teaching methods has not prevented MIT of becoming the leading world university in education grade-rating system and the university intellectual empire, with all possible and impossible achievements in different fields of knowledge.

Aachen Engineering University promotes its humanitarian medium as a business-like type, open to collaboration and innovation, which, in its turn, includes extensive integrated experimental disciplinary system, forming future science [8].

Despite the distinct differences of the above-mentioned humanitarian media there are existing similar features between them:

- a wide selection list of humanitarian disciplines, which are compulsory for future engineers;
- university policy and its departments involves a "humanitarian concept" , reflecting the dependence concept of social and technical progress to personal traits and human creative qualities, as well as, readiness to struggle for the safe development of anthropogenic civilization;
- integrated - based education programmes are designed;
- scientific-engineering problem-solving on the boundary of technical and social spheres;
- personal-oriented learning;
- students of engineering professions can receive a second university degree (humanitarian) within the same university,focus- oriented support and development of the humanitarian medium within the university itself.

The article describes the management problem of the humanitarian medium in an engineering institute. Based on the humanitarian medium experience analysis of three world-wide engineering universities – Ecole Politechnique, MIt, and Aachen Engineering University, guidelines in improving the education medium of Russian engineering universities were developed.

The overall result analysis shows that the education medium in most RF engineering universities is developing in a technocratic way.

The turning point in the development of this humanitarian medium could be the versatile thematic humanitarian component which exists in Russian engineering education. However, social-science curriculums are fragmented and do not include the "ideological" humanitarian concept, which, in its turn, could exclude student's inclination to technocracy and contribute to the students understanding that the future planet and human civilization depends only on their profile professional activities. This situation can be adjusted by the authorities of humanitarian and socio-economic departments, as well as, the introduction of tailored courses reinforcing social responsibility motivation to the engineering profession, for example such a course as "Ethics of Engineering Profession".

The explicit disadvantage is the lack of an integrated academic and research relationship and collaboration between engineering and humanitarian departments. Based on the experience of world-leading engineering universities, this collaboration could include teaching individualization and project management. Moreover, this is extremely important, as the compulsory part of all accredited engineering programmes, unified by Bologna process, is a corresponding criterion for the principles in the development of a stable society.

Stable society development – a regulating development, involving target control over existing changes; forecasting and adjustment of the most dangerous development instability and disproportions; oriented and coordinated activities, directed to negative social, economic and ecological disproportions, accumulated in the society and surroundings; establishment of conditions excluding the occurrence of such disproportions; extensive government investments in "human assets".

The observation of these principles promotes the implementation of project management, oriented on the society's specific demands and executed through engineering and humanitarian departments. The experience of European engineering universities in this sphere can be imported, leading to further formation of creative interdisciplinary staff, capable of solving not only academic and research, but also commercial tasks. These economic and humanitarian departments could offer such items as marketing and sociological research, retrospective historical- analytical reviews, etc.

To establish a contemporary education medium, i.e. humanitarian one, oriented on the demands of human and society development, the education policy itself should be changed. The establishment and development of a humanitarian medium for technical students includes the design and introduction of modern compulsory and elective courses, forming a cultural basis and demand in creativity. The following items should be involved: new aesthetic and moral behavior models, extensive social, concert and exhibition activities; creation, support and development of university and department traditions; organization skills in cultural and informative community entertainment; organization of special decorative interiors in institutes and different aesthetic theme visuals of different professional backgrounds [10].Of course, in this case, high-qualified professionals should be involved in organizing such social activities, which, in its turn, gives rise to the development of the so-called humanitarian medium.

The backbone in the above-mentioned programme could be a set of recommendations in altering the policy and strategies of the university itself, its departments and programmes, and where the humanitarian concept is the platform for the future development in this sphere. In spite of the inflexible framework of the RF education standards, the main targets include individualization of the education system, student motivation in intellectual autonomy, development of interdisciplinary projects, within which different professional teams work, i.e. engineering, natural science and humanitarian.

To meet the world standard requirements, every engineering university, should develop its own independent education-humanitarian –medium. It is the only way to achieve high performance in the development and activities of this or that university.

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Engineering Man Power for Real Economy

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THE ROOT OF THE PROBLEM IS SECONDARY SCHOOL

There seems to be a persistent paradox in Russia today - with an increasing number of university or college graduates there is still an increasing lack of young, creative engineers and technical workers. The number of people with non-technocratic way of thinking prevails in our society, despite the fact that universities do not offer students any state-funded places at educational programmes in management or humanities. According to the labor market forecast we will face a significant shortage of engineers by 2015.

Statistics show and large Russian recruiting agencies confirm that day after day there is a growing demand for professionals in such fields as information technology (IT), mechanical engineering, power engineering, civil engineering and woodworking. Moreover, with economic development the need for this kind of professionals with higher and secondary professional education is increasing.

The main task of educational institutions is not only to train, but also to help students to discover the right way. So, after choosing their future profession, they would be able to realize themselves in it. Therefore, today's secondary school graduates should properly evaluate the prospects of the chosen educational programme. Supervising teachers, school directors and university representatives are expected to help their students in it.

In order to satisfy country's demand in highly qualified engineers by 2015 it is urgently needed to change the attitude to natural sciences of secondary school and university managers and students. For example, in some graduate classes it is given only one hour a week for the teaching of physics - taking into account the current realities, it is simply unacceptable. After all, knowledge of physics is required for the majority of

Global financial crisis reminded that Russia lacks highly qualified, adapted to the market specialists without who it is impossible to improve economy. With a diploma on higher education, alumni should immediately start work, applying innovative knowledge and skills, being able to introduce them. But how should the specialists be trained? What do we need to start with? What are the problems technical universities face with? Are there universities ready to share their specific results in training engineers, who can already meet the demands of the current industrial environment? These are the main issues discussed in the article.

engineering specialties at university. In the short run, we have to revise and upgrade al existent educational standards so that students could get sufficient knowledge in natural sciences.

The problem should be solved with universities assistance. Our university for example, allocated one million rubles from its own funds for additional - one hour a week - lessons in physics in each graduating class of the Republic of Mari El.

And we are going to double or triple this investment next year. In addition, MarSTU has developed an entire assistance programme for Mari El schools in teaching of natural sciences.

After passing entry exams a lot of university applicants, especially from rural areas, face such problem as the lack of knowledge to study successfully on higher education programmes. And this is rather their trouble than a fault. To help low achieving first-year students to fill in the gaps in their knowledge, "aligning groups" were organized at MarSTU: qualified teachers help those lagging behind to catch up with a core group of students; at the very beginning it is important to read and properly understand the information, acquire and apply new knowledge. Moreover - with the current academic year so-called preparatory module has been introduced at the university: within first three weeks students are engaged in repeating the bases of school programme major disciplines of each faculty - physics, chemistry, graphics, foreign languages. Although it is too early to review the experiment results, I am sure there will be an obvious progress. The only question is how successful we could be in tying up the loose ends of secondary school [1].

Another crucial task of the preparatory module is to identify among first-year students the most talented and creative. For this purpose we have developed a system of tests aimed at determing the competence level of our newcomers. All the tasks in the test they need to complete differ from each other. Some students receive less complicated tasks - to learn the basics of the minimum level knowledge, and the advanced students deal with high complexity tasks that require quick wits and ability to find innovative solutions. Such talented students will be invited to join educational programmes of high complexity. They will defend the honor of the university at competitions, scientific exhibitions and conferences. And at the senior-year courses these students are expected to form creative business teams capable to respond real challenges.

In the recently accepted strategic plan of advancement of MarSTU for the next five years it is pointed out that in addition to traditional training of qualified engineers, we should think about training of elite engineers that are able to invent and research, develop innovative technologies and, finally, achieve economic progress.

FIRST PRIORITY – COOPERATION BETWEEN HIGHER EDUCATION AND INDUSTRY

"Achilles' heel" of our higher education is its dramatic isolation from industry. Although it remains strong enough and respected in the field of fundamental research, it still has not become a reliable base for building modern innovative economy.

There is a serious blank between a professional training at university and real applying of graduates' skills. This is a great problem of the whole education system that continues to prepare certified theorists, while there is an increasing need of "doers" – experts in mechanical engineering, radio electronics, civil engineering, agricultural and wood industry and other branches of our economy, who can combine specific professional knowledge with managerial skills, teamwork skills and entrepreneurial flair.

We have to acknowledge that during the reforms at the end of the last century, the majority of strategic branches of our economy lost their developments without creating new ones. The market oriented firms which have appeared in industry are yet not ready to follow the example of economically developed countries in supervising the main source of their staff – educational institutions. Quite often business representatives are even not able to inform colleges and universities about their personnel needs. So the gap between higher education system and industry continues to grow.

In my opinion, professional engineers should be trained on the base of sectoral universities and multilevel higher education complexes – with advanced educational technologies and research developments, and the main fact – real mutually beneficial cooperation with industrial enterprises.

There should be an opportunity not only to train, but also to retrain different kind of experts to meet the requirements of industry branches and particular successful enterprises.

Can it be realized? Is it possible to convince business in importance of such cooperation? I am sure the answer is YES, if we focus our efforts to achieve this goal. In a business portfolio of our university there are ongoing contracts with dozens of successful enterprises and the organizations which supervise them. Their heads make concrete and sometimes well-paid orders to the research departments of our university, invite students for practical training, selecting the best ones for real job.Such interaction scheme became real after long years of hard work and cooperating with heads of these companies, a lot of them are our graduates and members of the MarSTU Board of Trustees. They take an active part in all serious projects of the university.

At the same time the academic staff members of our university should be retrained, as the major part of them have last century dated professional skills, in direct and figurative sense. They do not have real work experience for industrial companies, neither for modern and advanced, nor for the old ones. That is why the main goal is to fill in this gap using several possible ways, for example to engage successful businessmen in the training process.

When training modern experts it is important to focus not only in engineering aspects, but also on the management and computer skills, foreign language qualifications and ability to find out information and use it effectively. It should be essential for modern engineer to combine roles of manager and researcher, and to have enough skills in business running. Such specialists could be trained only on the base of sectoral higher education complexes with modern facilities, effective educational technologies, highly qualified faculty, engaged in real economy activities [2].

A modern university should include different levels of education. This idea was realized in MarSTU when a multilevel university complex was founded. With new status the university offers educational programmes for different degrees: qualified industrial worker - technician - bachelor - engineer - master - candidate of science (PhD) - doctor of science. It is supposed that every next level improves and develops acquired knowledge and skills of the previous one. Starting with college gives our students good chances to become top managers in the future. These opportunities are ensured by coherent curriculum across the university and by implementing block-mode training and rating technologies, so-called RYTHM system.

AN ENGINEER AND AN INDUSTRIAL WORKER – IN ONE PERSON

It is obvious that in recent years functions required from industrial workers, technicians, engineers have become much more complicated. If formerly the lack of specific knowledge could be balanced by practical industrial experience, now it is rapidly becoming necessary be trained at graduate degree engineering programme in order to manage complex technological processes effectively. Professionals working in modern industrial branches need to have a deep understanding of computers and high-tech equipment. They are both engineers able to analyze, think creatively, learn and apply new skills, and highly qualified industrial workers at the same time.

After careful consideration of this matter focusing on economic requirements, the government of the Russian Federation decided to develop essentially new educational programmes at universities and vocational schools-Applied Engineering Bachelor programmes [3]. Mari El State technical university joined the list of universities that has been taking part in the experiment of generating new wave of engineers.

The system of training Bachelors of Applied Engineering is widespread abroad: in Germany, the Netherlands, Belgium, Denmark, Sweden, Norway, Ireland, Portugal, Greece etc. In Finland, for example, bachelors of Applied Science are trained at special high schools, so-called polytechnics. Meanwhile universities offer traditional bachelor programmes. Graduates of both polytechnics and traditional universities have opportunity to continue their education at master level at Finnish universities, for example, the largest one - the University of Helsinki.

Within several internships abroad I had several opportunities to see how

blue-collar workers and average technical staff are highly thought of in Western Europe and other industrial countries. They have practical skills to work with modern equipment.

Perhaps they are even more valued than engineers, thanks to the wider scope of their professional skills. The status of these professionals has only grown over time. They are aimed at acquiring new knowledge, and if necessary continue their professional training. I am sure we will also achieve this goal. Employers have already declared their wish to get our best students, keeping track of their progress at the university and during practical training at real enterprises. Moreover our university has its own facilities for practical lessons. There are modern equipped laboratories and computer classes at MarSTU. With the new academic year we have opened the Centre of computer-aided engineering with unique robotic equipment. It was opened on the base of college "Polytechnic". All these facilities are available for our students.

In addition, the Institute of Lifelong Learning was founded in MarSTU a few years ago. It allows today's managers and engineers to study and improve their skills to meet the modern requirements. And at the same time, taking part in solving real engineering problems permits to retrain our teachers, who in turn will teach and produce competent and skilled professionals.

INNOVATIONS - THE PATH TO SUCCESS

Nowadays state requirements to the higher education institutions are more than ever high. If the minimum objective of modern universities is to train specialists, adapted to the market conditions, then the maximum objective is to match the innovation requirements.

Back in the mid-nineties, we chose as one of our main priorities reliance on the integration of educational technologies and high school science, closely related with industry. The goal was not only to prepare competitive specialists, but also to earn money with the help of this integration. We have not lost when made that choice. So, over the past eight years, the volume of research in MarSTU increases annually by 1,5-2 times. Its amount in 2002 was 10,7 million rubles., and according to the forecast it will overcome 150 million rubles be the end of 2010.

Besides the effective cooperation with successful businesses, our scientists make research in line with the thematic plan of Rosobrazovanie, scientific and technical programmes Rosnauka and Rosles, educational grant competitions, contracts with Russian and foreign organizations [4]. Researchers of MarSTU were the main experts in the development of forest plans (documents defining the strategy for forestry of the Russian regions for ten years) for the Nizhny Novgorod region, the Mari El Republic, Samara region.

Undergraduate and graduate students are involved in the research activities, in order to get valuable practical skills. At their disposal - a wide range of MarSTU facilities, including training and experimental forestry, botanical garden, modern multimedia laboratories, technopark, which brought together innovative structures of the university. And of course the Center of multiple- access with the unique equipment for the development and implementation of innovative technologies in the field of environmental management.

Based on the development of young researchers seven small innovative enterprises have already been founded at MarSTU, and three new ones are going to be opened by the end of the year. So the call of the Russian Government for transition from the commodity-based economy to knowledge economy has been heard.

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Fundraising in Russian University

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Higher education has never been as important as it is now, at the beginning of 21st century. It occupies a central position in technology-based and education-oriented economy. In highly developed countries, the growing demand proves the fact that education is one of the "top goods". Notwithstanding - and to some extent due to – these demand, higher education has bumped into tough economy: unbalanced and deteriorating financial position of state-sponsored higher educational establishments. In relation to this, economists, consultants and advisors recommend universities and other educational establishments to be less reliant on funding from government and taxpayers. This advice is theoretically irrefutable. However, there are significant restrictions in income diversification policy, especially in Russia, where the need for such a strategy is getting aggravated from year to year.

Higher educational establishment is a non-commercial organization, therefore it can attract funds as non-commercial organization. As traditional most non-commercial organizations turn to a variety of fund attracting methods, but in most cases such sponsorship is based on personal contacts and it is not regular. As fund attraction is a complicated process requiring professional and sistematic approaches, such fund attraction can hardly be considered as a successful one. When it comes to a higher educational establishment, it is necessary to develop such an organizational pattern which should penetrate into all its spheres and affect its scientific and academic ideology.

This article suggests the scheme of fundraising launching in Russian University (within the framework of National Research Tomsk Polytechnic University).

First of all, it is necessary to define fundraising activity in the frame of university.

The paper proposes the fundrising organization structure for Russian universities based on the international experience. Basic principles of this framework are the submission of educational activity to the social unity of university. The key role involves the tutor contacts with applicants, students and alumni.

Fundraising (from the words fund – money and raise - increase), can be referred to as:

1. Fund collection for charitable (non-commercial) needs, that is the lack of direct material profit from such activity- narrow meaning.
2. Activity for attracting donators of any kinds (financial, physical, labor) for any needs (not necessarily charitable). Here, fundraising also involves non-monetary (physical, labor and etc.) donations - broad meaning.

As part of university income system, fundraising is primarily understood as alumni giving.

Based on the analysis of leading Russian universities, the following finance receiving strategies can be pointed out:

1. Budget orientation;
2. Budget and non-budget integration;

Non-budget combines paid educational service or integration of paid service and science research work.

In any of these strategies fundraising income share does not exceed 1 %.

In a case of foreign universities, fundraising has slightly different meaning. Fundraising as a public appeal for donations is mostly American than European or Asian tradition. As for Europe university fundraising is less developed (the average amount of endowment funds, at one of the tens largest American private universities, three-fold exceed Cambridge funds and ten-fold Oxford). USA fundraising department estimates 100 persons, while European - not more than 10.

In the USA both state and private universities take an active part in donation. From 20 universities actively involved in fundraising, 64% of endowments move to private universities, 34% - to the state. Each alumnus donates approximately 50 USD per year. In average, endowment builds 1000 USD, about 5% of alumni do this annually.

Amount of donations is interrelated with the quality of university education. The largest part of donations (80%) is obtained by universities entering the list of top 50 universities of the country.

In European universities the quality of education and endowment fund application is guaranteed by independent audit which incorporates alumni and trustees of administration agency to which university vice-chancellor is affiliated. There are a lot of programmes and opportunities for sponsors to participate in university development. These are non-specialized donations, specialized donations, and grants.

Most universities have well developed web-sites and network focused in fundrising and sponsorship attraction. They fully reveal the information about projects and funding (except the universities whose fundraising strategy is elitism).

Fundraising in Western countries is based on colossal self-sustaining nets. Websites were developed not only for money attraction, but mostly to involve university in social life and for university community creation. Fund building is only one of the objectives as university benefits in all the spheres of its activity.

In most developed countries charity is tax free. More over, it carries tax bonuses: in particular in the USA charity donations do not enter tax base. In cases when income tax is progressive, tax bounce may be 45%. Besides, the property which was granted for university is also tax free. When this property is sold it is sold tax free.

While launching fundraising activity in Russian University, it is necessary to develop an efficient mechanism which must include:

- university department cooperation arrangement, authority distribution;
- methods and special nature of work with donators;
- fundraising planning process.

In this article we will focus only on organization structure development.

FUNDRISING ORGANIZATION STRUCTURE

The main idea of organization structure development is to concentrate work with university clients in the sphere of education (applicants, students,

alumni). Major organization structure branches (responsibility centers) should be (in descending order):

Tutor Department; Department of Fundraising and Educational Activity; Information Center.

Suggested organizational structure is presented in Figure l.

1 - Rector should have the following responsibilities: to announce strategic fundraising aims in his annual report, promote, popularize and advertise fund-raising activity at meetings, and participate in donators attraction.

2 - Pro-rector for Alumni & Development, is given a special attention in the scheme as in foreign higher educational establishments the university development is connected with the success of its alumni. Alongside with students and alumni managing work, Pro-Rector can be authorized to develop Committee for Development and Planning, organize universities collaboration, etc.

3 - Department for Working with Students and Alumni. It's necessary to unite the departments which work with students and alumni (Department for Fundraising and Educational Activity) and make it submitted to Tutor Union management, with functions of managing staff being indicative - in urgent situations they can be authorized with any managing functions; this can provide a staff interchange. The direct task will be execution of tutor decisions for the period between their meetings as well as arranging the connection between rector, pro-rector, pro-rector for development and departments. (Link 1, Fig. 1).

4 - Tutor Union. The major managing department should be the Tutor Union which combines senior tutors and tutors of all universities. At monthly meetings the questions touching the activities of all departments are discussed. Each tutor has a right to bring up his urgent matters for discussion, but only after the approval of Tutor Union management. All tutors should be present at meeting (the absent ones must provide explanatory letter).

The Union Managing Department consists of senior university tutors. They meet weekly for discussing special matters and solving questions between union meetings, principle ones are making union meeting order. Managing Department has a right for extra meeting call.

Managing Department should cover programmes and activity reports, discuss current interrelation matters, discuss organization experience, give orders and recommendations to the Department of Fundraising and Educational Activity (Link 5, Fig. 1) and Information Center (Link 2, Fig. 1) and solve current questions.

5 - Department of Fundraising and Educational Activity. The main working principle of this department should be based on Tutor Union subordination. Its field includes the work with applicants, students, alumni and, consequently, fundraising. Also, it should develop programmes and activities (not less than one activity per month); be involved in all university departments coordination for programme realization (wages); collect tutors, alumni and students proposals about next year activities and programmes.

Department of Fundraising and Educational Activity should use Information Center data (Link 3, Fig. 1) and give orders for database maintenance and site managing.

Let us discuss the scheme of fundraising campaign development (alumni as donators):

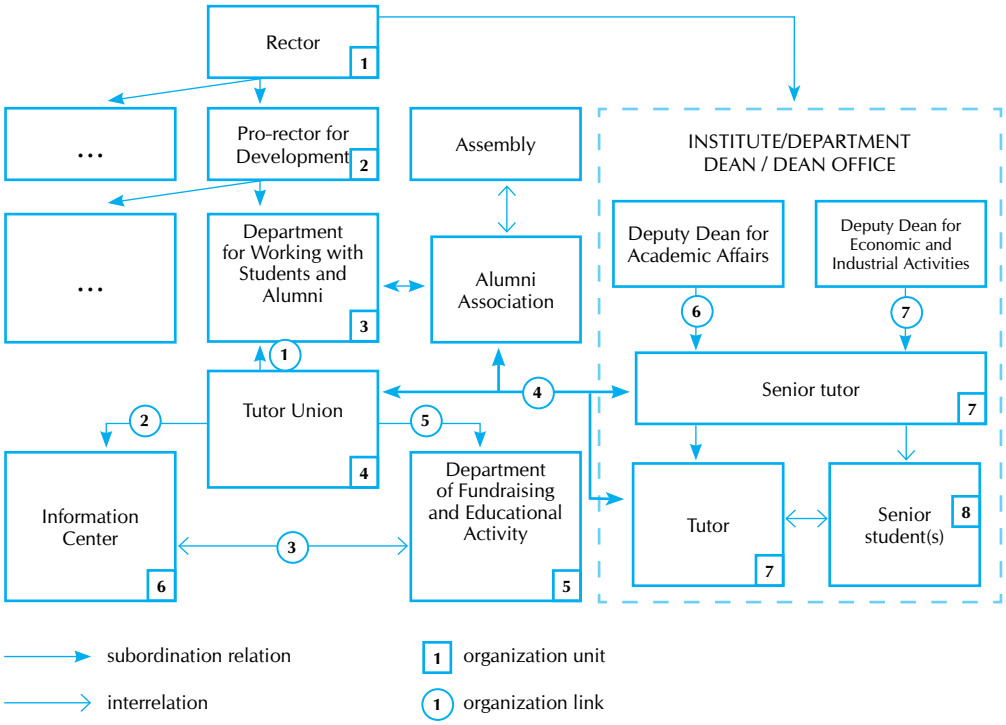
1. During the whole year, tutors can make their proposals about the organization of educational activities for the next year with an activity being fundraising. Tutors are fully involved in this process as the main part of their wages is an efficiency wage and the next year salary rate depends on the efficiency of fundraising activity.

2. The programme and possible fundraising activities for the next year which are to be approved by Tutor Union till the beginning of October are started to be developed in the middle of the year.

3. Proposed activities are specified in project forms and approved by university authorities from October till December. Control figures proceed to the Department for Working with Students and Alumni.

4. For activity development and realization, tutors can apply to the

Fig. 1.
Proposed Fundraising Organizational Structure



Department of Fundraising and Educational Activity and receive a consultation within a working day.

5. If university coordination is necessary for activity development, tutors address to the Department of Fundraising and Educational Activity which provides this coordination in definite period attracting, if necessary, Department for Working with Students and Alumni, Pro-rector for Research and Development and Rector.

6. The results of department activity are summarized, annual report is approved, year activity efficiency is evaluated, tutors and departments specialists wage is established (Department for Working with Students and Alumni, Information Center) in Tutor Union meeting at the end of January.

Efficiency wages are paid in accordance with the tutor salary rate and university activity index.

6 - Information Center. This department aims to develop and implement registration forms for major departments; manage applicants, students and alumni database; do mailing and information search (together with Alumni Association and Tutor Union); develop web-sites for Alumni Association, social university organizations, endowment fund and university trust fund, together with web-server of Department for Development; be responsible for major departments information supply (mailing of announcements and other information).

Center staff enumerates in average 5 persons.

7 - Tutors. Tutors are the major executives of organization functions within described scheme. They realize educational activity as the basic one with the average university salary rate and irregular working hours. This position may be occupied by those who have an experience of organization work, by enthusiasts who can establish psychological contact with students.

It is supposed that there will be one senior tutor (among all university tutors) coordinating university tutors activity.

Senior tutor is submitted to the institute's Deputy Dean for Educational Activity who is responsible for students academic progress and enrolment (Link 6, Fig.1); students accommodation, scholarship, fundraising, sponorship and etc. – to the Deputy Dean for Economic and Industrial Activity (Link 7, Fig.1).

As a rule a tutor is appointed to conduct one group of students from first till the fifth year of study (unlike in TPU – only for the first two years of study),as well as to enroll student for a definite speciality and keep contacts with alumni. Tutor can attract assistants among senior students. Among tutors responsibilities the following must be pointed out: carrying out of different activities, creating of funds for activity realization (initially the financing should be realized by university, further, in course of social net promotion, tutor can create endowment funds in university), keeping, supporting and developing new traditions, contacting with alumni, specialty advertising and promotion, presents receiving (through materially-responsible person), carrying out of group lessons with fixed credits assigned by curriculum.

Methods of student encouragement: accommodation, name scholarship reference, social aid, employment, internship, discounts for learning and other university services, etc.

Major tutor purpose – gain students trust, to be aware of all students affairs, keep contact with parents, meaning almost to become a student's family member in order to provide future contact with university; on the other side tutor is a face of university in the eyes of the students. It appears that with the help of tutors, university creates its own social capital, which can be spent in future on different needs. Thus, a long term contract must be signed with experienced tutors (for ten or more years).

Cultivating of "inescapable sense of guilt", reflecting in inner respectful attitude to everything which is connected with university, as well as rendering of any help, can be considered as a common tutor aim.

Efficiency evaluation criteria for long-term tutor activity can be the amount of alumni (considering place of living), keeping contacts and regularly participating in university affairs, as well as the results from appealing (number of responds per one appealing), amount of attracted funds. This can't be achieved in a year, so tutor should be given a time (not less than three graduations).

8 - Students. Senior students are tutors' assistants, participating in all activities. There may be a lot of participants, fee can be received either by one participant or it is shared among all of them. Fee can accumulate in university special-purpose fund (upon students decision) and could be spent on the next activity.

9 - Alumni Association. A part of Alumni Association and its working committee responsibilities, (i.e. work with alumni and curriculum development) is planned to be charged over Department of Fundraising and Educational Activity as its functions and staff are extending. Only authorities and administration enter this Association. They appeal to the Department of Fundraising and Educational Activity with the activity initiative, the department, in its turn, provides activity development and realization under association's supervision and cooperation. Representatives of Association administration are the regular participants of Tutors Union meeting (Link 4, Fig.1) and are permitted to propose initiative projects, and as senior tutors, they take part in Association activity.

The above presented scheme is focused on a long-term result. The first years of scheme realization will be rather cost. However, the major target – education of university devotee – requires much spending and individual approach. Today, universities apply to this approach and attract large funds for target realization, but relations between university and its alumni were established in the past. Now the question is to develop university fund for the year 2030 and further.

Table 1
Department of Fundraising and Educational Activity: authority and average staff quantity

№	Position	General authority	Average staff quantity
1	Head of the department	Department activity management	1
2	Advertising, marketing and PR specialist	Campaign developing Appealing documents design Tutor support in donator appealing design, students participation in education activities	3
3	Psychologists	Developing of donators, applicants, students and alumni appealing procedures; Carrying out of trainings for students and tutors. Participating in appealing design Tutor support	5
4	Economy and law specialist	Company plan and budget design Document legal review Company efficiency assessment Fund attraction Competition regulations and other documents University support	4
5	Competition and activity organization specialist	Arrangement of students competitions, honored scholarships Competition funds University support	5
6	Alumni specialist	Department and Alumni Association coordination Activity planning	10
7	Applicants specialist	Applicant involvement, tutors and universities collaboration Activity planning	10
8	VIP-client specialist	Efficient donator involvement, influential persons. Designing variants for VIP- clients appealing documents. Collaboration with Alumni Association, assemblies, rector for VIP- client meeting Maintaining contacts with VIP- clients	4

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Perspectives of Engineering Education for Industrial and Innovational Development of Kazakhstan Republic

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Over the past years the economy of Kazakhstan Republic was characterized by the sustainable growth, but in order to save this dynamics it is necessary to implement new model of development which is based on high technology application, growth of brain capital and innovation distribution. For high quality economic prosperity it is essential to create actual innovational, educational, scientific and technological infrastructure which provides reproduction of brain capital, generating of new knowledge and innovation, its capitalization, reforming to new products, services and technologies, development and market consumption.

Industrial and innovational strategy of Kazakhstan Republic development requires higher educational establishments of new generation, innovational research universities of international rank which will be the centers of accumulation and maximum effective application of educational and scientific potential. They will be ready to make a breakthrough in the development of basic economic branches of the country. Kazakh National Technical University named after K.I Satpaev (KazNTU) can become one of these centers.

The establishment of such research university can contribute to the quality increase of engineering professional specialist training for innovational economy in basic spheres of modern science and technology, entrepreneurship in high technological field.

While transferring high educational establishment into Research University, several top-priority goals are defined. These goals imply the development of progressive technical educational programmes and modern educational technologies which include:

- development and implementation of modern educational programmes, including foreign language programmes, educational programmes considering

The article reveals the latest methods of professional specialist training system development in terms of national and international educational need, problems of training quality management, questions of university priority orientations development.

the priority areas of science and technology (nanotechnology, new material technology, informational and telecommunicational technologies, energy saving technologies, technologies of rational land management and etc), as well as modernization of existing learning environment and technologies of high school education in accordance with world best practice;

- implementation of such new educational technologies as: electronic university, electronic environment including for instance electronic educational port; new technologies in professional education through the application of modern information technologies;
- introduction of common international BA, MSc and PhD programmes with leading international universities in terms of experience sharing and internationalization development.

In order to turn this idea into reality, university has programmes of bi-diploma education together with different universities of the world. Besides, a joint Kazakh-Korean centre of informational and communicational technologies created by South Korean organization KOICA was opened in KazNTU in 2009. This center aimed to broaden the potential of international programme training and to provide the socio-professional recognition of educational training programmes through national and international accreditation.

Through several years KazNTU maintains an active cooperation with partner universities possessing great experience in educational programme accreditation and with international accreditation agencies on assessment of engineering educational programmes such as American Accreditation Agency ABET (USA) and Association of Russian Engineering Education.

Accreditation, being a wide- spread method of teaching quality assessment, is considered in many countries to be the acknowledgement of quality development and maintenance that means the presence of efficient education system which provides steady development.

Universities of Europe, the USA and other countries consider accreditation to be the main external assessment which gives the educational establishment an authority for realization of educational programmes. Thereafter, the result of such assessment will influence the quality of professional specialist training and university status; it will make university more competitive in the educational market in any types of ranging;it will contribute to the development of main interaction methods with employers and establishment of joint industrial committees.

At present KazNTU is creating industrial-consulting council involving industry and university representatives for the improving of professional engineering specialist model and integrating forces for growing high-qualified and skilled postgraduates:

- development of new educational standards in the sphere of high technologies and rendering of educational service for the industry where universities should provide training and retraining in different industrial spheres based on the life-long learning principal, for instance, programmes for adults training, continuing professional training for industry representatives, etc;
- further development of material and technical specialty basis, science-educational interdepartment laboratories on scientific priorities through the creation of special collegial authorities which analyze, study the development, relevance and specialty perspective;
- large-scale analysis of world leading technological universities experience in development of professional competence, i.e. relevant professional knowledge and skills of their postgraduates, development of educational programmes

and system of quality indexes allowing to provide postgraduates with necessary level of training in accordance with the high forecast of technological industry development.

Based on the obtained results and international standard requirements, there is the necessity of the development of competence matrix and improvement of professional engineering specialist model.

At further transformation of high educational establishment into research university, it is necessary to develop the system of service advancement in the sphere of engineering, projecting, science-research and test-constructing works. It is essential to create engineering centers, to develop technology transfer centers which will further become modern management service of intellectual property. Based on modern science acheivements and technological facility, joint informational and digital resources, there is an opportunity to develop center and laboratory infrastructure as well as to conduct modernization of existing facilities in order to provide high quality of experimental work.

One of these institutional structures is national science shared laboratory of information and space technologies. KazNTU is equipped with the most powerful in the republic supercomputer.

It is possible to develop infrastructure within the proposed programme to support the university and students innovations of university specialists and students.

Besides it is planned to create integral system of technological internship for MSc and PhDs by integrating of new practicum which fully imitates the real working conditions. For this purpose the university has created Technological Business Incubator.

It is necessary to introduce the programmes aimed at the attraction of young scientists and professional specialists for science-pedagogical work, as well as to train staff and create new scientific schools with international approval.

The establishment of research university will help to improve the technology development in a number of technical and technological spheres.

Research and technology associations will become a tool for providing university's input into the basic republic economical sphere development as they can unite the forces of the state, industry and science for the purpose of rapid development in definite techno logical areas.

The results will be:

- modernization of educational establishment activity, providing integration of education, science and industry and also training of highly qualified professional engineering specialists for technological areas entering the sphere of national interests;
- establishment of university which will correspond wiht the best international models and will be competitive at international educational market through the collaboration development with universities of Europe, Asia and America in frames of international education and science programmes, distribution of Kazakh educational technologies and standards round the world. It will improve the image of Kazakh Republic like an international science-educational country;
- convergence of university researches and fundamental academic science, and qualitative combination of knowledge in the sphere of modern technology, discovering of new research priorities necessary for industrial-innovational country economy development;
- the development of science work commercialization mechanisms and improvement of scientific innovational potential;
- control and development of scientifically based system intended for consideration of economy needs in

professional specialists, which will result in supplying the labor market with mostly required professional specialists aiming to satisfy personal, state and industrial interests and will contribute to stable national economy growth, intellectual and technical leadership of Kazakh Republic in 21st century;

- emerging of new ways of business and economy development, as well as large innovational projects and new vacancies in high technology sphere, extracting and refining of natural resources, particularly on the basis of research consortium mechanism realization, infrastructure development for technology promotion and commercialization, and also development of different innovation-active companies, cooperating with university.

High rate of Kazakhstan development – the country which is being developed under the conditions of market economy - puts new objectives for country educational establishments. The role of modern educational system which is an important factor of country economic development becomes significant.

Contemporary social relations and changing of labor markets require adequate reaction to nowadays educational challenges and economic development requirements correspondence.

In his message to Kazakh people, the president of Kazakhstan N. Nazarbaev, formulated a state strategic education development task, which should provide contemporary level of education, training of professional specialists most-searched in any labor market of the world and providing of international standard quality educational service. Also, new country development priorities were defined. The question of educational establishment certification at the level of international standards was specially highlighted because it can truly evaluate the quality of each university education. The president also specified the objective for technical universities in new generation professional technical specialists training, with contemporary set of mind and modern labor market requirements correspondence.

At present, the quality of education system is of a great concern for all educational establishments and especially universities.

To implement new technologies and create quality insurance system, it is necessary first of all to develop the "culture of quality" that means an active collaboration of all specialists, critical self-judgment and specialists' responsibility.

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Summary

MECHANISMS OF INDEPENDENT LEARNING QUALITY ASSURANCE BASED ON THE ANALYSIS OF DEMAND FOR UNIVERSITY GRADUATES AT LABOUR MARKET AND RECOMMENDATIONS ON THEIR PRACTICAL APPLICATION.

Vitaliy V. Borsch, Ekaterina G. Abramova
Moscow Automobile & Road State Technical university (MADI)

A new model for independent evaluation of the higher education quality named «PROvuz» is presented in the article. The main idea of «PROvuz» model is to evaluate higher education quality by analysing the demand for gratuates. Also, the article describes the performance indexes and examples of evaluation result application.

STUDENTS AND EMPLOYERS ABOUT THE TWO-LEVEL EDUCATION SYSTEM AND THEIR ASSESSMENT OF QUALITY ASSUARANCE AT UNIVERSITY

Natalia V. Vozhennikova, Svetlana V. Vikhareva, Olga G. Smirnova
Vyatka State university

The article provides students' and employers' opinion review of higher education reform and importance of developing common cultural competences among graduates. The employers' opinion about graduates of Vyatka State university is also cited.

THE MODEL OF UNIVERSAL COMPETENCES OF A QUALIFIED ENGINEER

Sergey I. Gerasimov
Siberian State Transport University

The article proposes a general competency model for professional engineers. The characteristics of development stages and indicators of general engineering competencies are considered.

PROFESSIONAL TRAINING IN INNOVATION AND COMMUNICATION TECHNOLOGIES WITHIN THE IMPLEMENTION OF THE GRADING-RATING SYSTEM (GRS)

Alexander S. Ksenofontov, Rita V. Gurfova, Larisa A. Moskalenko
Kabardino-Balkarian State university named after H. M. Berbekov

The article attempts to further explore aspects of training ICT professionals within the rating system. The authors examine labor market for computer science specialists and prospective teaching techniques addressed to ICT students. One of the ways to organize educational process based on rating system of knowledge, skills and competencies control was proposed

DEVELOPMENT AND IMPLEMENTATION OF BASIC

EDUCATIONAL PROGRAMMES IN ENGINEERING AND TECHNOLOGY

Igor A. Safyanninkov, Emiliya N. Belomestnova, Mikhail G. Mimin
Tomsk Polytechnic University

A systematic approach to organizing the process of developing and implementing basic engineering educational programmes is regarded by the authors in line with the new educational standards. The experience of National Research Tomsk Polytechnic University has been studied in this area. A prominent feature of the presented project is that it is focused on all inputs and outcomes of the educational process: from the goals of professional education itself to the goals of the concrete activity, from developing training technologies to choosing quality evaluation methods.

TOPICAL ISSUES OF PERSONALITY-CENTERED PROFESSIONAL EDUCATION QUALITY MANAGEMENT

Roman E. BULAT / Military Technical University (St. Petersburg)
Elena Yu. SHADRINA / Tomsk Polytechnic University

Establishment of government system of education quality management is one of the major issues in government educational policy. Priority of personality development also belongs to these major issues. However, existing approaches to management of educational systems cannot provide the implementation of personality-centered education concept. Engineering education quality management systems should be developed not only in the engineering subsystem but also in psychoeducational, organizational, methodological and other subsystems.

EXPERIENCE IN THE SHORT-TERM EDUCATIONAL ENGINEERING PROGRAMS REALIZATION AT KABARDINO-BALKARIAN STATE UNIVERSITY

Alim B. Khuranov, Alexander S. Ksenofontov
Kabardino-Balkarian State university named after H. M. Berbekov

The article is dedicated to short-term educational programmes in engineering specially designed for college graduates , who have already obtained knowledge and skills at vocational education level. The problems of legislative and methodological standards are discussed. Kabardino-Balkarian state university named after h. M. Berbekov shares good practices in this area.

PUBLIC AND PROFESSIONAL ACCREDITATION OF EDUCATIONAL POGRAMMES. WHO NEEDS IT AND WHY?

Yury P. Pokholkov
Tomsk Polytechnic University

The development of professional public accreditation in engineering and technology is considered in the article. The author points out distinctive accreditation features in Russia and abroad.

RUSSIAN SYSTEM OF PROFESSIONAL ENGINEERS CERTIFICATION AND REGISTRATION BASED ON THE APEC ENGINEER REGISTER INTERNATIONAL STANDARD

Petr S. Chubik, Alexander I. Chuchalin, Alexander V. Zamyatin
Tomsk Polytechnic University

The quality assurance system in engineering education has proved its efficiency in a large number of developed countries all over the world.

International experience on the matter and first results of attempts to develop a similar system in Russia on the base of the APEC Engineer Register international standard are presented in the article.

EUROPEAN ENGINEER QUALIFICATION FOR RUSSIA

Vladimir M. Sitsev, Mikhail Yu. Rachkov
The Russian Union of Scientific and Engineering Organizations

The paper describes the structure of accreditation standards for engineering programmes and requirements to receive the degree Euroengineer for Russian specialists. This information helps to estimate conformity of the educational process level in Russia to the European level, to accredit Russian educational programmes and to certify specialists as Euroengineers. The history and activities of European federation of national engineering associations and Russian federation of scientific and engineering associations are presented.

ACTIVITY OF THE IGIP RUSSIAN MONITORING COMMITTEE AND DEVELOPMENT OF THE ACADEMIC MOBILITY

Vyacheslav M. Prikhodko, Larisa G. Petrova, Alexander N. Solovyev, Ekaterina I. Makarenko
Moscow State Automobile and Road Constructing Technical University (MADI).

IGIP is one of the oldest (since 1972) European non governmental organisations dealing with higher education teachers' training. The IGIP National Monitoring Committees (NMC) have now become important IGIP "branches" in many countries. The IGIP Russian Monitoring Committee (RMC) was organized in 1993. RMC coordinates the efforts of the IGIP Centres of Engineering Pedagogy to reinforce the linguistic and communicative training in order to promote international academic mobility. Members of RMC organize the international university consortiums to realize Tempus Projects.

SOME PROBLEMS IN THE DEVELOPMENT OF ENGINEERING IDEAS IN RUSSIA AND ADVANCED LIFE-LONG PROFESSIONAL ENGINEERING LEARNING

Sergey G. Kukushkin / Information Satellite Systems Joint-Stock Company
Michael V. Lukyanenko, Natalya P. Churlyaeva/ Siberian State Aerospace University

Some general problems of training creative engineers are briefly outlined. More profound consideration is given to the specific problems related to the isolated nature of Russian engineering and the reasons for its low creativity are explained. The prospects for the engineer thinking further development are associated mainly with continuing professional training systems at enterprises that pursue innovative activity such as Information Satellite Systems Joint-Stock Company.

HUMANITARIAN MEDIUM IN AN ENGINEERING UNIVERSITY: IS THE IMPLEMENTATION OF WORLD-LEADING EXPERIENCE INTO DOMESTIC ENGINEERING EDUCATION POSSIBLE OR NOT?

Natalia V. Trubnikova
Tomsk Polytechnic University

The article is devoted to the problem of humanitarian medium management in engineering university. Based on the vast experience in humanitarian medium management of "top-level" technical

universities (Ecole Polytechnique de Paris, Massachusetts Institute of Technology and RWTH Aachen University) practical recommendations to improve the educational environment of a Russian technical university are formed.

ENGINEERING MANPOWER FOR REAL ECONOMY

Evgeny M. Romanov
Mari State Technical University

Global financial crisis reminded that Russia lacks highly qualified, adapted to the market specialists without who it is impossible to improve economy. With a diploma on higher education, alumni should immediately start work, applying innovative knowledge and skills, being able to introduce them. But how should the specialists be trained? What do we need to start with? What are the problems technical universities face with? Are there universities ready to share their specific results in training engineers, who can already meet the demands of the current industrial environment? These are the main issues discussed in the article.

FUNDRAISING IN RUSSIAN UNIVERSITY

Marina V. Ryzhkova
Tomsk Polytechnic University

Based on international experience we suggest organizational design of fundraising activity for Russian universities. The main forming principal of the structure is that pedagogic activity is aimed at developing the social university web. The key player in this case is a supervisor who maintains contacts with graduates, students and alumni. The supervisor and his social chains are the social capital of the university.

PERSPECTIVES OF ENGINEERING EDUCATION FOR INDUSTRIAL AND INNOVATIONAL DEVELOPMENT OF KAZAKHSTAN REPUBLIC

Gulnara M. Sarsenbayeva
Kazakh National Technical University named after K.I.Satpaev

The article is devoted to the contemporary approaches for developing high engineering education in accordance with national and international challenges. Ways of improving quality assurance system and sustainable institutional development of the main university activities are regarded by the author.

List of RAEE Accredited Programmes

Non-commercial Russian Association for Engineering Education (RAEE) has been actively involved in the development and improvement of the professional accreditation system for more than 10 years. Since 2007 it has conducted national professional accreditation of educational programs in accordance with both the accreditation standards for engineering programs applied in European higher education establishments and the criteria approved by the member-countries of the Washington Accord.

Seven national agencies which have introduced their own accreditation criteria in accordance with the existing standards possess the right to assign European quality mark EUR-ACE Label (European Accredited Engineer) to the educational programs. These are the agencies ASIIN (Germany), CTI (France), IEI (Ireland), OE (Portugal), ECUK (Great Britain), RAEE (RAEE, Russia) and MUDEK (Turkey).

In 2009, RAEE entered the international market and first educational programs of higher educational establishments in the Republic of Kazakhstan were accredited.

147 educational programs of Russian and Kazakh higher educational establishments, with 66 educational programs being awarded EUR-ACE Label have been accredited by 01.11.2010.

The list of the accredited programs approved by RAEE is given below.

The list of the accredited programs, approved by RAEE, Russian Federation (01.11.2010)

Code	Qualification	Title	Certificate	Accreditation Term
Altai State Technical University named after I.I. Polzunov				
100400.65	INT	Electrical Supply	RAEE	1997-2002
120100.65	INT	Mechanical Engineering Technology	RAEE	1997-2002
120500.65	INT	Welding Equipment and Technology	RAEE	1997-2002
150900.62	FCD	Technology, Equipment and Automation of Mechanical Engineering Productions	RAEE	2003-2008
Ivanovo State Power University				
140404.65	INT	Nuclear Power Plants and Installations	RAEE EUR-ACE®	2009-2014
210106.65	INT	Industrial Electronics	RAEE EUR-ACE®	2009-2014
Irkutsk State Technical University				
130100.65	INT	Aircraft and helicopter construction	RAEE	2004-2009
250400.65	INT	Chemical Engineering of Natural Power Supplies and Carbon-base Materials	RAEE	2004-2009
Kazan State Technological University				
240100.62	FCD	Chemical Technology and Biotechnology	RAEE	2004-2009
Krasnoyarsk State Technical University				
200700.65	INT	Radio Engineering	RAEE	1997-2002
220100.65	INT	Computers, Systems and Networks	RAEE	1997-2002
210302.65	INT	Radio Engineering	RAEE	2003-2008
Komsomolsk-on-Amur State Technical University				
140600.62	FCD	Electrical Engineering, Electromechanics and Electrical Technology	RAEE	2005-2010
140601.65	INT	Electromechanics	RAEE	2005-2010
140604.65	INT	Electrical Drives and Automated Industrial Sets and Engineering Systems	RAEE	2005-2010
Moscow State Technological University "Stankin"				
120100.65	INT	Mechanical Engineering Technology	RAEE	1993-1998
120200.65	INT	Metal-cutting Machines and Tools	RAEE	1993-1998
120400.65	INT	Machines and Metal Forming Technology	RAEE	1993-1998
210200.65	INT	Automation of Technological Processes and Manufacturing	RAEE	1993-1998
210300.65	INT	Robots and Robotic Systems	RAEE	1993-1998
220300.65	INT	Automated Production Systems	RAEE	1993-1998
Moscow State Mining University				
090400.65	INT	Mine and Underground Construction	RAEE	1996-2001
090500.65	INT	Open-pit Mining	RAEE	1996-2001
130408.65	INT	Mine and underground construction	RAEE EUR-ACE®	2010-2015
Moscow State University of Applied Biotechnology				
070200.65	INT	Low Temperature Physics and Technology	RAEE	1996-2001
170600.65	INT	Food Production Machines and Devices	RAEE	1996-2001

210200.65	INT	Automation of Technological Processes and Manufacturing	RAEE	1996-2001
250600.65	INT	Plastic and Elastoplastic Processing Technology	RAEE	1996-2001
270900.65	INT	Meat and Meat Products Technology	RAEE	1996-2001
271100.65	INT	Milk and Dairy Products Technology	RAEE	1996-2001
Moscow State Institute of Radio Engineering, Electronics and Automation (Technical University)				
210302.65	INT	Radio Engineering	RAEE	2004 -2009
220402.65	INT	Robots and Robotic Systems	RAEE	2005-2010
200203.65	INT	Optoelectronic Devices and Systems	RAEE	2005-2010
220401.65	INT	Mechatronics	RAEE	2005-2010
210104.65	INT	Microelectronics and Solid State Electronics	RAEE EUR-ACE®	2005-2015 *
230105.65	INT	Computer Technology and Automated Systems Software	RAEE	2005-2010
230201.65	INT	Information Systems and Technologies	RAEE	2005-2010
230101.65	INT	Computers, Systems and Networks	RAEE EUR-ACE®	2008-2013
200200.62	FCD	Optical Engineering	RAEE EUR-ACE®	2010-2015
210300.62	FCD	Radio Engineering	RAEE EUR-ACE®	2010-2015
Moscow Institute of Electronic Technology (Technical University)				
210100.62	FCD	Electronics and Microelectronics	RAEE	2003-2008
230100.62	FCD	Computer Science	RAEE	2003-2008
Statc Technological University Moscow Steel and Alloys Institute				
150101.65	INT	Metallurgy	RAEE	2004-2009
150105.65	INT	General Metallurgy and Metals Treatment	RAEE	2004-2009
150601.65	INT	Material Engineering and Substitute Material Technology	RAEE	2004-2009
Moscow Power Engineering Institute (Technical University)				
140600.62	FCD	Electrical Engineering, Electromechanics and Electrical Technology	RAEE	2005-2010
140602.65	INT	Electrical and Electronic Machines	RAEE EUR-ACE®	2007-2012
140604.65	INT	Electrical Drives and Automated Industrial Sets and Engineering Systems	RAEE EUR-ACE®	2007-2012
140609.65	INT	Electrical Equipment for Aircraft	RAEE EUR-ACE®	2007-2012
140611.65	INT	Insulators, Cables and Capacitors	RAEE EUR-ACE®	2007-2012
140403.65	INT	Technical Physics of Thermonuclear Reactors and Plasma Installations	RAEE EUR-ACE®	2010-2015
"MATI" -Russian State Technological University				
190300.65	INT	Aircraft instruments, Measuring and Computing complexes	RAEE	1996-2001
110400.65	INT	Foundry of ferrous and non-ferrous metals	RAEE	1996-2001
110500.65	INT	Metal Science and Thermal Treatment of Metals	RAEE	1996-2001
110700.65	INT	Welding Metallurgy	RAEE	1996-2001
Samara State Aerospace University				

160301.65	INT	Aircraft Engines and Power Plants	RAEE EUR-ACE®	2008-2013
160802.65	INT	Spasecraft and Rocket Boosters	RAEE EUR-ACE®	2008-2013
Saint Petersburg Electrotechnical University "LETI"				
220200.62	FCD	Automation and Control	RAEE	2003-2008
210100.62	FCD	Electronics and Microelectronics	RAEE	2003-2008
230100.62	FCD	Computer Science	RAEE	2003-2008
200300.62	FCD	Biomedical Engineering	RAEE	2003-2008
Siberian Federal University				
210200.68	SCD	Microwave Equipment and Antennas	RAEE EUR-ACE®	2010-2015
230100.68	SCD	High-Performance Computing Systems	RAEE EUR-ACE®	2010-2015
Taganrog Institute of Technology of Southern Federal University				
210100.62	FCD	Electronics and Microelectronics	RAEE	2003-2008
230100.62	FCD	Computer Science	RAEE	2003-2008
230100.62	FCD	Computer Science	RAEE EUR-ACE®	2010-2015
220200.62	FCD	Automation and control	RAEE EUR-ACE®	2010-2015
Tambov State Technical University				
210201.65	INT	Design and Technology of Radioelectronic Devices	RAEE	2006-2011
140211.65	INT	Electrical Supply	RAEE	2006-2011
Togliatty State University				
140211.65	INT	Electrical Supply	RAEE EUR-ACE®	2009-2014
150202.65	INT	Industrial Welding Technology and Equipment	RAEE EUR-ACE®	2009-2014
151002.65	INT	Mechanical engineering technology	RAEE EUR-ACE®	2009-2014
Tomsk Polytechnic University				
071600.65	INT	High Voltage Engineering and Physics	RAEE	1996-2001
080200.65	INT	Geology and Prospecting of Mineral Resources	RAEE	1996-2001
180100.65	INT	Electromechanics	RAEE	1996-2001
200400.65	INT	Industrial Electronics	RAEE	1996-2001
210400.65	INT	Applied Mathematics	RAEE	1996-2001
250900.65	INT	Chemical Engineering of Modern Energetic Materials	RAEE	1999-2004
250800.65	INT	Chemical Engineering of Refractory Non-Metal and Silicate Materials	RAEE	2000-2005
070500.65	INT	Nuclear Reactors and Power Plants	RAEE	2000-2005
220100.65	INT	Computer Science	RAEE	2000-2005
100500.65	INT	Thermal Power Plants	RAEE	2000-2005
101300.65	INT	Boiler and Reactor Engineering	RAEE	2000-2005
230100.62	FCD	Computer Science	RAEE EUR-ACE®	2003-2013*
140600.62	FCD	Electrical Engineering, Electromechanics and Electrical Technology	RAEE EUR-ACE®	2003-2013*
140601.65	INT	Electromechanics	RAEE	2004-2009

140604.65	INT	Electrical Drives and Automated Industrial Sets and Engineering Systems	RAEE	2004-2009
230101.65	INT	Computers, Systems and Networks	RAEE	2004-2009
020804.65	INT	Geoecology	RAEE	2004-2009
130100.62	FCD	Geology and Prospecting of Mineral Resources	RAEE	2005-2010
200106.65	INT	Measurement Devices and Technologies	RAEE EUR-ACE®	2007-2012
200203.65	INT	Opto-Electronic Equipment and Systems	RAEE EUR-ACE®	2007-2012
240304.65	INT	Chemical Engineering of Refractory Non-Metal and Silicate Materials	RAEE EUR-ACE®	2007-2012
240901.65	INT	Biotechnology	RAEE EUR-ACE®	2008-2011
140200.62	FCD	Electrical Power Engineering	RAEE EUR-ACE®	2008-2013
150917.68	SCD	High-technology Physics in Mechanical Engineering	RAEE EUR-ACE®	2008-2013
140200.68	SCD	High Voltage Engineering and Physics	RAEE EUR-ACE®	2010-2015
130100.68	SCD	Groundwater Resources Formation and Composition	RAEE EUR-ACE®	2010-2015
Trekhgorny Technological Institute				
230101.65	INT	Computers, Systems and Networks	RAEE	2004-2007
Tyumen State Oil and Gas University				
130501.65	INT	Design, Construction and Operation of Gas and Oil Pipelines and Storage Facilities	RAEE	2006-2011
130503.65	INT	Development and Exploitation of Oil and Gas Fields	RAEE	2006-2011
130504.65	INT	Oil and Gas Drilling	RAEE	2006-2011
190601.65	INT	Automobiles and Transportation Facilities	RAEE	2007-2012
190603.65	INT	Transport and technological machinery and equipment service (oil and gas production)	RAEE	2007-2012
190701.65	INT	Transportation organization and transport management (automobile transport)	RAEE	2007-2012
130602.65	INT	Oil and Gas Fields Machinery and Equipment	RAEE EUR-ACE®	2008-2013
150202.65	INT	Industrial Welding Technology and Equipment	RAEE EUR-ACE®	2008-2011
190205.65	INT	Lifting, Transportation Means and Road Machines	RAEE EUR-ACE®	2008-2013
240401.65	INT	Chemical Technology of Organic Substances	RAEE EUR-ACE®	2009-2014
240403.65	INT	Chemical Engineering of Natural Power Supplies and Carbon-base Materials	RAEE EUR-ACE®	2009-2014
240801.65	INT	Machines and Apparatus of Chemical Production	RAEE EUR-ACE®	2009-2014
280201.65	INT	Environmental control and rational use of natural resources	RAEE EUR-ACE®	2010-2015
280102.65	INT	Safety of technological processes and productions	RAEE EUR-ACE®	2010-2015
120302.65	INT	Land cadastre	RAEE EUR-ACE®	2010-2015

Ural State Forest Engineering University				
270205.65	INT	Automobile Roads and Aerodromes	RAEE	2006-2011
Ural State Technical University				
240302.65	INT	Technology of Electrochemical Productions	RAEE EUR-ACE®	2008-2013
Ufa State Aviation Technical University				
280200.62	FCD	Environment Protection	RAEE	2005-2010
230100.62	FCD	Computer Science	RAEE	2005-2010
150501.65	INT	Material Science in Mechanical Engineering	RAEE	2005-2010
280200.68	SCD	Environment Protection	RAEE EUR-ACE®	2008-2013
Ufa State Petroleum Technological University				
130504.65	INT	Oil and Gas Drilling	RAEE EUR-ACE®	2007-2012
130603.65	INT	Oil and Gas Processing Equipment	RAEE EUR-ACE®	2007-2012
150400.62	FCD	Oil and Gas Processing Equipment	RAEE EUR-ACE®	2007-2012
240100.62	FCD	Chemical Engineering and Biotechnology	RAEE EUR-ACE®	2008-2013
240403.65	INT	Chemical Engineering of Natural Power Supplies and Carbon-base Materials	RAEE EUR-ACE®	2008-2013
130602.65	INT	Oil and Gas Fields Machinery and Equipment	RAEE EUR-ACE®	2008-2013
130501.65	INT	Design, Construction and Operation of Gas and Oil Pipelines and Storage Facilities	RAEE EUR-ACE®	2009-2014
551830.68	SCD	Chemical Engineering of Fuel and Gas	RAEE EUR-ACE®	2010-2015
551831.68	SCD	Equipment Design Theory for Oil and Gas Processing, Petrochemical and Chemical Production	RAEE EUR-ACE®	2010-2015
550809.68	SCD	Technological Systems and Equipment Reliability	RAEE EUR-ACE®	2010-2015

* Subsequent accreditation

FCD – First Cycle Degree Programme
SCD – Second Cycle Degree Programme
INT – Integrated Programme

**List of Accredited Programmes,
Republic of Kazakhstan (01.11.2010)**

Code	Qualification	Title	Certificate	Accreditation Term
Innovative University of Eurasia (Pavlodar, Republic of Kazakhstan)				
050701	FCD	Biotechnology	RAEE EUR-ACE®	2010-2015
050718	FCD	Electrical Power Engineering	RAEE EUR-ACE®	2010-2015
Kazakh National Technical University named after K.I. Satpaev (Almaty, Republic of Kazakhstan)				
050704	FCD	Computer Science and Software	RAEE EUR-ACE®	2010-2015
050711	FCD	Geodesy and Cartography	RAEE EUR-ACE®	2010-2015
050712	FCD	Mechanical Engineering	RAEE EUR-ACE®	2010-2015
050718	FCD	Electrical Power Engineering	RAEE EUR-ACE®	2010-2015
050723	FCD	Technical Physics	RAEE EUR-ACE®	2010-2013
Karaganda State Technical University (Karaganda, Republic of Kazakhstan)				
050702	FCD	Automation and Control	RAEE EUR-ACE®	2010-2015
050707	FCD	Mining Engineering	RAEE EUR-ACE®	2010-2015
050709	FCD	Metallurgy	RAEE EUR-ACE®	2010-2015
050712	FCD	Mechanical Engineering	RAEE EUR-ACE®	2010-2015
050713	FCD	Transport, Transport Facilities and Technology	RAEE EUR-ACE®	2010-2015
Semey State University named after Shakarim (Semey, Republic of Kazakhstan)				
050727	FCD	Food Technology	RAEE EUR-ACE®	2010-2015
05072	FCD	Processing Machinery and Equipment	RAEE EUR-ACE®	2010-2015

Dear Colleagues!

Russian Association of Engineering Education invites all universities to participate in the non- government - professional accreditation of engineering education programs. This non-government-professional accreditation in engineering and technology is a process to improve the quality of engineering education in accordance to the global standards, and to obtain acknowledgement in the professional engineering community for high-qualified professional engineering training.

Such accreditation of engineering education programs provides the opportunity to obtain an independent evaluation of the quality of the university's education programs and recommendations for their further improvement; to assert one's high-professional engineer training level and, thus, enhancing the competitiveness of engineer-graduates in the domestic and global labor market.

The graduates of such accredited engineering education programs can receive the profession degree EUR ING "European Engineer" in the future.

Association of Engineering Education is the only agency in Russia that has the qualifications to certify EUR-ACE. Accredited programs are included in the RAEE accreditation program register, as well as, the European register of accredited engineering programs.

All necessary information can be found on the following website:

Accreditation Center RAEE www.ac-race.ru.

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Tel\Fax (3822) 42-14-78

e-mail: ac@ac-raee.ru

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78 Vernadsk Prospect, Building №7

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30 Lenin Prospect, Room 328

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