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UDC 378.14

Development of engineering graduates' competences

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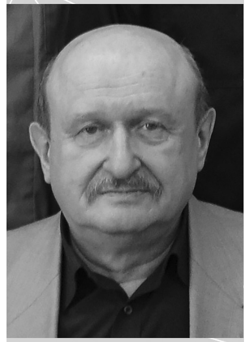


Yu.A. Krupin

Knowledge opens doors, but you have to step through.
D. Likhachev

The article proposes the use of competence-based approach in Higher Engineering Education. The proposed graduate's competence model developed in accordance with the Federal State Educational Standards, and employers' requirements makes it possible to unite all participants of education process in order to achieve a primary goal, i.e. high quality of engineering education. This would certainly raise the prestige of engineering education.

Key words: competence-based approach, education quality, active specialization acquisition, learning outcomes.

The future of the Russian Federation is directly dependent on development of innovation and knowledge-driven economy that is based on scientific and technological progress (real technological revolution). However, the ambition to achieve high economic performance alone is not enough. It is necessary to define the key factors to achieve such a purpose.

As stated by S.S. Naboychenko (Rector of Ural Polytechnic University), human intellectual assets play an important role in innovation-driven economy development [1, p. 7]. At the same time, it is the responsibility of High School to assist in preparing and guiding human intellectual assets that are currently of great demand.

There are a great number of economists, lawyers, and humanists. There is no doubt that these professions, especially educators, are of great importance, however, they do not produce any goods or items of value. Economy is built due to engineers and workers. Despite rising diversity of education programs offered by Higher Engineering School (production engineering, manufacturing, modeling and design), most graduates work as engineers or high-qualified workers. In most cases, they start their carrier upon completion of so-called "on-the-job training program". Is it possible for a bachelor student to become an engineer? B.A. Prudkovskiy, Professor of National University of Science and Technology «MISiS», has stated that engineering activity is confined to the three basic actions: to manage, to research, and to design [2, p. 5-6]. Therefore, according to the Federal State Educational Standards (FSES), fields of the professional activity for graduates with the Bachelor's Degree include:

- production and manufacturing;
- organization and management;
- design;
- engineering;
- research and development (analytical).

Basically, students can be adequately prepared within one or several fields. It is obvious that a graduate, even a bachelor's degree holder, can become a "real" engineer when he/she begins to accumulate qualifying engineering experience after graduation. This fact was clearly identified by V.S. Sheynbaym, Professor of Gubkin Russian State Oil and Gas University [3, p.15-28]. Therefore, universities are to be concerned not only about the quality of education, but also the readiness of labor market to accept a new generation of graduates. It is this fact that would raise the prestige of an engineer in Russia.

Already the ancient Greeks were aware of the fact that "If one does not know to which port one is sailing, no wind is favorable".

Within the Higher Education System, "the port one is sailing" or "destination" of teaching process is defined by the graduates' knowledge and skill requirements. Today, these requirements are linked to graduates' competences (individual performance outcomes) which are clearly stated in FSES and education programs. This constitutes the basic characteristics of our graduates, i.e. the "product" of educators' work. It is obvious that upon completion graduates demonstrate different levels of skills and competences; however, they should have enough knowledge and experience to become a well-qualified specialist, a responsible, honest, and goal-oriented member of our society.

Unfortunately, most Russian universities just formally try to implement the FSES competencies without modernizing the education system itself. Therefore, the main goal of the current study is to propose the ways how to implement competence-based approach into education process.

Within new economic policy in Russia, Higher Professional Education is shifting from so-called "forever" education towards long life learning. This process is stipulated by the following social changes:

- significant technological advances which, in its turn, gave rise to new professions and qualifications;
- the increasing role of employees' horizontal mobility during his/her working life;
- decentralization of economic responsibilities and product (service) liability;
- changes in life styles at all levels: social, organizational, and individual;
- application of management techniques in Higher Professional Education;
- rising factor of dynamism and uncertainty;
- the increasing role of "personal development" ("long life skills") [4, p. 20-28].

The need to adjust to new social and economic environment urges the development of new approaches to training specialists who would actively participate in economic transition and reforms.

Within the described paradigm, the primary goal of higher education is to ensure that students are acquiring general knowledge and professional competences that are deemed to be essential to career success and future life. As goal is a backbone component, its transformation should involve the change of the whole education system, as well. Therefore, being regarded as a primary goal or/and outcome of learning process, the competence-based approach stipulates the development of a new education procedure. The education program courses and practice training are taken in sequence in accordance with the stages to develop the required competences. The credits awarded to students for course completion serve as indicators of the learning achievements for each course of the Basic Education Program (BEP) [5,p.77-81].

Thus, it can be stated that education program should be always based on the graduate's competence model.

In FSESs, BEP outcomes are regarded as competencies. However, at the stage of standard drafting, there were proposals to use two widely applied notions: "competency" and "competence". In the current research, it is of great importance to outline the main difference between these two notions and clarify authors' position on this issue.

Bologna Seminar: Learning Outcomes Based Higher Education – The Scottish Experience (Edinburgh, 21-22 February 2008) noted that there is "a lack of clarity and shared understanding about some of the key terms associated with the introduction of learning outcomes in different countries which is likely to impede effective implementation" [6, p. 134-138].

Following the idea of I.A. Zimnaya, we regard competence as a characteristic of the ability to apply knowledge and skills and demonstrate social and personal attributes. This characteristic is an employer's (consumer's) evaluation of education quality and graduates' ability to work [7, p. 15-17]. Competences can be referred to general personal features.

Competency is an ability to perform an action, in other words, it involves practical skills within a definite field. Thus, competencies are developed while completing each course, precisely, during student-teacher classroom interaction, practice classes, and research assignments. Unlike competences, competencies are referred to the definite and individual skills and knowledge of a graduate. The notion "competency" implies the idea of "know how to do".

The competence should not be opposed to qualification, at the same time it should not be identified with it. In the opinion of I.A. Zimnaya, a specialist is a person who specializes in or devotes himself/herself to a particular area of activity demonstrating high level of required knowledge and skills. Having deep knowledge and required skills within a particular field, a competent specialist demonstrates interpersonal skills, creativity, cognitive abilities and a good understanding of interrelated processes and/or phenomena. Thus, expertise can be regarded as a part of competence.

The FSESes (bachelor's degree program) have been recently modernized with due regard to the following requirement: all cultural and professional competencies, including integrated-professional ones that are related to the qualification to be acquired, should be integrated into the program learning outcomes. However, each university has a right to expand the list of competencies in accordance with the focus of the program. Thus, universities should develop a graduate's competency model for each education program. They should be used as the basis for education program design.

In addition, universities have a right to develop program learning outcomes on their own account. It means that each education program should include definite learning outcomes which, in our opinion, can be presented as graduate's competencies.

However, numerous competencies of education programs should be in strict relation with cultural and professional competencies of a graduate, his/her social and personal attributes, i.e. competence model. Therefore, we believe that a primary goal of education, i.e. learning outcome, is a set of competencies which together shape the competence of a graduate.

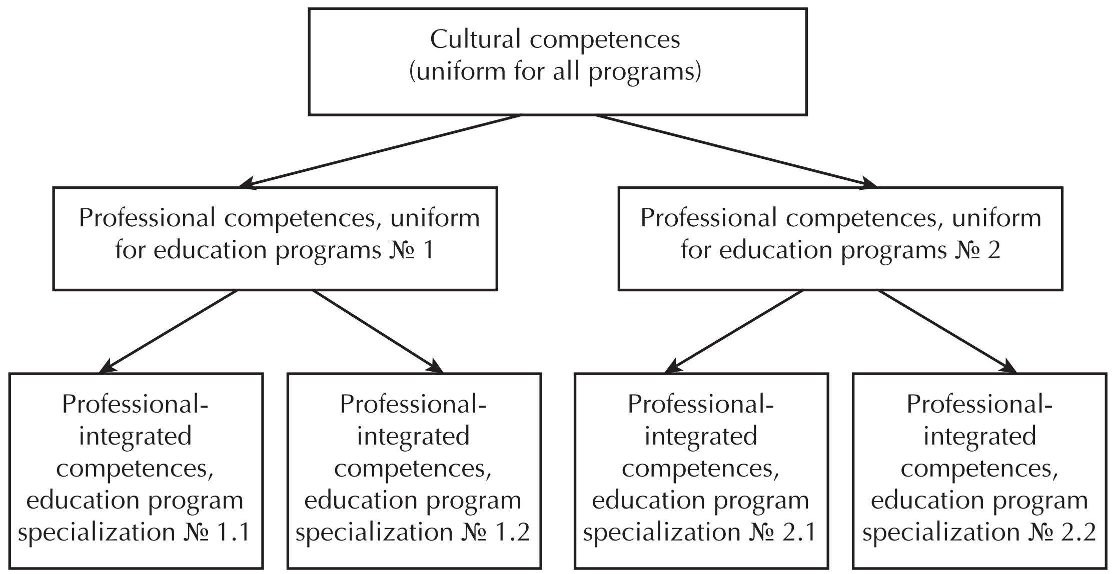
In case of engineering education programs (bachelor's, master's, specialist's degrees), it is possible to develop such a graduate's competency model that would include invariable cultural, professional, integrated-professional, and practical/instrumental competences, usually termed as general competences, without reference to the focus of the program (speciality). Cultural competencies of FSES for bachelor's degree programs (2014-2015) were modernized in light of the above statement.

As each university offers a great number of education programs, the following graduate's competence model is proposed (Fig.1).

In our opinion, the graduate's competence model should include a number of generalized attributes of a graduate which would fully reflect the diversity of the various education program competencies. Therefore, the FSES of Higher Education should be redrafted and revised.

Firstly, as the findings form the survey of employers show, the graduate's competence model must include intellectual abilities of a graduate, his/her social and personal attributes, such as responsibility, sociability, civic consciousness, initiativity, self-discipline,

Fig 1. The Structure of Graduate's Competence Model



and independence [8, p.145-150].

These attributes might seem, at first sight, to develop naturally over a long period of education. However, in fact, it is hardly to be achieved when there are no combined efforts of the faculty who should work within the definite system. As a result, most students fail to shape these attributes in full.

Secondly, in order to ensure focused training of students, it is necessary to divide *professional competences* (PC) into three groups:

- professional competences (identical to FSES competences within the definite education program) (PC);
- practical/instrumental competences, such as knowledge of equipment, mathematical tools, information technologies, research methods, and etc. (P/I C);
- integrated-professional competences that embrace all types of activity (IPC);
- specialization-related competence (SRC).

To ensure the quality of engineering graduate training and compliance with international requirements, the proposed competence model should be reviewed and approved by the potential employers. It needs to be weighed against the roles and responsibilities of engineering staff or professional standards.

The professional competence, as well as professional-integrated one, is developed within such courses as economics, material science, thermal engineering, and etc. The problem is that while developing education programs, faculty members from many different departments work independently despite the overall objective. Therefore, the only way to solve this problem is to develop education programs based on the graduate's competence model which integrates various competencies into a whole.

As an example, let us consider such practical/instrumental competence as ability to calculate and draw a conclusion (can be invariable) as a part of the graduate's competence model. Physical chemistry has traditionally given students broad training in thermodynamic and kinetic calculations, consequently, the learning outcome within this course can be defined as follows: ability to carry out physico-chemical calculations and draw a conclusion on reaction pathways. It is obvious that this competency is not the only one that is related to the ability to calculate and draw a conclusion. Therefore, it can be stated that the learning outcome of this course is related not only to the specific competency, but also to more general ability, i.e. ability to calculate and draw a conclusion.

In that regard, we believe that it is of particular importance to supplement education programs with the section "acquired skills and abilities (specific competencies) required for developing competences and personal attributes". Thus, the course "Designing, Running and Analyzing Experiments" includes the mentioned section in the following way [9, p. 11-14].

Abilities:

1.15 – to process experimental and statistical findings and to present them in the form of variation series and diagrams (L 1.1, L 1.2, PC 1) P/IC3.

2.15 – to evaluate reliability and importance of experimental data (L 2.1, L 2.2, PC 4) P/IC5.

3.15 – to evaluate experimental results

Table 1. Development of cultural competences (CC) while studying "Legal Science" course (education program "Thermal Engineering")

№ п/п	Learning outcomes (competences)	Corresponding cultural competences (CC) according to BEP
1	Ability to identify and analyze legal issues in scientific and professional contexts	Ability to analyze, identify, understand information and undertake problem identification, formulation, and solution(CC-1) Ability to acquire knowledge independently based on contemporary educational and information technologies (CC-4)
2	Ability to evaluate actions and behavior of people regarding legal environment	Ability to analyze, identify, understand information and undertake problem identification, formulation, and solution (CC-1) Demonstrate an understanding of ethical and legal norms in interpersonal communication (CC -9)
3	Ability to express logically one's own opinion on legal aspects of one's own profession in terms that customers, management and colleagues can understand and further cooperation	Ability to present and report the results of the work performed (CC -13) Demonstrate knowledge of business correspondence standards (CC -14) Demonstrate an understanding of ethical and legal norms in interpersonal communication (CC-9)
4	Ability to prove and define one's own opinion on the discussed legal problems	Ability to recognize the need for, and have the ability to engage in independent and life-long using the basic methods and technologies of social, humanitarian, and economic sciences (CC -5)
5	Ability to administer and execute legal regulations in decision-making within professional domain	Ability to apply basic methods and technologies of social, humanitarian, and economic sciences in solving social and professional tasks (CC-4) Demonstrate an understanding of ethical and legal norms in interpersonal communication (CC-9)

by functional relationships (modeling) (L 4.3, PC 5) PC8.

4.15 – to design experiments for building regression models of factor impact on quality indicators (L 5.1, L 5.2, L 6.1, PC 7-10), P/IC2.

The numbers and abbreviations in this example should be deciphered in the following way: numbers 1.15, 2.15 indicate the numerical order of the competency and "Designing, Running and Analyzing Experiments" course in the education program (15). L 1.1, L 2.1; PC 1, PC 4…, are assigned to lectures (L) and practice classes (PC) aimed at developing corresponding competencies (for lecture, the first number indicates the numerical order of the section, the second one is for the topic discussed; the practice classes are defined by class number). The abbreviations P/IC2, P/IC3, P/IC5, PC8 stand for the competences incorporated into the graduate's competence model. They constitute part of the following competences: P/IC – practical/instrumental competence, PC – professional competence.

Tab. 1 presents the learning outcomes (competencies) of "Legal Science" course. It is worth noting that each of the described competencies serves as an important element in shaping cultural competences (CC) enumerated in the basic education program (BEP) [5].

Education is a long process that successively provides learners with certain competences. However, it is not a simple summing of skills and abilities. It is development of such personal attributes and features that shape a student as a personality and expert.

Having developed the curricula of the courses that constitute BEP, it is essential to conduct assessment of its compliance with the final learning outcomes. In order to do this, it is required to build a "tree" that would represent a competence (Fig.2) or to draw up a table (map) of a competence (Tab. 2) [10, p. 77-81].

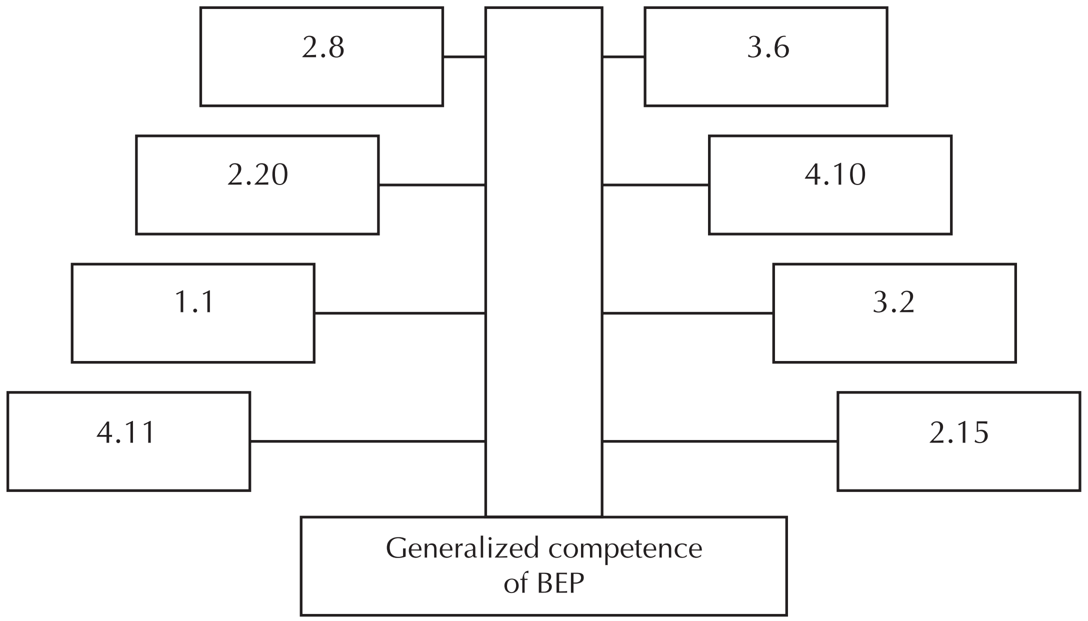
Each "branch" presented in Fig.2 indicates the competencies within different courses. These competencies, in one way or another, are related to the generalized competence. It is clear that the higher the number of "branches" in the "tree" or competencies in the map, the higher probability to shape the corresponding competence. The issue that arises then is what will happen if there are few competencies? There are two possible answers: this competence might seem to be unimportant or certain mistakes have been made during course curriculum development.

This kind of analysis allows educators to determine how fully graduate's competences will be developed. If necessary, it is possible to revise the content of definite education program courses or even introduce new ones.

Table 2. Map of graduate's competence development (education program "Metallurgy")

Competence	Course competencies (course code, competency code)	Courses (curriculum code)
Ability to manage technical process of continuous casting	14.3 ability to calculate heat exchange index during metal hardening	14. Thermal engineering
	18.5 ability to control steel quality	18. Steel Metallurgy
	10.4 ability to define structural components of steel microstructure	10. Material Science

Fig. 2. The scheme for plotting competence "tree" (numbers indicate the numerical order of the course and competency)



To develop such competence maps, we are planning to apply Bloom's taxonomy [11, p. 11-15] who distinguished six education objectives: knowledge, understanding, application, analysis, synthesis, and evaluation.

In order to determine learning outcomes in compliance with the mentioned education objectives, we have introduced the following verbs: knowledge – to present, tell, formulate, etc.; understanding – to classify, identify, etc.; application – to demonstrate, solve, etc.; analysis – to calculate, evaluate, etc.; synthesis – to compare, plan, etc.; evaluation – to discuss, judge, etc.

To align learning outcomes with future profession requirements, it is essential to draw up a "passport" or short description of each key competence. Tab. 3 gives an example of such a "passport", precisely, the description of the generalized competence "to manage technical process" which is most obvious in graduates' future professional activity. The comparison of the definite competencies with the competence features allows educators to define the focus of each course curriculum, including course projects, practical assignments, and student coursework.

For successful development of innovation and knowledge-driven economy, the specialists who possess such a key competence as "commitment to quality" are of great demand.

In our opinion, to ensure contemporary engineering training, it is necessary to resolve at least two tasks:

- each education program should include continuous quality training;
- the elements of quality management system (QMS) should be incorporated into teaching process, QMS principles and benefits being clearly demonstrated. It is desirable to involve students into the events and work related to QMS (inconsistency correction, preventive actions,

Table 3. Competence "passport"

Competence	Competence features	Teaching process elements	Ways to develop
Ability to manage technical process	1. Understanding of technical process principles 2. Ability to identify inconsistencies 3. Understanding of control action 4. Ability to correct the process 5. Estimation of system respond to external actions 6.Understanding of implications of taken decisions 7. Ability to train staff	1. Courses (list) 2. Practice training/Internship 3. Student coursework	Lectures Practice classes Labs Internship Workshops Engineering games Intellectual games

students and faculty satisfaction survey).

To resolve the first task, it is necessary to revise the learning outcomes of each course, more precisely, it is required to reveal whether they are aligned with the quality requirements. If necessary, the course content should be improved, as well. In addition, academic faculty, especially faculty members of graduating departments, have to study professional standards and requirements of their students' qualification, since the universities prepare students for future job responsibilities by means of well-organized practice classes and internship.

Under modern conditions, to ensure professional success, university leaders and decision-making personnel should always observe the key principles of the quality management system. The main goal of university training is to make students understand that these principles are vital in any professional activity. This can be achieved by introducing these principles into education process itself.

It would be a serious mistake to train bachelor's students within the definite specialization. In most cases, they have no any work experience and have no idea about their future occupation. Therefore, it is better for them to gain a broad understanding of industrial processes than to specialize in one specific subject. This would be to the benefit of a graduate development.

Quite a different approach should be applied to master's program development. In this case, all FSES aspects must be considered: field, object and activities. In our opinion, in master's programs two activities should be regarded as key ones: research and engineering projects. It is worth noting that managerial and organizational performance will be carried out in both projects. The following stages for developing master's program are proposed:

Stage 1. The analysis of the definite bachelor's student competence model.

The master's program should be designed based on the definite bachelor's program competences which can be further developed.

Thus, the master's program will be supplemented with the bachelor's program competences labelled BM.

Stage 2. Development of master's student competence model for a definite education program.

Stage 3. Based on the FSES requirements and competence model, the list of program courses, practice classes, and internships is made up.

Stage 4. The curricula of program courses, practical training, and internships are developed using competence-based approach.

Stage 5. The map of course-related competencies is designed for each competence.

Stage 6. The structure of professional activity (according to FSES).

1. Determination of master's student professional domain.
2. Selection of professional activity object.
3. Determination of the type of professional activity.
4. Professional activity objectives.

Stage 7. Development of master's program content design algorithm. Fig. 3 illustrates the algorithm for master's program "Material Science" design.

Stage 8. Determination of master's student learning trajectory.

The trajectory is defined on the basis of general training model. Let us consider the following example (refer to Fig. 3):

Professional domain – 1.1 – material analysis and new material development.

Activity objects – 2.1 – metal inorganic materials and 2.6 – ultra-hard materials.

Activity type – 3.1 – research-and-development 3.3 – managerial.

The master's program should be designed based on the above-described competence mode.

The proposed algorithm allows educators and master's students to choose any learning trajectory, to develop a specific graduate's competence model and corresponding education program.

It is desirable to provide engineering training on the basis of the system of active specialization acquisition (SASA) which was developed by V.A. Roments in 1990s at National University of Science and Technology «MISiS».

The main principles of SASA are as follows:

1. Focused training: students should gain career-related knowledge and experience, including not only specific subjects, but also the courses which equip them with scientific, engineering and humanitarian fundamentals. Methodologically, the SASA is based on the model of professional environment that imitates future professional practice.

The model of professional environment is termed as a system description of the workplace conditions a graduate is expected to work in. It is designed to give learners opportunities to transfer gained fundamentals and recall the skills and knowledge in the imitated workplace, including difficult tasks and business educational games. The trainers can model any component of graduates' future profession: technological process, manufacturing site, lab, workshop, factory, and industry.

It is not a coincidence that at the Council for Education and Science held in June, 2014, the President of the Russian Federation V.V. Putin said: *"There is need to modernize the engineering education process itself by focusing on practice training, of course without prejudice to the theory"*.

2. Anticipatory training and education: the profession-related subjects should be introduced into the program starting from the first year of education in order to:

- tarting from the first year of education in order to:
- fully familiarize students with the fundamentals of their future profession;
- awake students' interest in their future profession;

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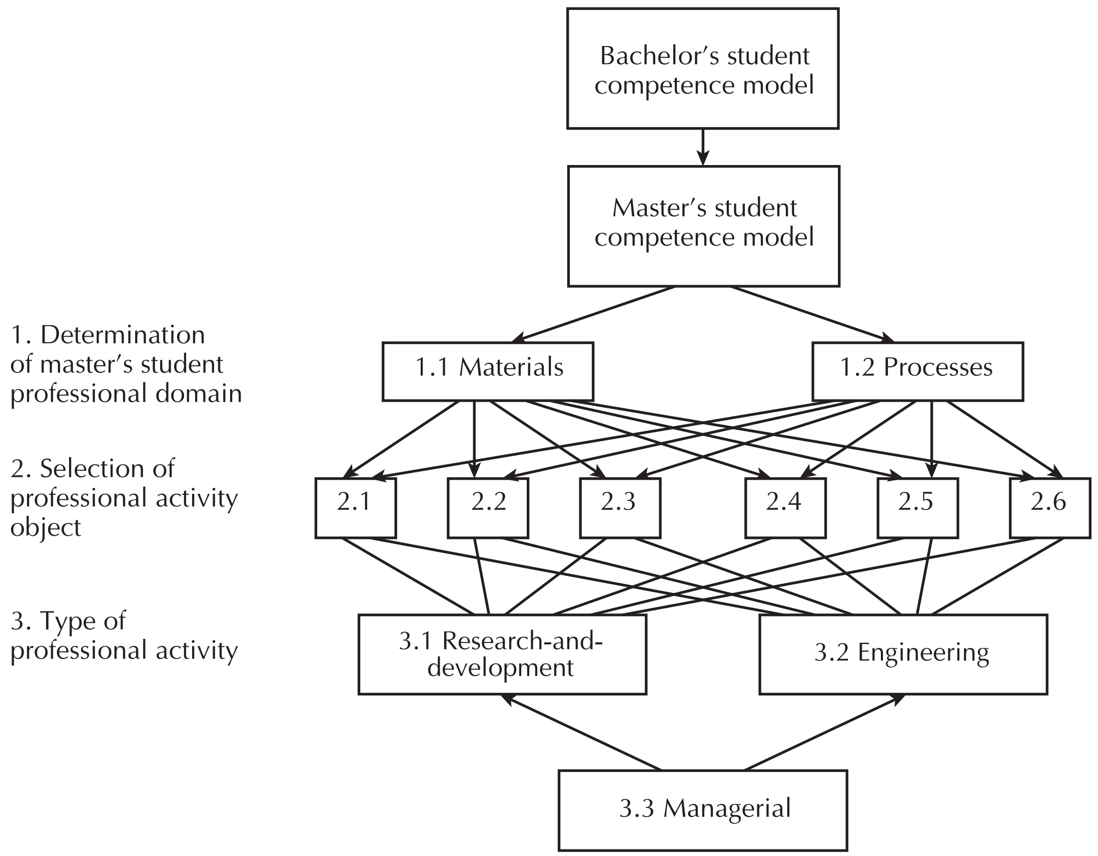
Fig. 3. Master's program design algorithm



- show not only positive sides of the chosen profession, but also its challenges which require from graduates responsibility, deep knowledge in mathematics, physics, chemistry, mechanics, and other subjects. Therefore, students must study these subjects having a clear vision of their profession requirements. This would guarantee their good understanding of the key principles of the profession they have chosen. In this case, such subjects as physics, mathematics, etc. are no longer considered alien within the education program. The gap between completion of the enumerated subjects and transfer of the gained fundamentals into workplace environment is also reduced.

3. Independence and commitment of a student to acquire profession-related knowledge: students, more specifically, their professional needs, become a prime mover of the educational wheel. Lecture, seminars, labs, business games, automated systems are just support tools for an independent and highly-motivated student. There are ongoing changes in the content of student independent work: it does not only provide students with subject-related assignments, but is also intended for an active and motivated student who is striving to resolve all possible tasks derived from the learning outcomes that are stated in the education program and competence model. In addition, there is dramatic drop in students' dependency on external control, i.e. on various tests and exams. Every effort is made to carry out constructive work – to train a good specialist. The role of a teacher is currently undergoing conceptual change: the fundamental job of teaching is no longer to distribute facts and data, but to organize education process effectively. The goal of education is as follows: the focus is not on knowledge (it is an intermediate goal), but on professional skills and abilities **(through knowledge to competences).**

4. Individualized learning:

- the content of curriculum is defined according to students' needs and interests;
- instructional technology, pace of learning are based upon the abilities of each learner. Consideration of individual needs and abilities should also include compliance of personal features with the type of profession chosen.

Besides, supportive and you-can-do-it attitude of an educator is one of the most important motivating factors. One of the main tasks of a teacher is **encouragement and support.**

The system of active specialization acquisition (SASA) implies revision of course content and objectives. In addition, the course itself is regarded as an integrated system. The goal of a definite course is to provide a student with an integrated system of knowledge and teach him/her how to use this knowledge in profession-related task solving [10, p. 94-98].

The SASA is based on modern teaching technologies:

- design-based learning;
- problem-based learning;
- context-based learning;
- module-based learning.

The basic task of the faculty is to create favorable environment and equip students with the required competences. It is also important to align the applied teaching technologies with this task. The above-enumerated teaching technologies are not something new for a Russian teacher; they were widely applied not only at National University of Science and Technology «MISiS», but also at a great number of Russian universities. However, little attention is currently paid to the choice of this or that teaching technology. It is said that it is primary responsibility of a teacher to choose the method to instruct students. Despite this fact, we believe that there is an urgent need to explain modern teachers how to use well-known teaching technologies effectively. For this purpose, it is required to hold methodology seminars in various departments on regular schedule. Attendance at such seminars and workshops should be regarded as faculty professional development.

The discussed approaches to developing engineering graduate's competence model are primarily based on the experience of leading Russian universities.

Apart from strict requirements to profession-related knowledge, abilities and skills, employers place a special emphasis on student's commitment to self-education, his/her ability to work and solve problems independently, assume responsibility, and respond to crisis.

Within a two-tier education system, bachelor's degree programs create a foundation for further student independent work with the use of modern information technologies. Student independent work should be interwoven throughout the whole education program. No knowledge could be effective if it is not reinforced by independent work.

In addition, student independent work is of significant educational importance: it plays a vital role in shaping a number of crucial personal features of future specialists, i.e. persistence and determination. As stated by our distinguished scientist D.I. Mendeleev "There is no talent, neither genius without hard work".

In recent years, due to intensive development of information technologies the leaders of USA universities have been increasingly recognized that "face-to-face" education costs 30 thousand dollars, while the price for distance learning is 2 thousand dollars. This fact emphasizes the role of a teacher in shaping future graduate's personality. It is no coincidence that leading universities are hunting for the teachers who are popular among young people.

The positive effect of a teacher is rather essential as it helps to shape professional consciousness of a specialist who is now of great demand.

The foregoing leads us to the conclusion that it is essential to:

- make the borderline between such two terms as competency and competence;
- distinguish in engineering programs practical/instrumental competence;
- introduce "commitment to quality" as an obligatory competence;
- apply the elements of the active specialization acquisition system (SASA) in education process.

The study presents the examples of competence models development for bachelor's and master's programs. It also proposes the methods to plot the competence "tree" and compile the competence "passport".

The current study has revealed the need to revise the education process in order to ensure high quality of engineering training and effective development of graduates' competences.

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UDC 378

Measures Contributing to Publishing Activity of Faculty Members

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Today, publishing activity is one of the priority indicators in department faculty activity. In all international ratings the significant share of the integral indicator (from 30 to 50 %) ranking universities in their positions accounts for the evaluation of research activity performance. It is worth noting that most of department members of Russian universities face a number of challenges in developing their publication career due to insufficient level of foreign language and information technologies knowledge. The article presents the actions that should be taken in order to stimulate publishing activity of faculty members and increase their citation index.

Key words: publishing career, publishing activity, article, citation index, h-index, stimulation of publishing activity.

THE BACKGROUND

At present academic teaching staff (ATS) is the most valuable assert of any university as the efficiency of academic performance depends directly on its qualification, quality, and proficiency which is closely connected with university competitiveness [1, 10].

As is known, one of the key indicators of university performance is its teaching staff's publishing activity. Publishing activity is a result of an author's or a team's research activity or some corporate author's research activity realized in the form of research publication, for example, a research paper, article in a multi-author collection, report in scientific conference proceedings, an author's or multi-author book, research report [6]. In some cases, publication is a mandatory requirement, for instance, when applying for research grants or research fellowship, rewarding academic degrees and titles, certifications, as well as election of winners in various contests for proficiency [11].

In addition, in some educational and research institutions a number of positions require some publications as a crucial indicator of staff's rating score or performance evaluation. In present condition, the presence of submitted articles is not enough – career of any teacher or researcher depends also on their ability to publish their research results in the leading peer-reviewed journals included in the international Web of Science and Scopus databases [9, 11].

Not only teaching staff is interested in regular publications, but also institution authorities, since the number of publications is a key indicator in an institution accreditation for research activity, its rating evaluation among other educational institutions, tender application for research projects, and in some other cases [8].

It should be noted that, in spite of significance of the given indicator in a university teachers' performance, there is a lack of articles in the leading domestic journals dealing with the problem of teachers' publishing career development. The given aspect is consistently considered in the articles by P.G. Arefiev [5, 6].

QUALITY OF RESEARCH ARTICLES

One of the main laws of research activity formulated by Robert Merton and