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A Practical Example of Professional Standards Integration Into the Educational Process of a National Research University

National Research University of Electronic Technology "MIET"
E.V. Omelyanchuk, O.P. Simonova, A.Yu. Semenova

E.V. Omelyanchuk

O.P. Simonova

A.Yu. Semenova

The article focuses on the issue of aligning HEI study programmes with the present-day circumstances. A problem of major discrepancy between the higher education standards and the requirements of professional community has been indicated. The article justifies as the problem solution the implementation of additional competences which should guide graduates to carry out work functions introduced by professional standards.

Key words: competences, educational standards, professional standards, learning outcomes.

A shift of priorities in the development of hi-tech and strategically important sectors of Russian economy requires updating of study programmes, majors and specialties in accordance with the approved professional standards. At the same time, representatives of the professional community remark the discrepancy between learning outcomes after graduation and employers' requirements. It is said that over 65% of employers prefer to provide extra training or retrain their workers on the basis of their own educational departments [1, p. 14], which indicates the gap between the contents of educational standards of higher education and the requirements towards learning outcomes demanded by the real economy that are stated in the professional standards. This problem is topical for training engineering workforce.

In order to assure study programmes competitiveness it should indicate such learning outcomes that clearly state knowledge, skills and attitudes demanded by the economic sector of graduate's future employment.

One of the traditional approaches to narrow the gap between HEIs' and employers' view on a future graduate is to introduce industry-based departments. However, this approach only allows partly meeting the demand in specialists even within one enterprise.

As a different solution the Ministry of Education and Science of the Russian Federation proposes to introduce Professional Standards (PS). At the same time aligning the Federal State Educational Standards (FSES) and the Professional Standards leads to new difficulties, first of all, in the organizational process of developing study programmes and designing curricula.

According to the paragraph 11, part 7 of the Federal Law on Education in Russian Federation No. 273-FZ of 29 December 2012 new state educational standards should be formed based on the existing professional standards; thus, the developers of study programmes face the need to take into account the requirements of the PS. However, at the moment, only guidance materials for the designers of educational standards have been developed [2]. With an aim to provide efficient teaching and guiding activities the current study programmes have to be updated in line with the trend of introducing PS into FSES.

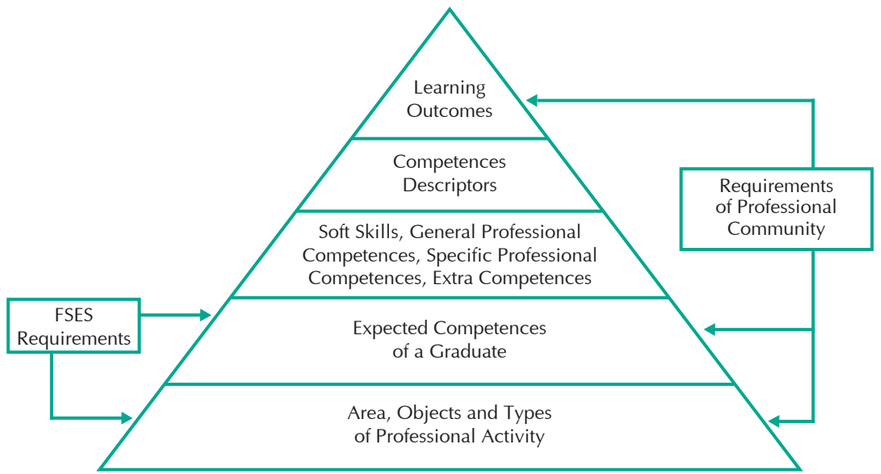
Based on the practice of designing study programmes in National Research University of Electronic Technology the article discloses the opportunity to integrate professional standards into the educational process in cases, when the description of requirements towards learning outcomes stated in FSES does not fully correspond to the requirements set by the professional community. A practical example of this approach is presented further. It has been executed in a study programme on "Informational and communicational technologies and communication systems" of National Research University of Electronic Technology in line with a Plan for Development and Approval of Study Programmes for Higher Education [3].

Development of a study programme begins with designing graduate's competence model, which appears as a comprehensive integral image of the final result of education and is based on the idea of a "competence" [4, p. 8]. Realization of a competence model is aimed at achievement of the expected learning outcomes, which have to correspond to the requirements set for a graduate by professional communities. Authors propose a structure of graduate's competence model that illustrates interaction between professional and educational standards within the study process (fig. 1).

As can be seen from the scheme on fig. 1, study process is focused on learning outcomes, which form knowledge and skills needed for professional activity. The descriptions of Soft Skills, General Professional Competences, and Specific Professional Competences are strictly declared by FSES; however, in order to increase the efficiency of study process authors see the need to provide descriptions of certain sub-competences of the Specific Professional Competences, as well as to introduce Extra Competences using the descriptors of industry's professional standards.

Level of learning outcomes' achievement (i.e. level of competences formation) should correspond to the approved descriptors of competences determined by the Professional Standards. A list of competences of study programmes future graduate, as well as the area, objects and types of graduate's professional activity are determined, on

FIg 1. Approximate structure of graduate's competence model introduced to the study programme on "Informational and communicational technologies and communication systems" of National Research University of Electronic Technology



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the one side, by FSES requirements, and on the other side – by the requirements of professional community formulated as work functions and work actions of the corresponding Professional Standards.

As a rule, concordance of FSES and PS terminology is respected as shown in the table 1.

The authors propose an algorithm for integration of professional standards to the educational process for specialty "Informational and communicational technologies and communication systems" of National Research University of Electronic Technology. It should be noted that the proposed approach can be mostly used when executing applied study programmes for training engineers. Though higher education supposes fundamental training and scientific character of the knowledge gained, strict abidance to the requirements of professional standards may lead to the loss of scalability and flexibility in the choice of professional area of a graduate [6, p. 31].

It is proposed to comply with the following order of actions:

1. Types of professional activities for students' acquisition are chosen from corresponding educational standards based on the analysis of labor market demand, scientific and research resources and material and technical facilities of a department.

2. In line with the chosen type (types) of professional activity, professional tasks that graduates should be able to perform are determined.

3. Further, learning outcomes of a study programme are formulated in terms of soft skills, general professional competences and specific professional competences corresponding to the type (types) of professional activity of the SP's focus.

4. If needed, the competences are split into sets of the so-called sub-competences, which present a competence in a form of more particular learning outcomes formulated through sub-competences' descriptors that correspond to the professional standards' descriptions.

5. If the descriptions of learning outcomes corresponding to the chosen type of professional activity do not fully meet the requirements of professional standards, educational institution can supplement the list of learning outcomes by introducing extra competences.

It seems viable, first of all, to formulate more broadly the learning outcomes in the terms of extra competences through work functions determined by a corresponding professional standard, and further to specify them as a set of sub-competences based on the requirements towards work actions.

6. Links between the fostered competences and disciplines or modules are established.

7. In line with the curriculum, work programs of each discipline are developed, as well as means for competences' evaluation.

Table 1. Concordance of the Russian Federation Federal State Educational Standards and Professional Standards terminology [5, p. 3232]

Terminology of PS	Terminology of FSES
Generalized work function	Type of activity
Work function	Professional competence
Work action	Practical expertise
Skill	Skill
Knowledge	Knowledge

8. The means for evaluation of specific professional and extra competences should undergo expert assessment with participation of representatives from the professional community.

9. In case of positive expert assessment of means for competences' evaluation they can be introduced to the study process.

It should be noted that specific professional competences are described very broadly by FSES. At this, when fostering these competences it is possible to split a particular competence in line with a set of professional tasks that should be carried out by a future graduate. Thus, splitting competences to sub-competences allows specifying a particular competence and creates an opportunity to execute individual learning paths while fostering one or another element of students' competences.

It seems viable to formulate sub-competences and extra competences while focusing on the corresponding work functions from Professional Standards [7, 8] in the field of professional activity that complies with the study major.

The distinction in the approaches to development of PS and FSES lead to the fact that it is not always possible to comply sub-competences and work functions directly. Tables 2 and 3 present the examples of complying work functions and sub-competences/extra competences formed within disciplines of the "Informational and communicational technologies and communication systems" programme.

Feedback from representatives of the professional community on the first stage of the algorithm's introduction is collected during students' industrial internships by gathering and analyzing employers' reviews on students' performance during internships and the results of employers' survey, which reflects level of employers' satisfaction with students' level of professional training.

While the educational standards of the next generation are still in the process of development, higher educational institutions, in particular National Research Universities have the authority [9] to start an active process of integrating professional standards requirements to the educational process. This is essential, first of all, in order for today students of higher professional educational programmes to be demanded on the labor market not only in the near future, but also on a remote prospect.

Table 2. Example of complying work functions with sub-competences

FSES competence	Sub-competence (Discipline)	Work function (Code)
Ability to design project and technical documentation, to draw up final design-and-engineering projects in line with norms and standards (specific professional competence No. 10)	Ability to create technical decisions on a communication object or system (telecommunication system) and its components (Architecture and software for network infocommunicational devices)	Pre-project build-up and development of a systemic project for communication object (system), telecommunication system (A/01.6)
	Ability to design technical documentation using systems of automated design for drawing up documents in accordance with the requirements of Engineering and Computer Graphics	Design of a technical and work project for communication object (system), telecommunication system (A/02.6)

Table 3. Example of complying work functions of PS with extra competences

Work function	Extra competence	Discipline (elective)
Mathematical and computer simulation of radioelectronic devices and systems with an aim to optimize (enhance) their parameters	Ability to design mathematical models of infocommunicational devices and systems and their realization with regard to available elements	Software radio
		Methods of simulation and optimization in infocommunicational systems
	Readiness to use programme software and ability to apply it for creation of new telecommunication systems and nodes	Systems on a chip for telecommunication
		MATLAB mathematical simulation

REFERENCES

1. Strategiya razvitiya systemy podgotovki rabochikh kadrov i formirovaniya prikladnykh kvalifikatsii v Rossiiskoi Federatsii na period do 2020 goda (Strategy for development of workforce training system and formation of applied qualifications in Russian Federation until 2020) [Electronic resource]. – Moscow, 2013. – 58 p. – URL: http://xn--80abucjiibhv9a.xn--p1ai/media/events/files/41d4701a6bfda8ac356e.pdf, free. – Tit. from the screen (usage date: 12.12.2016).
2. Metodologicheskie rekomendatsii po aktualizatsii deistvuyushchikh federalnyikh gosudarstvennykh obrazovatelnykh standartov vysshego obrazovaniya s uchetom prinimaemykh professionalnykh standartov (Methodological recommendations on actualization of the current federal state educational standards of higher education in line with the incoming professional standards) [Electronic resource]. Approved by the Ministry of Education and Science of the Russian Federation of 22 January 2015 No. DL-2\05vn. – Available from reference legal system "KonsultantPlyus".
3. Poryadok razrabotki i utvergdeniya obrazovatelnoi programmy vysshego obrazovaniya (bakalavriat i magistratura) (Order of Design and Approval of Educational Programmes of Higher Education (Bachelor and Master Degrees) [Electronic resource]. Approved at National Research University of Electronic Technology Academic Board meeting on 15 June 2016 / Ministry of Education and Science of the Russian Federation; National Research University of Electronic Technology. – Moscow, 2016. – 40 p. – URL: https://www.miet.ru/upload/content/Uchebny_process/Poryadok_razrabotki_i_utverjdeniya_OP_VO_(bakalavriat_i_magistratura).pdf, free. – Tit. from the screen (usage date: 12.12.2016).
4. Azarova R.N. Razrabotka pasporta kompetentsii: metodologicheskie rekomendatsii dlya organizatsii proektnykh rabot I professorsko-prepodavatelskogo kollektiva vuzov (Development of Competences Passport: Methodological Recommendations for Organization of Project Work and Faculty of Universities) / R.N. Azarova, N.M. Zolotareva. – Moscow: Research center of problems on quality of specialists training, Coordination Board of Teaching and Methodological Associations and Scientific and Methodological Boards of Higher Schools, 2010. – 52 p.
5. Tarasova T.N. Teoreticheskie aspekty integratsii FGOS i professionalnykh standartov (Theoretical Aspects of FSES and Professional Standards Integration) [Electronic resource] // University complex as regional a center of educational, science and culture: Proceeedings of All-Russian Scientific and Methodological Conference, Orenburg, 3-5 February 206 – Orenburg: Izdatelstvo OGU, 2016. – pp. 3227-3233.
6. Senashenko V.S. O sootnoshenii professionalnykh standartov i FGOS vysshego obrazovaniya (On the Correlation between Professional Standards and Federal Educational Standards of Higher Education) // Vysshee obrazovanie v Rossii [Higher Education in Russia]. 2015. – No. 6. – pp. 31-35.
7. Ob utvergdenii professionalnogo standarta "Ingener-proektirovshchik v oblasti svyazi (telekommunikatsii)" (On Approval of Professional Standard "Design Engineer in the Field of Communications (Telecommunications)") [Electronic resource]: Order of the Ministry of Labour and Social Protection of the Russian Federation No. 316n of 19 May 2014 // GARANT.ru : informational and legal portal. – Moscow: Garant-Service, 2016. – URL: http://base.garant.ru/70697874/#ixzz4LkakqaK1, free. – Tit. from the screen (usage date: 12.12.2016).
8. Ob utvergdenii professionalnogo standarta "Ingener-radioelektronshchik" (On Approval of Professional Standard "Radioelectronics Engineer") [Electronic resource]: Order of the Ministry of Labour and Social Protection of the Russian Federation No. 315n of 19 May 2014. – Available from reference legal system "KonsultantPlyus".
9. Razyasneniya razrabotchikam osnovnykh obrazovatelnykh programme, realizuyushchim federalnye gosudarstvennye obrazovatelnye standarty (Clarification for the Developers of Main Educational Programmes that Execute Federal State Educational Standards) [Electronic resource]: updated on 09 January 2014 // Altai State University: website. – Barnaul, 1999-2016. – URL: http://www.asu.ru/education/struc_edu01/questions/development, free. – Tit. from the screen (usage date: 12.12.2016).