Sherlock Holmes and Third – Generation Education Standards

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Training modern competent engineers with relatively in-depth "economic" and "cultural" competence, which is based on the third-generation State Education Standard (SES) without changing the structure and content of existing programs is rather problematic. The solution of this problem is to design such a competence model to further unit-module curriculum for task-oriented competence development.

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What is it all about? The matter in question is not an investigation of some intricate crime within the walls of the Ministry of Education, and, moreover, it is not about the deductive method which could be applied in designing the State Education Standards for engineering training, the so-called "third-generation" Standard. As far as is concerned, it is professionalism, which was a distinct characteristic feature of Sherlock Holmes, together with his determination and in-depth knowledge in one single area. And this is undeniable what an engineer-graduate should obtain through this or that engineer training programs.

Here is a citation from one famous A. Conan Doyle novel which is controversial even today:"..... But I am not everyone! Watson, do not misunderstand me: the human brain is like an empty attic- attics are catch-alls. A fool stows this attic full of everything and the kitchen sink. And then comes the time when the must-have cannot be rammed into this attic. Or it is tucked away and you cannot get it. I do it in another way. In my attic there are only necessary things for me. They are many, but in perfect order and at my fingertips.

Needless bits and pieces I don't need.

– *Is Copernican theory rubbish, says you ?!*

– *All right. The Earth rotates around the Sun.*

– *It is...what is it....WHAT should we suppose???*

– *The Earth rotates around the Sun. But for me, it is useless in my affairs!.."*

Now, let's turn to more serious items, i.e. modern engineering education. Besides the fact that the Earth rotates around the Sun, there is an abundance of information, which according to existing conceptions (for example, SES requirements) a person should assimilate, elaborate and accumulate to have the reputation of being not only an "educated" man but also a high-qualified professional. One cannot reject the authenticity of a fact that a person should be an "erudite". Hence we infer that a professional in the engineering sphere should develop "humanitarian and economic" competence to successfully communicate (without an "interpreter") within that "cultural" area and understand those requirements and demands when designing this or that engineering project. However, the human brain capability and capacity (only

in that well-studied hemisphere) is fairly limited for the assimilation, retention and application of all the necessary information for a specific activity, i.e. that "attic" in which all imaginable and unimaginable "stuff" (information) is rapidly and randomly stowed. Additional information content expansion and its simultaneously high assimilation result in the degeneration of these intensive knowledge acquirements and application level in a professional sphere, involving further professional "non-competence".

What are the basic requirements in the third-generation SES of higher professional engineering education and what is the principal difference from the first- and- second –generation State Education Standards? Based on the analysis of above-mentioned documents, it can be underlined that there is no principal difference between them. However, one must mention the following facts- technically, the higher professional education system was changed (introduction of 2-level system of education) and, revolutionarily, there was an expansion of accessible information content (computerization and Internet), but, at the same time, the information acquisition time period remained unaffected. The structure and content of third-generation SES, concerning the Bachelor training degree, principally, did not change in any item, except in the following fact- the term "class hours" was changed to "hour-credit", while "learning skills" to "competence". Structure requirements to the basic education programs remain the same, i.e. it includes not only, all the following subject-cycles: humanitarian and socio-economic, mathematic-natural science, scientific and professional [1, pg. 9-16], but also compulsory and optional subjects for each discipline cycle. In other words, the situation is as follows: the economic society parameters have sharply changed; the volume of different processing information has drastically increased; and the requirements to the education end-process have also changed, while the higher professional education model for future graduates is still the same within the previous framework.

It's important to underline the fact that within the framework of the SES, any education institution has the right to design its own basic Bachelor or Master Degree training program. Thus, the institution community has the possibility for creativity. However, unfortunately, a significant number in this community are rather conservative to any innovation in the education sphere, especially if this or that innovation is not documented by the federal or regional administration, for example, SES. In this case, most Bachelor or Master Degree programs are either previously ready-to-use ones (for example, the Education Program from Education and Methodics Association [EMA]) or designed (by the universities) with minimum possible alterations within earlier existing education programs. Both variants of designing education programs principally make it impossible to change the education process itself, as they do not include those characteristics relevant to contemporary development demands in science, technology, engineering and society, necessary for future graduates. This relative "impossibility" is based on the fact that the new education content is "squeezed into" the previously old existing forms and methods so as to enforce it.

Although it may not be a revolutionary one, the way-out plan in this case could be some definite changes in the education process and within the structure of the Higher Professional Education program itself. What processes and forms are to be improved in the engineering education?

Firstly, it is the design of a competence graduate model for each education program with its further updating. As there are already adopted existing Standards, the so-called designed graduate model should, in one way or another, formally consider these requirements without contradicting them. For example, in the SES section "Requirements to the assessment of basic Bachelor degree education program "an

unspecified competence list is defined in accordance to some characteristic feature, i. e. "cultural or personal-social" competence, "engineering or technology", "professional" and so on. One can use the above-mentioned terminology in the project graduate model, however, the informative content of these competences should be tailored in compliance with the potential employer demands, global or European criteria, and at the same time, envisage the future development of this or that engineering sphere and, respectively, include perspective professional competences. Competent graduate model should be designed in such a way that within each group of competence there are two-three dominants, which in its turn, are developed through different disciplines (modules, courses, programs). The designed competent education graduate model should involve an assessment mechanism to control the compliance of this model to the obtained results and an updating mechanism as well.

Secondly, the main item is to change the graduate curriculum structure. Existing Bachelor and Master Degree curricula are simply a revision of an engineer curriculum, i.e. a cut-down version. A curriculum should be designed on the basis of a developed competent graduate model, but, at the same time, excluding the requirements stated in the SES – because a variety of disciplines for each particular cycle are not integrated by one definite target which would further develop this or that specific competence. (Table 1).

This discipline cycle is compiled in an optional sequence from natural sciences to professional courses throughout the curriculum itself; and such factors as the teaching succession of these disciplines, their content and scope are frequently employed unreasonably or may even involve a subjective interpretation, for example, using such words as "always" or "it's convenient" to avoid further misunderstanding. To design a curriculum promoting the development of this or that competence, it is necessary to provide a task-oriented classification and time distribution in teaching the different subjects, courses, modules and practical training (session). Instead of a discipline cycle integrated into "humanitarian", "engineering", "professional" categories, academic modules should be designed, each of which would stimulate the development of specific competencies or competence groups, initiated into the graduate model. No matter whether these individual academic modules could include all disciplines or only a part of them (humanitarian and socio-economic, natural sciences, general professional disciplines, and professional disciplines), all of them are oriented in developing an assigned competence, i.e. each academic module "is responsible" for the development of this or that competence. Furthermore, it would be advisable if a supervisor could head one of these modules and be responsible for it, which in its turn, would be more effective (Table 2).

The successive implementation of such academic modules could be based

Table 1. Extract from a section of «Basic Professional Training Structure» SES for Bachelor Degree in discipline 190600 "Operation of industrial-transport vehicles and systems"

B.3	**Professional cycle** **Compulsory** **(basic professional)** After studying this cycle, a student should know: definition of a dot, line, plane and polyhedron on a plot; metric and positional equations; curves; surface of rotation.	105-115 55-60	Descriptive geometry and engineering graphics Theory of strength of materials Theory of Machines and Mechanisms Principles of machinery elements	OC-1 OC-3 OC-4 OC-5 OC-6 OC-8 OC-9 OC-10 OC-15 RC-1 RC-2 RC-3

Table 2. One structure element (of an academic module) and its content from the new curriculum for a Bachelor Degree in one of the engineering disciplines

Competence	Learning module	Courses, practical training, trainings, modules, term papers, graduate papers and projects	Supervisor of the module
Target (socio-personal)	academic module №1.1 "Socio-communication and culture"	Personality psychology - modules №1, 2, 3 History of Russia – complete course History of World Culture - module №1 Foreign language - Module №1 «speaking» Philosophy - modules №1, 2 Russian language and culture- modules №1, 2 Department of public communications- trainings №1, 2, 3	V.V. Nurenberg, director of public communications department
Capability: be communicative in social interrelations, including speaking a foreign language and appropriate behavior in a definite social environment			
Capability: to understand and analyze world outlook, important social and personal philosophic problems; the dynamics and mechanism of the historical process			
Skills: intellectual culture, generalization, analysis and perception of information			

on the same competence model which underlines the following requirement for any graduate- from simple to complex. Besides this, each module, except the first one, should include essential pre-details from the previous module. According to the developed competence-based academic modules, it is not difficult to plot the learning trajectory of the students, comparing it to a LEGO, where these blocks can be replaced or inserted. At the same time, the coefficient output of such a module is easy to evaluate in credits, as the number of developed modules, total content of the education program and expert determined significance degree of each module to further the education process results are known.

However, such a curriculum structure requires that the executives of these education programs, professor-teaching staff and university administration apply every effort in order to change not only the content and volume of the academic courses, but also to develop a new education process schedule. Such problems could arise: absence of necessary personnel and the necessity to introduce additional courses. There is no doubt that the designing and application of such block-module programs has a positive effect, i.e. in the "attic" of a graduate there will be only necessary and adequate implements for the future professional activity and "cultural" communication, and this all will be in perfect order and at one's fingertips.

REFERENCES (ALL TITLES IN RUSSIAN)

1. Federal State Education Standard of Higher Professional Education in discipline 190600 "Operation of industrial-transport vehicles and systems" (electronic version): official document approved by Ministry of Education and Science, Russian Federation, dated December 8, 2009: № 706