Soft skills in training specialists in the sphere of standardization, metrology and quality management as a part of education for sustainable development

N M Galimullina1,5, O A Vagaeva2, D E Lomakin3, T E Melnik3 and A V Novakovskaya4

1 Department for Sociology, Political Sciences and Management, Federal State Budgetary Educational Institution of Higher Education “Kazan National Research Technical University named after A.N. Tupolev – KAI”, 10 Karl Marx Str., Kazan, Republic of Tatarstan, 420111, Russian Federation
2 Chair of Pedagogics and Psychology, Penza State Technological University, 1a / 11 pr.Baydukova / Gagarina Str., Penza, 440039, Russian Federation
3 Faculty of Algebra and Mathematical Methods in Economy, Orel State University named after I.S. Turgenev, 95 Komsomolskaya Str., Orel, 302028, Russian Federation
4 Department of Economic Theory and Resource Management, Federal State Budgetary Educational Institution of Higher Education “Kazan National Research Technical University named after A.N. Tupolev – KAI”, 10 Karl Marx Str., Kazan, Republic of Tatarstan, 420111, Russian Federation

5 E-mail: nadiyagalimullina@yandex.ru

Abstract. The research is devoted to the role of soft skills in training engineers in the sphere of metrology, standardization and quality management. Supra-professional competencies make a specialist more competitive in the labor market and later facilitates labor efficiency and sustainable development of the society as a whole, that is why the system of engineers’ education should include mastering time management, teamwork, and orient students towards developing their ability to handle stress and self-development. The article presents the results of a survey of students and practitioners in the sphere of metrology, standardization and quality management about the most important soft skills and the most popular ways to master them. To determine the features of forming soft skills in the Russian higher education system, we analyzed the federal state educational standards and researched curricula of 20 Russian universities training students in the said majors. The research allows concluding that supra-professional competencies are demanded by the students. We also found that the special disciplines forming soft skills are unevenly included into the curricula of universities, while there is a trend to increase the share of special courses training students for non-production activity as the education system is being reformed.

1. Introduction
The issue of the role of soft skills in training high-quality specialists in engineering has been considered by researchers during a rather long time [1-5].
It is still disputable whether the term can be specified and the phenomenon can be conceptualized [6]. In general, hard skills are technical competencies, a complex of competencies necessary for the job and skills determining the professionalism of each specialist, ensuring the execution of specific production functions of an employee in the particular industry. Hard skills as technical skills associated with the performed activity in the sphere of formalized techniques are included into the list of requirements described in a job profile. Researchers consider and define the notion of “soft skills” through the prism of their outlook and sphere of scientific interests. However, almost all definitions are close to each other. Soft skills are personal qualities and acquired skills influencing the efficiency of interpersonal communication [7]. This definition is echoed by that of J. Rezgui, who, using synonymous terms “employability skills” or “life skills”, reduces soft skills to psychological preparedness to adapt to the social behavior and positive attitude which provides efficiency in achieving the everyday goals [8]. In terms of research methodology, the closest to ours is the work by M. Itani and I. Srour, who carried out a comparative analysis of the expectations of employers and students about the most demanded soft skills. They revealed inconsistency in the priorities in this field set by the practitioners and the students and concluded that it is necessary to shift accents in training engineers towards professional interaction, in particular, emphasizing the importance of developing the skills of oral communication for student of Engineering majors [9].

S. Kumar stated that the challenges of today’s highly competitive market and the rapid changes in industry lead to the necessity to prepare engineers for project activity, assessing the available tangible and intangible resources an mobilizing these resources to achieve the goal, which is only possible if soft skills are formed in addition to hard skills, the latter being no less topical [10]. According to the latest research, “[t]he high unemployment rate of vocational high school graduates, which is up to 9.27% of the 131.55 million productive age people” [11]. Researchers believe that this may be due to the slow change of the education paradigm and the excessive orientation towards sole development of technical skills, while the disciplines or forms of learning aimed at supra-professional skills (Communication, Creativity, Collaboration, Critical Thinking) development are completely ignored insufficiently included into curricula.

Soft skills development can be considered one of the trends in contemporary education, a constituent of educational conception aimed at sustainable development. For instance, the World Summit on Sustainable Development (Johannesburg, 2002) adopted decisions aimed at intensifying the varied activities of national education systems to transit to global sustainable development. Hence the importance of researching the role of soft skills in training specialists in standardization, metrology and quality management with a view of improving the quality of their training in future.

2. Materials and methods

To achieve the research objective, we used a survey method in the form of questioning. The respondents were the students of Kazan National Research Technical University named after A. N. Tupolev, majoring in “Standardization and Metrology” and “Quality Management”, and practitioners in the same sphere, working in industrial companies. The features of forming soft skills at university were researched by analyzing the normative documents regulating the educational process: the federal state educational standards in the studied Bachelor majors and the curricula of Russian universities.

3. Results and discussion

Soft skills, like communication and teamwork, are vitally important for an engineer’s success in the workplace. Despite this, “there is a perceived shortage of soft skills among engineers, particularly engineers of the Millennials” [12]. Y.V. Pukharenko and V.A. Norin highlight that Bachelors must, as early as at the learning stage, be ready to apply knowledge and skills under the conditions maximally approximated to the actual production process [13], hence, develop both labor skills and competencies ensuring employment and career growth. Employability skills include the following abilities: problem solving, communication, the retrieval of information, presentation and social interaction [14]. However, as researches show, graduate engineers were taught the following soft skills: ethics,
entrepreneurial and communication skills but were not in line with industry expectations [15]. Employers want new employees to have strong soft skills, as well as hard skills.

In a 2012 research, ten soft skills were marked as perceived the most important by executives: responsibility, integrity, courtesy, social skills, flexibility, communication, work ethic, professionalism, teamwork and positive attitude [7]. In our work we focus on engineers’ qualities and skills, thus the results were different: while several options could be selected, skills of records management got 36 votes (72%), mastering of foreign languages – 24 (48%), self-motivation skills – 30 (60%), time management – 18 (36%), ability to plan one’s career – 20 (40%), and ability to work in a team – 34 (68%). The respondents marked the following qualities most important for successful professional activity: analytical abilities – 38 (76%), communicative skills – 30 (60%), ability to handle stress – 38 (76%), emotional intellect – 12 (24%).

Current society demands not only more engineers, but better ones, equipped with abilities to solve complex technical challenges, working in interdisciplinary teams and dealing with social and cultural issues as well [16]. Thus, the survey results (communicative skills – 30 (60%)) are rather explicable.

At the same time, only 28% of the respondents marked leadership as a significant quality, although leadership may become the key component facilitating the efficiency of engineering labor in general and competitiveness of an individual professional under competition. That is why practitioners in the sphere of industry and production face the need to develop the leadership qualities of employees at all stages of production hierarchy [17]. Notably, in our survey practitioners marked the significance of leadership qualities among other soft skills more often than students (11 out of 14 answers). The differences in the priorities between practitioners and students were also apparent in the estimation of public speaking skills (13 answers by practitioners, 3 answers by students) and time management (14 answers by practitioners, 4 answers by students). This is probably because the students are insufficiently immersed into production processes and do not duly realize the future interaction in the labor collective, while overestimating the existing skills, in particular, as regards assessing time and using the techniques of its correct assignment and planning.

If an engineer obtains correct conclusions, but cannot communicate these results in a proper way, then the value of the achievements could be diminishing dramatically [18]. That is why the skills of public speaking and making presentations were marked by a rather high number of the respondents – 32% and 12%, respectively.

To effectively implement the paradigm of sustainable development, it is necessary to teach most of the population to understand global issues and to build their professional activity with a view of satisfying the economic demands of the society, taking into account the laws of biosphere development. Achievement of these goals should be based on education system. Soft skills may help the youth to cope with complexity and uncertainty, teach them to work under increased individualism and social diversity; hence, it is necessary to provide for the development of supra-professional skills at the stage of educational standards. Having analyzed the federal state standards in higher education (Bachelor level) in “Standardization and Metrology” and “Quality Management” majors, we may conclude that supra-professional competencies are concentrated within the block of general cultural competencies. They comprise the ability to use the fundamentals of knowledge in economics in various spheres of activity; the ability to use the fundamentals of legal knowledge in various spheres of activity; ability for oral and written communication in the Russian and foreign languages to solve the tasks of interpersonal and intercultural interaction; ability to work in a team, tolerantly perceive social, ethnic, confessional and cultural differences; ability for self-organization and self-education.

The closest type of professional activity in which soft skills significantly contribute is organizational-managerial activity (including organization of the work of small teams; participation in reclamation, designing the plans for introducing new measuring equipment, compiling requests for product certification; analyzing the performance of production units, preparing the source data for choosing and justifying the scientific-technical and organizational decisions based on economic calculations; elaboration of operative plans of the primary production units; preparing reports by preset forms and organization of activities necessary for effective functioning of the quality
management system, managing material and information flows during production), which is not
frequently selected when developing educational programs.

In our opinion, however, the competencies not directly related to executing professional activity
but providing interaction with colleagues and efficiency when performing production tasks are also
necessary for such types of activity as production-technological; scientific-research; project-design
(for “Standardization and Metrology”) or production-technological; production-design; project-design
(for “Quality Management”).

In should be noted that the developed but not yet adopted projects imply the increased role of soft
skills, which were classified into the following groups: 1. Systemic and critical thinking; 2. Project
design and implementation; 3. Team work and leadership; 4. Communication; 5. Intercultural
interaction; and 6. Self-organization and self-development (including health protection). At the same
time one may see that, in general, the new standard reflects the students and practitioners’ awareness
of the value of supra-professional competencies.

Skill elaboration is a process which is fulfilled by exercise (purposeful, specially organized
repeated actions). Due to exercises, a technique is improved and consolidated. An indicator of a skill
presence is that, starting an action, a person does not think in advance how they will perform it, does
not distinguish its separate individual operations. That is why it is necessary not just to list the
competencies necessary for a successful career and for achieving professional goals while jointly
solving production tasks, but also to provide for a systematic process of their forming and
development during university education. That is why nontechnical engineering skills should be added
to engineering curricula [19]. Having analyzed the curricula of the Russian universities in
“Standardization and Metrology” (10 universities) and “Quality Management” (10 universities), we
identified the disciplines aimed at forming soft skills which fall beyond the course of Philosophy,
History and Foreign Language, obligatory at all universities.

In the curricula, the largest number of disciplines of the researched type are aimed at developing
communications (“Culture of speech” (MIREA — Russian Technological University), “Russian
language and culture of speech” (Kazan National Research Technical University named after A. N.
Tupolev – KAI), “Culture studies and intercultural interaction” (Nosov Magnitogorsk State Technical
University), “Business etiquette and culture of communication” (Gubkin National University of Oil
and Gas), “Culture of speech and ethics of business communication” (Moscow Polytechnic
University), “Culture of communication” (Saint Petersburg Mining University).

The skills of records management, highly estimated by the students, can be developed within such
courses as “Records management and computer processing of documents” (Nosov Magnitogorsk State
Technical University), “Document provision of quality management systems” (Institute for
Engineering and Economics, National Research University “Moscow Power Engineering Institute”),
“Business document flow” (Kazan (Volga region) Federal University), “Records management”
(Moscow Aviation Institute), “Records management and documentation provision in quality
management” (Penza State Technological University).

Many disciplines are aimed at developing project approach to solving professional tasks: “Project
activity” (Nosov Magnitogorsk State Technical University, Orel State University named after I.S.
Turgenev), “Introduction to project activity” (Moscow Polytechnic University), “Project management
within the quality management system” (Moscow Aviation Institute).

The respondents had different opinions about inclusion of general legal competence into soft skills
or hard skills: 40% and 24%, respectively. At the same time, the universities’ curricula often include
such special disciplines, alongside with the traditional “Legal science”: “Legislative metrology”
(Moscow State Technological University), “Legal provision of innovative activity” (Saratov State
University), “Bases of legislation in the sphere of science and technology” (Penza State Technological
University).

Regrettably, Russian universities offer few disciplines related to team work: “Techniques of team-
building and self-development” (Nosov Magnitogorsk State Technical University), “Social
Psychology” (Gubkin National University of Oil and Gas), “Engineering Psychology” (D. Mendeleev
University of Chemical Technology of Russia), “Collective psychology” (Orel State University named after I.S. Turgenev).

Creativity as an important quality was marked by 16% of the respondents, and some universities already offer disciplines aimed at developing creative abilities: “Basics of Scientific-Engineering Creativity” (Saratov State University), “Basics of Engineering Creativity” (Baltic State Technical University “Voennmeh” named after D.F. Ustinov), “Theory of inventive problem solving” (Penza State Technological University).

4. Conclusion

Thus, the complex of the carried-out research allows concluding that, on the one hand, soft skills are demanded by the employers. On the other hand, the necessity to be prepared for solving the tasks, not related directly to production processes is well realized both by employees and would-be specialists in the sphere of standardization, metrology and quality management. The respondents consider most important the skills of records management (72% of the responses), self-education and self-development (68%), ability to work in a team (68%); analytical abilities (76%) and ability to handle stress (76%).

In the normative documents, regulating the process of Bachelor training in “Standardization and Metrology” and “Quality Management” majors, soft skills are insufficiently reflected. At the stage of forming and developing these competencies, universities offer various special disciplines, the number of which differs in the curricula of Russian universities.

The research showed that student prefer developing their soft skills independently as a part of self-education (64%), without using the resources of Massive Open Online Courses to a full extent. At the same time, the significance of soft skills in training of the modern personnel for the Russian industry will grow, given the orientation towards sustainable development. Education for sustainable development implies broadening of systemic, critical, and creative thinking, comprehending and analyzing a complex of local and global issues, knowing and taking into account the intercultural differences. That calls for increasing the number of disciplines aimed at developing supra-professional skills at universities and at promoting the popularity of special disciplines “Time management”, “Skills of public speaking”, “Communication organization”, “Records management” and the like in the system of lifelong and online learning, for example, as a part of Massive Open Online Courses.

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