

Actualization of Competencies of Graduates-Engineers in Russia

Valentina A. Ivashova^{a*}, Galina V. Dub^a, Diana S. Kenina^a, Yulia F. Kosintseva^b, Marina V. Migatcheva^c

^aStavropol State Agrarian University, Stavropol, RUSSIA; ^bNorth- Caucasus Federal University, Stavropol, RUSSIA; ^c Stavropol State Pedagogical University, Stavropol, RUSSIA

ABSTRACT

The article presents the results of the empirical research relevant to the labor market competencies of graduates with the major in engineering. Subjective preferences of employers shape requirements for the personal and professional characteristics of a graduate. In authors' opinion, the professional competences of engineers stated in educational standards in sufficient detail and require updating in order of importance for the modern employer. The theoretical search and empirical test are due to determine the set of personal characteristics of graduates, which will affect the successful employment of young professionals and ultimately their competitiveness in the labor market. In the course of the expert survey we identified key competencies of graduates with the major in "Agro-engineering" (*Bachelors*) and "Operation of transport and technological machines and systems" (*Bachelors*); ideas of specialists about demanded in current professional work knowledge and skills were studied; grouping of the key functional responsibilities of professionals working in positions of the chief engineer and mechanical engineer was held. Information obtained during the survey of experts can be used to improve the matrix of competencies, content of workshops, updating set of competencies within the University.

KEYWORDS

Professional competencies; personal qualities of a specialist; position responsibilities of an engineer; graduates-engineers; socio-economic conditions.

ARTICLE HISTORY

Received 10 April 2016
Revised 24 May 2016
Accepted 29 May 2016

Introduction

Training of engineers in the Russian universities is currently carried out on the basis of educational standards of the 3d generation, which establishes the competence approach as a methodological basis of professional education.

The Competence approach is an objective phenomenon that has arisen as a result of the response of the vocational education to the changing socio-economic conditions of work (Ivashova and Gallev, 2011). Together with the need to implement this approach, both at the level of the legal framework that ensures accreditation requirements for the educational program, and at the tool level of the current

CORRESPONDENCE Valentina A. Ivashova ✉ vivashov@mail.ru

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educational process, there is an urgent need for timely updating of competence in accordance with the requirements of employers (Ivashova et al., 2014).

Materials and Methods

Subjective preferences of employers shape requirements for the personal and professional characteristics of a graduate (Abdulwahed et al., 2013). In our opinion, the professional competences of engineers stated in educational standards in sufficient detail and require updating in order of importance for the modern employer. The theoretical search and empirical test are due to determine the set of personal characteristics of graduates (Lobeyko et al., 2006; Flynn et al., 2013), which will affect the successful employment of young professionals and ultimately their competitiveness in the labor market. Based on the concept of B.D. Parygin competitiveness includes individual characteristics, such as psycho-physical health, age, appearance, ability, talent, intelligence level, supply of energy; as well as moral aspects: the hierarchy of values, belief systems, the presence of the prohibitions and restrictions of a personal (Parigin, 2000). In training of the modern engineer we should take into consideration not only the high quality of the results of his work, but also his ability to achieve the best results in comparison with competitors (Goncharuk, 2013; Souza and Rodrigues, 2015; Gustafson and Simon, 2013; Hundley et al., 2013). Empirical studies conducted by the authors, largely coincide with the ideas of V.I. Andreev (1996) about the personal qualities of graduates: "clarity of purposes and values, hard work, creative attitude, ability to take risks, independence, ability to be a leader (Ahn et al., 2014; Montjoye et al., 2014), commitment to continuous self-development, stress tolerance, commitment to continuous professional growth and to the high quality of the final product of his labor" (Andreev, 1996).

Results

General characteristic of the expert survey of the participants and their attitude to professional activities

The expert survey of experts in the area of training "Operation of transport and technological machines and complexes" and "Agro-engineering" was held in September-October of 2013 through individual questionnaires. In total, 54 people from 14 leading agricultural enterprises of the Stavropol Territory participated in the survey.

All members of the expert survey have the basic education of an "engineer", which corresponds to their position. Basically, the survey participants are graduates of the Stavropol State Agrarian University from different years - 49 out of 54 respondents. 3 large groups of industrial problems refer to the working responsibilities of experts that provide an insight into the key issues of the current professional activity in the areas of "Operation of transport and technological machines and complexes" and "Agro-engineering":

- Participation in processes of operating the machine and tractor park of an enterprise (repairing, operation, maintenance, troubleshooting of agricultural machines, production of tractors, combine harvesters at work, diagnostics of the machine-tractor park, content of technical equipment) – noted by 50 people;
- Management of production activities (equipment work control, quality of work, equipment repairing, service, quality of parts, analysis of production

activities, organization of production activities, work with staff) – mentioned by 26 people;

– Work with documents and external partners of the enterprise – noted by 18 people.

Answering the question: "What knowledge is needed to perform the work in your position?" ,the respondents answered that among the most in demand knowledge in the current professional activity is all the technical (engineering) knowledge of the device components, assemblies and technical characteristics of tractors (vehicles) (29 pers.) technology and the organization of repairing and proper use (7 pers.), knowledge of related areas, such as economics, marketing, livestock, construction (5 pers.), theoretical (1 pers.), computer (1 pers.).

In the survey experts independently formulated a list of skills that, in their opinion, are necessary for a successful career as an engineer mechanic. In the first place is the ability to work with diagnostic equipment, measuring equipment (mentioned by 9 people) and work with staff on the organization of work (mentioned by 9 people).

On the second place is the ability to repair (marked by 7 people).

On the third place is the ability to set and achieve production goals and objectives, make decisions (marked by 6 people).

On the fourth place is the development of documentation such as the repairing plan, filling the "punch list", reading blueprints (marked by 5 persons).

Skills that experts call as important, relate mainly to shaping of personal qualities of employees - perseverance, diligence, patience, communication, responsibility, attentiveness. Another group of skills regards professional activities - working with catalogs, documents, management of cars, tractors and other agricultural machinery, repairing skills, control and adjustment of equipment. In addition, experts note the necessity of skills to work in teams for success for the position of the mechanical engineer and chief engineer.

Characterizing the demand for engineering specialists at the regional labor market, only 10,3% of the experts pointed out that the work can be always easy to find, another 60% indicated that they have a chance to be employed as a "mechanical engineer" perhaps if they try and 30,8% said it is virtually impossible.

Experts have demonstrated a high commitment to the engineering field of study and type of professional activity. Responding to a question about what might make them change jobs; only 15,0% indicated a wish to change the direction and scope of activities. All other responses were related to the professional development within their chosen specialty: the wish to increase earnings (72,5%), the wish to change the conditions of work (22,5%), pursuit of excellence in the profession (15,0%). Another 12,5% of the surveyed participants said that nothing can force them to change their job.

Characteristics of demanded competencies of graduates with the major 190600 "Exploitation of the transportation-technological machines and complexes"

From the list of proposed universal competencies of a personality experts identified the most significant ones:

- ability to independently set the objective and make decisions (indicated by 60,0% of respondents);
- interpersonal skills and ability to communicate (indicated by 52,5% of respondents);
- creative abilities, the ability to solve non-standard problems (mentioned by 42,5% of respondents);
- ability to plan working hours (40,0% noted by respondents);
- ability to work in a team (indicated by 30,0% of respondents);
- punctuality, diligence (indicated by 27,5% of respondents);
- ability to learn (indicated by 25,0% of respondents);
- leadership skills and ability to lead others (indicated by 22,5% of those surveyed).

Among several less significant qualities there were such as perseverance, patience (15,0%), ability to analytical work (12,5%) and ability to concentrate (2,5%).

As part of the expert survey, participants were asked to rate a list of competences of the federal state educational standards for the major of training 190600 "Operation of transport and technological machines and systems" (Bachelors) in terms of their relevance in the modern production process. Among the most important common cultural competency the first 4 positions are occupied by:

- wish for self-development, improving their skills and craftsmanship (indicated by 66,7% of respondents);
- ability to acquire new knowledge, using modern educational and information technology (indicated by 61,9% of respondents);
- possession of the basic methods, ways and means of receipt, storage, information processing, having computer skills as a means of managing information (indicated by 57,1% of respondents);
- possession of a culture of thinking, ability to synthesize, analyze, process information, goal setting and choosing the ways of achieving it (indicated by 57,1% of respondents).

Among the most relevant professional competencies the first 3 positions are occupied by the following:

- being able to select materials for use in the operation and maintenance of transport vehicles and transport and technological systems for different purposes, taking into account the influence of external factors and requirements of safe and efficient operation and cost (indicated by 52,4% of respondents);
- having knowledge of technical terms and rules of the rational use of transport technology, the consequences of termination reasons of its efficiency (indicated by 61,9% of respondents);
- ability to use current technology of repair and maintenance with the use of new materials and diagnostic tools (mentioned by 61,9% of respondents).

Every fourth of the number of participants in the expert survey noted the need for further strengthening of the formation of professional competencies such as: knowledge of the methodology of developing projects and programs for the industry, necessary activities related to the safe and efficient operation of the transport and technological machines for various purposes, their aggregates, systems and components, as well as the performance of work on the standardization of

equipment, systems, processes, equipment and materials; basics skills review and analysis of various technical documentation (Abbas et al., 2013; Firouzian et al., 2014); ability in the composition of the group of performers to the evaluation of costs and operational performance of the organization; ability to use the techniques of rational decision-making regarding rational forms of maintaining and restoring performance of transport, technological machines and equipment; ability to use current technology of repair and maintenance with the use of new materials and diagnostic tools.

Characteristics of demanded competencies of graduates with the major of training 110800 "Agro-engineering"

Actualization of competencies in the major of training 110800 "Agro-engineering" showed that the most significant, according to the participants of the expert survey among general cultural competencies are the following: possession of a culture of thinking, ability to synthesize, analyze, process information, goal setting and choosing the ways of achieving it (73,7%); desire for self-development, improving their skills and craftsmanship, possession of skills of independent work (68,4%); ability to make organizational and administrative decisions and willingness to take responsibility for them (52,6%); ability to use legal documents in their work (52,6%); ability to work with information in computer networks (52,6%); ability to logically true and clear arguments to build oral and written language (42,1%); possession of the basic methods, ways and means of receipt, storage, processing of information; computer skills as a means of information management (42,1%) (Lunev et al., 2013; Nieman et al., 2013).

As part of the professional competencies, experts identify the most important for the area of training:

– *general professional - knowledge* of the device and the rules of operation of hydraulic machines and heating equipment (63,2%); ability to develop and use the graphical technical documentation (47,4%); ability to enforce safety regulations, industrial hygiene, fire safety, and occupational health and nature (42,1%); ability to use information technology and database of agro-engineering (42,1%);

– *industrial and technological activities* - readiness to professional operation of machines and technological equipment for the production, storage and primary processing of agricultural products (57,9%); ability to use standard technology maintenance, repair and restoration of worn machine parts and electrical equipment (42,1%); ability to use technical means to determine the process parameters and product quality (42,1%) (Szewczyk-Zakrzewska et al., 2013; Zaripova et al., 2014);

– *Organizational and managerial activity* - ability to organize the work of executors, finding and making decisions in the area of organization and regulation of labor (36,8%); willingness to organize and synthesize information on the formation and use of resources of the enterprise (36,8%);

– *Scientific-research activity* - willingness to participate in research of working and technological processes of the machinery (21,1%);

– *Project work* - the ability to collect and analyze raw data for calculation and design (36,8%); willingness to participate in the design of new technology (31,6%).

According to the participants of the expert survey with the major in training 110800 "Agro-engineering" the following competencies need additional attention:

- among *the general cultural competences* - possession of a culture of thinking, ability to synthesize, analyze, process information, goal setting and choosing the ways of achieving it (42,1%); ability to logically true and clear arguments to build oral and written language (31,6%); willingness to cooperate with colleagues, work in a team (31,6%);
- among the *professional* competencies - readiness for professional operation of machines and technological equipment for the production, storage and primary processing of agricultural products (47,4%); ability to solve engineering problems using the basic laws of mechanics, electronics, hydraulics, thermodynamics and heat and mass transfer (26,3%); knowledge of the device and the rules of operation of hydraulic machines and heating equipment (26,3%); ability to use standard technology maintenance, repair and restoration of worn machine parts and electrical equipment (26,3%); willingness to use technical means of automation and process automation systems (26,3%); ability to enforce safety regulations, industrial hygiene, fire safety, and occupational health and nature (21,1%) (Leuro and Kruger, 2013; Sharaf et al., 2013).

Discussion

During the discussion we found out that only a quarter of the experts surveyed believe that graduates with the major in training 110800 "Agro-engineering" and 190600 "Operation of transport and technological machines and systems" are trained on the modern equipment. About a quarter believe that the training is conducted on the outdated equipment that can be seen as a lack of skills of graduates to work with the modern equipment. The half of the experts found it difficult to give a specific estimate, which indicates a low awareness of employers in the field of material and technical base of the Faculty of Farm Mechanization, of insufficient work of the faculty to promote information about the technical potential of the modern training of engineers.

According to the experts the quality of training of graduates is the highest quality in higher education. Significantly inferior is the quality of graduates from the centers of secondary and primary vocational education.

The key factor in ensuring a high quality of graduates in "Agro-engineering" and "Operation of transport and technological machines and systems", according to experts, is to improve the quality of the practical component in the educational process. Two important factors are: ensuring the base practices and training of engineers with modern equipment.

Conclusion

Thus, in the course of the expert survey we identified key competencies of graduates with the major in "Agro-engineering" (*Bachelors*) and "Operation of transport and technological machines and systems" (*Bachelors*); ideas of specialists about demanded in current professional work knowledge and skills were studied; grouping of the key functional responsibilities of professionals working in positions of the chief engineer and mechanical engineer was held.

The comparative analysis showed that the most relevant and at the same time required, according to experts, general cultural and professional competencies showed that in the training of graduates of the educational program "Operation of transport and technological machines and systems" (*Bachelors*) a significant emphasis should be made on the formation of such competences as :

- general cultural
 - ability to acquire new knowledge, using modern educational and information technology;
 - possession of the basic methods, ways and means of receipt, storage, information processing, having computer skills as a means of information management;
 - possession of a culture of thinking, the ability to synthesize, analyze, process information, goal setting and choosing the ways of achieving it;
- professional
 - being able to select materials for use in the operation and maintenance of transport vehicles and technological systems for different purposes, taking into account the influence of external factors and requirements of safe and efficient operation and cost;
 - ability to use current technology of repair and maintenance with the use of new materials and diagnostic tools.

The comparative analysis of the most relevant and at the same time requiring to improve, according to experts, among the general cultural and professional competencies showed that in the training of graduates of the educational program "Agro-engineering" (Bachelors) a significant emphasis should be made on the formation of the following competencies:

- general cultural
 - possession of a culture of thinking, ability to synthesize, analyze, process information, goal setting and choosing the ways of achieving it;
 - ability to logically true and with clear arguments to build the oral and written language;
- professional
 - knowledge of the device and the rules of operation of hydraulic machines and heating equipment;
 - ability to ensure compliance with safety regulations, industrial hygiene, fire safety, and occupational health and nature;
 - readiness to professional operation of machines and technological equipment for the production, storage and primary processing of agricultural products;
 - ability to use standard technology maintenance, repair and restoration of worn machine parts and electrical equipment.

Information obtained during the survey of experts can be used to improve the matrix of competencies, content of workshops, updating set of competencies within the University.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes on contributors

Valentina A. Ivashova holds a PhD in Sociology and now is an Associate Professor of Management Department at Stavropol State Agrarian University, Stavropol, Russian Federation.

Galina V. Dub Stavropol State Agrarian University, Stavropol, Russian Federation.

Diana S. Kenina holds a PhD in Economy, Management Department at Stavropol State Agrarian University, Stavropol, Russian Federation.

Yulia F. Kosintseva holds a PhD in Technical Science and now is an Associate Professor of Department of Social Technology at North-Caucasus Federal University, Stavropol, Russian Federation.

Marina V. Migatcheva Stavropol State Pedagogical University, Stavropol, Russian Federation.

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