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“Your Future Starts Today”: First-Year Students’ Insights in Engineering Professions

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Abstract

The article considers the connection of professions of the future with engineering, what first-year students think of their future engineering job and what demands are made by future engineers today to do their job successfully in future. The article reveals the future specialists’ principle requirements as well as establishes the key factors of profession selection.

Key words: engineering jobs, engineering education, jobs of the future.

Introduction

The young generation has a great variety of choices in case of future profession selection. The choice of profession can be influenced by different factors: dynasty tradition, job prestige, high salary, and other factors.

Career choice and dynamics of its transformations have an effect on both present and future development of society and country on the whole. Looking back in the past one can remember that many children dreamed of being cosmonauts, hockey-players, doctors. In the 60’s of the 20-th century any pupil said that he/she wanted to be a cosmonaut, doctor or teacher. In the late 20-th and early 21-st centuries the juridical and economical specialities gained great popularity.

Usually, the top positions in the list of preferred professions include jobs providing regular income. However, according to the research of Institute of Sociology, Russian Academy of Sciences as well as data by Research Center of Sociological Surveys SuperJob.ru, more than 50% of the youth choose jobs based on the requirement that they should be interesting for them. The second factor influencing the choice is high salary that was indicated by the quarter of

respondents. The third and fourth places were correspondingly divided by prestige of a future profession and a chance to bring benefit. Every fifth respondent considers these factors to be important in selection of future job.

The days, when there were few engineers and most strived to be a lawyer or a manager, are gone.

The present determines our future. In its turn, future creates a new generation. The youth strives to realize its potential. This realization is focused not only on regular income and financial well-being, as was shown by the poll.

We live in the era of innovation, which aims at transformation and improvement of the world, the part of which is a man. The human factors and potentials are the current emphasis as they convert the opportunities and turn them into present, traditional, usual things. Those that have been recently considered impossible or fantastic, today are taking shape thank to engineers’ activity.

At the moment increased requirements are set for university curricula. During the rapid changes in different spheres, one of the important requirements is “proactive education”. It is evident that a key aspect here is a forecast of the most perspective

technologies and trends in science and education.

In the nearest several decades, new products and technologies will be designed, for the development of which new specialists will be in demand. The growth of complexity in management systems implies new skills. It is here and now that engineering profession is becoming the most urgent, since it is an engineer who is a man capable of not only taking correct decision, but also foreseeing their consequences in the future. Obviously that the role of an engineer today and in the future is one of the most crucial as the role of innovator, inventor, creator, and developer of new materials and processes, improving technologies etc.

“Your future starts today” and at present those students are taught engineering specialities that will create future. It is suggested to reveal a scheme of factors changing the engineers’ tasks in the industries, consider the expected work of the future related to engineering. Besides, it is proposed to establish the ways of first-year students’ viewing them, as they will influence the development of engineering in the nearest future.

Research

At the moment the relevant methods of interaction with students to obtain and exchange information are various case studies, surveys and workshops, which allow students’ involvement in discussion and obtaining data for visual analysis as, for example, histograms or graphs of target and input variables.

The first-year students, who are taught as engineering staff for information society, were presented the jobs of future related to engineering and potentially associated with the specialities trained by the students.

The professions were composed of different blocks from “The Atlas of New Professions 2.0” [4], where the results of survey were gathered by “Competence Foresight 2030” performed by Moscow School of Management Skolkovo and the Agency for Strategic Initiatives (more than 2500 experts participated in the survey). The professions were proposed from the

following blocks: “Safety”, “Robotics and Machine building”, “New materials and nanotechnologies”, “Transport”.

The discussion dealt with the results of the Third industrial revolution and expected results of the Fourth industrial revolution.

It should be mentioned that the jobs of the future appeared due to new requirements and factors. Among of the principle factors are: automation, globalization, changes in consumer preferences, new technologies, changes in production, development, service, etc. At this point the engineering specialities are becoming prominent. As was mentioned, in the condition of the New Industrialization there are demands for new approaches towards engineering education in Russia [1].

Although the Third industrial revolution has not spread everywhere yet, in some experts’ opinion, the time of the Fourth industrial revolution or “Industry 4.0” has already come, which is proved by discussion of Industry 4.0 at the 46-th World Economic Forum in Davos [2].

Thus, the Fourth industrial revolution implies extensive introduction of cyberphysical systems into production, servicing human needs including labour and leisure. It results in new requirements for work force. As previous industrial revolutions caused labour transformations and employment relations [3], so now one can speak of new generation of work force with updated and improved skills and competencies.

It is expected that many professions are no longer relevant and will completely disappear within several years or decades. For example, “professions of the past”, in researchers’ opinion, include: accountants, statisticians, analysts, librarians, translators, logisticians, copy-writers, proof-readers, etc.

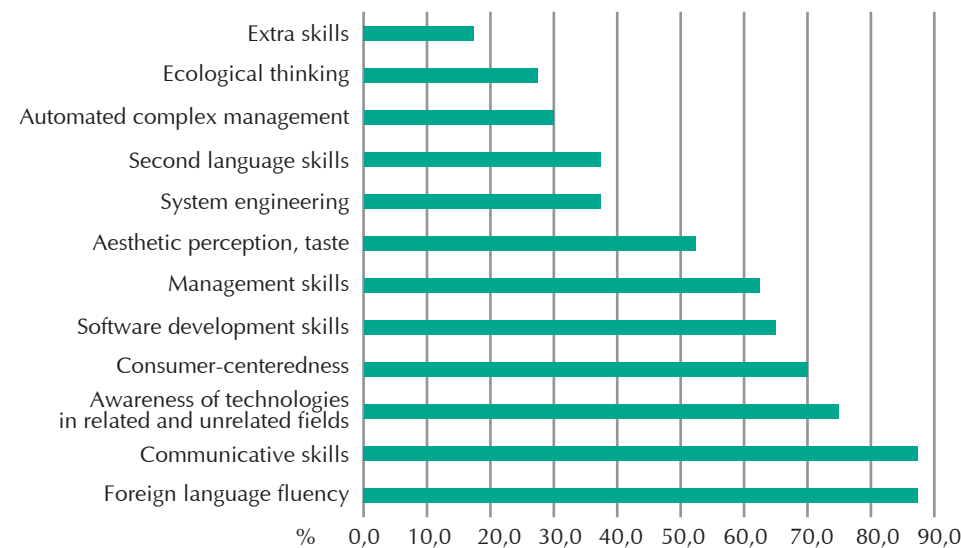
Taking into account extensive transformations, jobs related to engineering, on the contrary, can be referred to topical ones.

Among the relevant professions of the future proposed for students’ discussion were:

- *Smart environment designer* – a specialist taking software-technological decisions for smart environments;
- *Recycling technologist* – a specialist in development and implementation of technologies of recyclable materials, production of new materials from industrial wastes as well as development of zero waste techniques;
- *Ergonomist-designer* – a specialist designing robotic systems in view of consumers' ergonomic requirements taking into account their physical and psychological peculiarities;
- *Domestic robot designer* – a specialist developing and programming home robots (for example, robot dog walker);
- *Composite engineer* – a specialist dealing with composite materials to produce parts including 3D-printing;
- *Transport safety engineer, navy infrastructure engineer;*
- *Expert of system environmental disasters, etc.*

The list of necessary skills and requirements for personnel in the condition of the New Industrialization is rather extensive, but the university graduates do not often meet the requirements for personnel in the global labour market [5].

Fig. 1. The skills necessary for a future engineer



The students were offered to make a list and highlight the basic skills necessary for engineers. The results of students' opinion are presented in fig. 1.

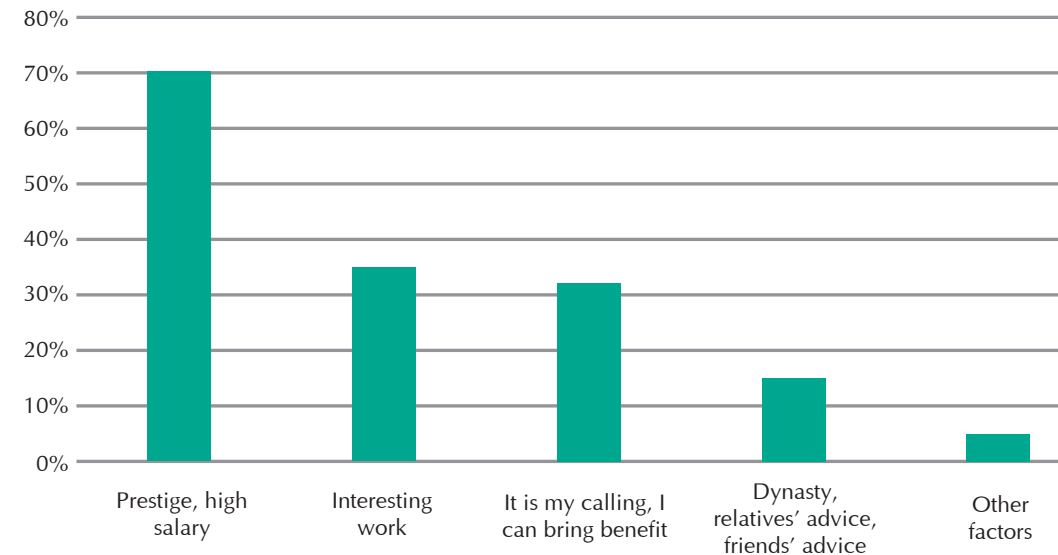
It should be noted that, in first-year students' opinion, essential skills for the future profession are fluency in foreign language and communicative skills that shows the trend of globalization, including production economic sphere. 75% of respondents pointed out the necessity of awareness in technologies of related and unrelated fields. The histogram below demonstrates a wide range and variety of requirements.

The main factors of profile and future profession selection noted by the students are presented in fig. 2. 70% of interviewed students think that an engineer is a prestigious and highly-paid job. More than 30% believe that their job is interesting and useful for society as an engineer is a link between innovative breakthroughs and scientific discoveries and their practical application.

Results and discussion

After discussion of proposed professions, the students have made several essential conclusions. On the one hand – *engineering professions are recognizable and have similar features in both present and*

Fig.2. Main factors of future profession selection



proposed new form of future. On the other hand – division of industries is less noticeable, hence, there is a demand for awareness of processes and technologies in related and unrelated fields. More acute is demand for acquiring skills of multidisciplinary communication and work under the condition of rapid changes in solved problems. In addition, it should be noted that all proposed "professions of the future" were accepted by the students as absolutely natural forms of labour. The students expressed their confidence in the fact that these professions have already occupied or will occupy their place in the sphere of new technologies in future. Moreover, most students noted that they can realize their potentials in one of those professions. As a result of discussion students revealed that one of the typical features of engineering professions is responsibility for development and application of new technologies and processes.

Based on the data obtained and students'

discussion one can conclude that students consider the job of engineer to be in demand and prestigious in the future. However, the choice is also conditioned by the interest in innovative developments and opportunity to be a man valuable for the community.

The students noted the increase in demand for sophisticated systems and technologies and, hence, requirements for himself/herself when training or working in future as a creator or driver of innovative approaches in different spheres of life. Future engineers understand: at present they demand higher standards for themselves and strive to invent and develop new technologies to improve the future. It is here and now that they lay down the foundation for these changes. Thus, the image of new and transformed engineering professions, perception of new competences and labour transformations have already been born in the minds of young people, they define their view of life and set a new development trend.

Intellectual Guidelines (References) of Engineers in Renovating Modern Production

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Abstract

Engineers lack sound guidelines to identify the level of changes in constructions and technologies. It leads to problems in planning and managing the renovation of modern production. The article discusses guidelines for gradual identification of level of changes in technologies and constructions based on interconversion of object and process systems.

Key words: innovative activity, competitiveness of enterprises, thematic plans of rationalization and invention, level of changes in constructions and technologies, system operation principles.

Relevance of the issue

The world changes constantly. Karl Marx stated: "Everything that is fixed is dead; everything that is in progress is imperfect. The modern dynamic environment requires companies' managers to receive the slightest signal of dangers and possibilities [1]. The signal sources are not only global trends and political events, but technological shifts (new materials, fundamentally new technologies and constructions). This approach is deeply rooted in the strategy of leading companies. The list of actions to manage changes, which is mentioned in the famous work by Igor Ansoff, includes the following points: 1) to create "a launch pad"; 2) to plan a process of changes; 3) to prevent conflicts between strategic and current processes; 4) to plan implementation; 5) to manage current production processes; 6) to institute the new strategy; 7) to maintain strategic response [1].

The areas of innovative activity in modern companies are multifaceted. All their subsystems (social, psychological, technical, economical) need changes. However, it is the technical and technological subsystem that is the dominant area in the structure

of changes. Describing the new role of a company director, researchers note that it is the ability to manage continuous sequence of technological steps that determines the company's survival [2].

Currently Russian economy is not in the best state. A lot of companies are looking for investments all over the world to upgrade their production cycle, though there are resources inside the companies. The portal "Production management" provides the opinion of a German consultant in production management, who states that Russia has lost the rationalization system that the Germans once learnt from [3]. The necessity to restore this activity is proved by the leading companies ("Votkinsky zavod", "Proton-PM", "Russian Railways", "Taifun", "NEVZ", "Kirovsky Zavod" etc.) [4–7]. It is a very important issue. There are a lot of examples in the Russian history when the state pays special attention to the area of invention and rationalization even in the hardest period – the Great Patriotic War [8].

The current synonyms for "rationalization proposal" are "Kaizen proposal", "total production optimization", "improvement

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