UNCEASING ENGINEERING EDUCATION

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Abstract — Modern conditions and the high pace of the development of science, production and information technologies force to revise and modernize the existing structures of engineering formation everywhere in the world. Information, received in an educational institution, quickly grows old and can not serve the permanent basis for successful engineering activity. Reality requires to develop the bases of such a dynamic system of engineering formation, which will be capable to safely provide the unceasing creative development of each certificated engineer during his whole professional activity. The years of high school education are the first, but very important phase in the creative educational process, which lasts for the whole life.

Index Terms — Engineering formation, educational technologies, international societies for engineering pedagogy.

INTRODUCTION: A STRATEGIC PROBLEM

From our point of view, a strategic problem for all of the engineering high schools is general. It consists of creating such an educational cycle in a high school, which would automatically educate each student to be a well-educated, socially active and creative personality. The continuity of professional development should become an internal “want” of any modern engineer. Herewith the never-ending engineering formation and the individual creative activity should become the motto of life. Concrete forms of the postgraduate education and self-education depend on both individual peculiarities of a person and from a row of external circumstances. Flexibility in the choice of a way of organization of the individual process of unceasing formation should be developed during high school years.

The general strategic line of the development of engineering formation can be provided by different tactical realizations. In engineering high schools of different countries there are their own traditions and their own ways of development. At present different aspects of innovated educational technologies develop. Exchange of individual experience is an important factor, influencing upon efficiency of the process of shaping of the international system of engineering formation in the twenty first century.

RUSSIAN ENGINEERING EDUCATION. TRADITIONS AND THE QUEST

The basis of the best samples of Russian engineering education is a powerful theoretical background. Serious physics and mathematics education allows future engineers to master special disciplines not only at a rate of understanding, but at a rate of active creative work on them too. Such approach to the organization of educational process is realised in Moscow Physics-Technical Institute (MPTI). Each student, after two years of education, continues his theoretical education and simultaneously begins exploratory work. Problems solved by students are not scholastic, but they are a part of a real scientific or engineering problem. Their own exploratory work opens a new stage in the educational process. At this stage new knowledge is gained not only by young researchers, quite often the results of their work are objectively new. This fact is a powerful stimulus for further creative training and work. Now young people choose such additional subjects, which are important for their successful work on the problem.

Unfortunately, on a variety of historical and economic reasons specialised departments in the majority of technical institutes in Russia don’t have the possibility to follow the remarkable example of MPTI. Objective economic difficulties have broken traditional relationships between scientific groups of institutes and the fabrication. This fact has negatively influenced the educational process. The stimuli to creative activity were destroyed by the break-up between "heavy baggage" of the passively received knowledge and the possibility of their active using. Many young engineers, beginning to work, feel a need to get concrete knowledge on the directions they require at their work.

How can we solve a task of acquisition of goal-directed knowledge after the graduation from the institute? How can we reconstruct the present-day system of quick adaptation of the students of engineering professions to the conditions of the requirements of world-level fabrication? How can we create an engineer, capable not only to work productively by himself, but also to manage a creative group effectively? All these questions are actual for Russia and are parts of the problems, which form the subject of the “Engineering Pedagogy” research. Russian technical high schools and teachers of engineering professions support creative contacts.

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with leading foreign engineering institutes and many associations on engineering, including IEEE, ASEE, IACCE, FBENGE, SEFI, IGIP and others. The International Society on Engineering Pedagogy (IGIP) is the most popular in Russia.

In 1998 an International symposium on engineering pedagogy (organized by IGIP) was for the first time organized in Moscow, Russia, in the Moscow State Automobile and Road Construction Institute (MADI) [1]. The participants arrived to this international forum from twenty-six different countries of the world. The number of countries, which took part in the symposium, indicates the urgency of the problem of modernization of the system of engineering formation in the modern conditions of quickly developing science and information technologies.

The articles on the symposium were presented by teachers of engineering high schools of Russia, Austria, Australia, Holland, USA, Great Britain, China, India, Hong Kong, Italy, Iran, Spain, Nepal, Finland, Norway, Macedonia, Peru, Brazil, Turkey, Switzerland, Sweden, Estonia, Yugoslavia, Slovakia, Bulgaria, Germany, Byelorussia, Ukraine and Kazakhstan. Sixty percent of all the registered participants made reports. Different sections on various aspects of engineering formation worked during the symposium. The success of the Moscow symposium stimulates activity, directed on the development and introducing of the latest pedagogical technologies in the sphere of engineering formation, in Russia.

There is a National Russian Monitoring Committee on engineering pedagogy (NRMC). The President of NRMC is the First Deputy Rector of MADI. The Monitoring Committee leads the work on the creation of engineering pedagogy centres in different cities of Russia. The NRMC on engineering pedagogy works in constant contact with the Russian Ministry of Education, as well as with national and international scientific and engineering associations. The President of the Alliance of Scientific and Engineering Organizations of the countries of the C.I.S. and, simultaneously, the vice president of the World Federation of Engineering Organizations (WFEO) – an academician Yuri Gulyaev – participates in the work of the Russian Centres for engineering pedagogy (EP), coordinating their activity in accordance with modern and perspective international requirements, presented to a creative engineer. At present there are eight centres of EP accredited by IGIP and several organizations are preparing to be accredited.

One of the leading institutes in the field of EP is the Moscow State Automobile and Road Construction Institute (MADI, Technical University). The main direction of the Centres’ activity is the preparation of teachers for engineering high school. This problem is particularly actual for Russia. As a rule, Russian teachers of engineering disciplines, who have been working with students for tens of years, are marvelous specialists in their field. Having obtained a lot of practice, they were able to compensate the absence of special pedagogical education. However, it’s rather difficult for many teachers of senior generation to start using modern information technologies in the scholastic process. The Centres of engineering pedagogy are trying to solve this important problem. It’s necessary to save and activate the potential of senior generation specialists and to create simultaneously a reliable foundation for the perspective development of Russian engineering formation in the twenty first century. The Russian Centres of engineering pedagogy are regularly conducting researches to check the correspondence of the engineering formation level in Russian high schools to international qualification standards. The following data is rather convincing. There are 369 European teachers of engineering high schools (ING-PAED IGIP), out of whom 129 pedagogues are Russian. The problem of the preparation of young teaching personnel is becoming particularly urgent. Each modern engineer working in a group must have both pedagogical and management skills. That’s why not only professional teacher, but also any graduate of an engineering high school in the twenty first century should possess an integrated system of knowledge, both in the chosen professional sphere and in the field of psychology, sociology and pedagogy. In accordance with nowadays requirements, courses of psychology and pedagogy are inserted to the new educational standards for engineering professions. The range of directions of theoretical and experimental investigations of the “engineering pedagogy” science is becoming broader. To ensure high quality of engineering education Russian EP Centres have established engineering pedagogy departments in a row of Russian technical high schools.

The department of engineering pedagogy [2] has been recently formed in MADI. The head of the department, prof. Zhurakovskiy V.M., is the first deputy minister of education of Russia and also a member of the International Monitoring Committee of IGIP (EMC IGIP). One of the activities of the new department is connected with scientific studies in the field of engineering education and with the promotion of the results to the educational process of both students and young engineers, who are improving their qualification. Let’s list the prior scientific directions that are being developed in the department:

- Development of new integrated courses targeted at the development of creative engineering activity;
- Development of modern strategies of remote education based on computer technologies;
- Study and development of efficient strategies of group management;
- Study of alternative educational structures and pedagogical methods, concerning particularities of student groups;
- Study of possibilities and development of different forms of creative engineering activity of students in the process of institute education.
CONCLUSION

Efficiency of a country’s economic development depends on many factors, including investments to production. The prestige of the profession of an engineer is increasing in Russia. An engineer, whose qualification corresponds to the modern international standards, is always wanted. The system of engineering formation is developing. Theoretically and practically motivated monitoring of the necessary qualification requirements is being conducted. Conditions for the realization of unceasing professional growth of occupied engineers are being created. The market of educational services is developing; different forms of remote education are becoming popular.

Russia is studying the international experience in the sphere of engineering formation. The system of unceasing engineering formation, which corresponds to the international level, is developing in the conditions of real national particularities.
