



Role of the President's Program of Training Engineers in Improvement of the Research University Educational Activity

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In 2011 the number of engineers in Russia constituted 6 million which is 40% of all specialists with higher education. The statistics show that 8% of engineering graduates work as laborers and this number has increased by 6 times over the past 15 years, and their share of work - almost by 3 times. According to the survey, 75% of engineers work in their profession immediately after graduation. However, for only 43% the content of work matches the area of their specialization. Throughout the course of the engineers' professional development it is only 33% of them who work within their specialization. And yet, labor productivity in Russia as a whole is 10 times lower than in the leading countries, and its share in the world trade is slightly more than 1% [1]. The Russian industry doesn't use the advances in science, technological developments and achievements in modern technology efficiently. The manufacturers are actively pushed out of the market of high technologies and high-tech products.

In 2012 these circumstances have prompted the President of Russia to release the President's program (hereinafter - the Program) of training for engineering staff for 2012-2014. [2] Since 2013 Kazan National Research Technological University (KNRTU) is among the program's participants. Along with the use of a significant amount of funds from the federal budget co-financing specific programs, the funding bodies also include enterprise ordering customers (1/3 of the program's cost). The structure of the program includes training in the form of lectures and practical lessons (starting from 72 hours), final certification, internship inside Russia (up to 50% of the participants under the terms of the competition in 2013, at least 20% of participating audience in 2014) and an internship abroad (up to 30% of participants in 2013, and at least 10% in 2014).

In 2013 KNRTU presented 4 competition programs: "Advanced polymer nanocomposites", "Technology of organosilicon compounds", "Equipment and machinery of silicone manufacturers", and "Innovative trends and modernization of production of gunpowder". Two of these programs are announced for participation in the competition in 2014 along with two new programs: "Industrial safety in the implementation of modern helicopter technology" and "New power-saturated pyrotechnic-type materials and manufacture of equipment elements".

All programs were designed and developed in accordance with the demands of participating organizations, enterprises, and were subject to the requirements of potential and actual participants of our programs such as managers and professionals (engineering personnel) of the actual economy sector. The preparatory stage included establishing distance work with the production segment, primarily with the training departments. Continuous interaction with enterprises helped motivate students to prepare for general classes individually; they have managed to gain good practical material for the final examination. Teachers have developed new teaching materials, which are now widely used in the educational process and mainly in the training of high school teachers. New educational technologies used in the implementation of programs are successfully incorporated into in the main educational process. Among them – lectures given by foreign partners of the project, in person as well as in the form of video lectures, audio presentations, recurring to pools of knowledge from the client enterprises' and program partners' databases; in-built consulting, etc. The preparatory work also includes proposals for the introduction of new disciplines and modules and analysis for the development of new programs for further participation in the competition under the President's training program for engineers.

A strong team of teachers and executive organizers have been formed.

The implementation of all 4 programs helped improve the quality of the educational, staff, and organizational capacity of the university. The university received orders for the programs from new

customers. New and last-year agreements for the participation in the program have been drawn, and the number of specialists enrolled for the training within the program is expected to increase. No less important is the increasing trust on the part of the companies to the teaching and learning process within the framework of the programs that are meant to meet the developmental needs of the respective areas in the enterprise development. Customer representatives were actively involved in the management of the educational process, in shaping its content. The programs have largely ensured achieving long-term agreements between the university, the businesses, and other participants of the program such as the organizations engaged in consulting, providing information services, databases and training practices.

All participants successfully completed the program's certification procedures which resulted in issuing each participant a certificate of professional development.

According to students, the most effective educational technologies helping to better grasp the study material are practical (laboratory) classes and seminars, during which the teacher discusses the practical and professional issues from different perspectives.

During the process of program revision the proportion of laboratory studies was increased and they have become more practice work-oriented. The program students and faculty noted the high efficiency working in the format of "round table" which allowed not only to listen to a report or a lecture, hear about the final project and ask questions but also to jointly discuss the details of the process, consider the problem areas and discuss possible solutions to problems. In general, preference was given to the interactive forms of learning that will be considered in the design and development of advanced training programs in the future.

The suggestions made in the final examination work and project assignments of alumni have practical significance and can provide economic benefit from their implementation. The subjects of all final examination work were coming from from the real-economy enterprises, which were previously discussed and negotiated by both parties. Suggestions were aimed at improving industrial and environmental safety, automation of existing facilities, the possibility of their improvement and renovation. A certain part of works was devoted to the study of various properties of materials, production process design of a new range of products for certain enterprise (for example, students works from the "Start" enterprise named after Procenko M.V.), etc.

Participation in the implementation of vocational training programs for engineering staff in the framework of the general educational university programs contributes to the professional development of teachers, allows them to study best practices in the world's leading research and educational centers, at the leading industry enterprises, and improve educational technologies. University teachers developed lectures and workshops prepared for the Program participants based on the updated teaching methods with a variety of distance-learning technologies.

However, the experience of implementing the Program showed that many university teachers require further training to ensure compliance with the modern education, science and industry requirements. Therefore, the university assumed additional costs and included teachers into the traveling abroad study groups.

Upon completion of all stages of the program, participants were given the final questionnaire, which had the following objectives:

- assess the quality and effectiveness of the program as a whole; separate its theoretical and practical components;
- evaluate the effectiveness of internships;
- evaluate the efficacy and feasibility of using educational technologies, methods, evaluation tools

and procedures during the interim and final evaluations;

- receive comments and recommendations for making corrections to the program content, eliminate organizational shortcomings for further successful implementation of the program.

Summarized results of the survey are reflected in the table below. Questions in the questionnaire were formulated so that the audience had the opportunity not only to choose from a range of responses, but also to express their opinion in free form. The survey was attended by more than 80 per cent of trainees.

The analysis of the trainee results and comments revealed "narrow" places of the programs and ways of their improvement, and confirmed that all four training programs constitute an effective tool for improving one's professional competencies for the engineering staff of enterprises and organizations according to industry.

The survey reflected a keen interest in learning, the program's usefulness, and the need for continuation. Many noted the importance of the program for further career growth and the development of interest to regular skills development. In groups where the representatives of various specialized enterprises were getting their training, the students felt it was important and useful to exchange their opinions with colleagues. Especially memorable and impressive to the trainees of the Kazan Helicopter Plant were the on-line lectures of the scholars from Purdue University, USA. Consequently, it was that university in particular that later offered its platform for holding trainings for the specialists of the enterprise.

Table 1

Program	"Advanced polymer nano-composite materials"	"The technology of silicon-organic compounds"	"Equipment and machinery for the silicon-organic production"	"Innovative trends and modernization of gunpowder production"
Number of participants	35	20	20	16
Managers / professionals	15/20	10/10	8/12	9/7
Women / men	20/15	11/9	3/17	5/11
Age: under 30	16	11	7	7
31 - 35 years old	6	2	1	5
36 - 40 years old	4	2	3	1
Over 40	9	5	9	3
Professional experience: less than one year	5	9	7	-
1 - 5 years	12	7	6	13
6 – 10 years	5	3	3	3
Over 10 years	13	1 (over 25 years)	4	-

All of the participants expressed their willingness and desire to improve their skills and to participate in similar programs in the future. They have also noted that the topic of the program was

directly related to their professional activities and there were no useless modules in the program. There were also positive remarks on such forms of learning as practical exercises, discussions and critical analysis of specific situations, round-table discussions, and possibility of communicating with teachers as well as with students. Among the main learning outcomes they identified: broadening of their horizons, acquiring new skills, obtaining applied knowledge and learning new approaches. The main wish all listeners had expressed was to do more practical exercises. The average rating for the training according to the 10-point system was 8.

The evaluation of the Program by the employers also proved to be very high, their reviews posted on the Program website <http://engineer-cadry.ru/>. The effectiveness of work performed by KNRTU can be confirmed by orders from partner companies made for 2014 in anticipation of the next competition in the Program's framework.

For sure, all programs applied for the competition were focused on real demands of the Russian economy and corresponded to its modernization directions. Program content and the mode of study were defined by the enterprises request and competence level of trainees. Nevertheless it is possible to implement such teaching model in partnership with the government, business and educational establishments in different countries at any enterprise taking into account national mindset and educational traditions of the country. In this regard, positive foreign experience assimilation enriches every project. For example, it is worth including design of round student lab at the Arizona State University in career development system. Tables at the lab are round as well, so students get entire presented information from any seat. Besides, another advantage of American educational technology is visibility and opportunity to sense and touch new materials that are studied.

The question of participation of the university in 2013-2014 program for the conservation and development of the achieved positive results was considered at the meeting of the KNRTU Academic Council. At the meeting the positive impact of the program on the improvement of the university teachers' qualifications was remarked, as well as the development of new educational technologies, establishing partnerships with program participants from the leading Russian and foreign educational and industrial centers. A number of publications accounting for the results of the field visits is being prepared. They will be based on the knowledge gained through new contacts with Russian and foreign scientists. The Academic Council decided on mandatory participation of KNRTU graduate departments in the program. The priority of the department development would be the direction of the matching enterprises. A number of departments will take part in the new competition. A great deal of organizational work was held within the companies – the KNRTU partners that didn't previously participate in the Presidential program. Discussed are the directions to improve the content and form of existing programs, the topics of the planned implementation of new training programs for the engineering staff, and started to develop is the necessary training and methodological materials.

Prepared are the proposals for the development of similar regional program in the Republic of Tatarstan for the participation of enterprises and organizations in the petrochemical cluster.

In the process of implementation of the program some problems were revealed:

1. Although the competition was held in March, and financial resources for the implementation of the Program were received in a timely manner, the particularity of the operational mode of an educational institution with its summer vacation period allows enterprises to starting training only in September. Accordingly, the internships abroad were held at the end of the year, which made it harder to work with accounting documentation and perform timely closure of the program. The large time gap between the application and the start of implementation of the program leads to the fact that there inevitably occurs the replacement of students.

2. Another problem was the fact that the foreign partner organizations may change their mind about the internships held on their premises: because of the timing of implementation, due to the change of managers or responsible people, due to a change in the political climate, etc.
3. Despite the availability of high-tech equipment the related businesses generally do not have sufficient technical capacity to use modern educational technology, including the full implementation of the distance learning capacity, on-line consultations, etc.
4. An important task and, at the same time, a big challenge was the need for multiple trips for the team members and teachers – the Program participants and leaders of the final certification works needed to go for consultation on management practices and organizational issues to correct the content (making updates and revisions) of training programs, negotiations with organizations - places of internships, providing advisory services to students during internships and others. The budget cycle of the Program does not include travel expenses for these purposes.
5. Finally, significant difficulties in reporting were caused by various internal organizational procedures and accounting policies of partner companies.

Experience of the Presidential Program for training engineering staff represents a strong example of the fact that the businesses today's need professional training programs, and the universities are ready to provide them. However, these processes in Russia call for state support - organizational and financial. At the same time, such an integrated program involving different participants can be successfully implemented in different countries provided comprehensive international cooperation of educational institutions, scientific and industrial structures.

References:

1. Arefiev A.L. Engineering education in Russia in numbers. / A.L.Arefiev, M.A. Arefiev // Higher Education in Russia. - 2012 . - № 3 - p.122 -131 . S. 125.
- 2 . Presidential Decree of 7 May 2012 № 594.+