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**CAPACITY OF YOUTHS IN THE REPUBLIC OF TATARSTAN TO
DEVELOP TECHNICAL CREATIVITY**

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Abstract

The relevance of this researched problem is connected with the development of technical creativity and recruitment of talented youth into technical colleges of the Republic of Tatarstan (RT). The research purpose is to identify a child's interest in engineering, which plays an important role in determining competencies and further development of creativity in engineering in RT. Main research methods used in this work are practical experiments conducted among youths in order to determine their levels of regional attractiveness factors; the results gained by using this method prove that RT is an innovative and active region with a great number of enterprises working in the field of science and technology. This article provides summary results of the survey carried out among children interested in engineering in RT. Practical experiments conducted among youths to determine regional attractiveness factors are included in this research work. The experiment results have allowed us to identify the main factors and the level of attractiveness of the Republic of Tatarstan in the area of science and technology in comparison with other regions.

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Keywords: Scientific and technical creativity, robotics development, innovation base, machine-building cluster, youth potential, an attractive factor.



1. Introduction

1.1. The relevance of the research

The relevance of the research under study is determined by the development of technical creativity and bringing talented youth to the technological Universities of the Republic of Tatarstan. As of today, support and development of children's technical creativity is the significant priority of the national policy. The main task of our region with regard to educational institutions is extending and upgrading the activities aimed at developing scientific and technical creativity of children and youth. In that context, the given article is concerned with implementation of technical creativity in the younger generation, in the area of the Republic of Tatarstan.

1.2. The Bibliographical Survey

The problems of elaboration of technical activities began from the researches of Engelmeyer (1898), the first philosopher of technology in Russia and the author of «classics of philosophy» of technology and technical creativities, which was meant as efforts to create something new. In his book, «THE TECHNICAL RESULT OF XIX CENTURY», 1898, he focused on the study of technical creativity, and he designated the invention and the process of the invention as the creativity kernel of engineering. Engelmeyer (1898) supposed that the formation of any invention can be characterized by a so-called *rehakt* - desire, knowledge and skills, or in other words, goal-setting, formulation of a plan for achieving this goal, and its actual physical implementation.

This approach to the study of technical creativity was determined with a technical practice early XX century, when the technical and technological innovations came from specific individuals, and European socio-cultural meanings, linking technical creativity to art. That's why the emphasis in technical creativity of research is being done to develop the algorithms of inventing and solving creative problems. Noting the social and cultural conditioning of the creative process, most researchers focused on the cognitive and psychological aspects of creativity.

The problem of technological innovation was more difficult. Application of information approach to the study of creativity used by Charles Lumsden (1841-1945) - an early supporter of sociology, whose interests were partially in the mathematical and philosophical basis of the physical theory of the origins of creativity. Charles Lumsden said: «Innovation - is any discovery that has reached a certain level of recognition in the present society. To qualify discovery as an innovation, it must be broadcasted and, therefore, must allow the possibility of broadcasting». «Broadcast» or communication's connection, in the Soviet period of development of our country, in case of a major technological innovation, was not so much horizontal as vertical. That's why forms of technical creativity such as rationalization has flourished in the country; it did not require significant restructuring of production and was resolved at administrative structural level of companies, through horizontal communication links.

Speaking about the current stage of researches' development in the field of education and technical creativity, we should take note of the very popular works of the early XXI century, published in major Western European journals, in particular, the work of Lebaron and Collier (2001) - "The successful

implementation of technology in the school," Means (2000) - "Technology in American schools", Reiser's (2001) - "History of the institutional design and technology", which was published in the prestigious foreign publication "Educational technologies of research and development." It should be noted that all these works, in one way or another were devoted to the analysis of development of technical creativity and the introduction of information technologies in the educational process of foreign countries. At the same time, the articles had pedagogical orientations and focused on the training component; the main direction of our research, unlike the Western European's view, is to identify the different ways of implementing programs of technical education and the disclosure of the technical capacity of students both using teaching methods, and references to socio-political, creative and other sources. The interest in the problems of the students potential disclosure by implementing technical creation programs and elements in Russia has just begun, in different regions, as well as in the Republic of Tatarstan, monitoring of statistical data on the assessment of the effectiveness of such practices is on its way, meanwhile, there is still no holistic analysis of the problem in any region, so there is no doubt in the relevance of their research.

Currently, Russia is on the way of innovative evolution and broad using of scientific progress in the sector of real economy. Nowadays, with the shift of priorities toward economics, management and law, getting higher technical education by young people must be welcomed. An active person is able to express himself in non-standard conditions, to use the acquired knowledge flexibly and independently in different situations. A generally recognized necessity for this period becomes an interest in research and innovation, in scientific and technical creations. To the author's opinion, it is a kind of creative activity by developing of tangible products - equipment, which include the formation of new engineering brainchildren and implement them in creative projects. Anna Dzhordanous and Bill Keller in their work «Modelling Creativity: Identifying Key Components through a Corpus-Based Approach», published in 2016, wrote that creativity is a complex multi-faceted process that encompasses many aspects of skills, characteristics and behavior. This article describes a unique approach to development of a model and describes how a creative behavior forms itself, based on the words that people use to describe a particular concept.

Categories of «creativity» cannot be determined unambiguously. This is due to the ambiguity of understanding 'creativity' - from idea of pan-rationalism to product's features, or from lifestyle to the ability to think. Also it should be noted that the concept of creativity is still developing, which allows us to find new interpretations of this category. As a result, we get a diversity of definitions, in this case we describe creativity in four dimensions: the creative work / achievement; creative person / person; the creative process; and complex of social stimulants - the conditions of creativity.

The fact that technical spheres should contain creative component was stated by Safhalter and Pešaković (2015) in the article «Technical talent and technical creativity in lower secondary school students»; he wrote that the technical issues should include creative activities to promote the development of technical creativity in talented students. According to him, talent should be regarded as potential or characteristics which a certain student has. Then creativity can be described as an activity through which such talent is demonstrated. Safhalter and Pešaković (2015) conducted research among 109 students aged between 11 and 15 years in two junior high Slovenian schools. This revealed the existence of a correlation between the technical talent and technical creativity.

The qualitative leap in the development of new technologies is focused to the group of people, who can go beyond and create something that was not there in all life's domains. The great principles of socio-economic policies nowadays involve young people in the technical sphere of professional activity to improve the image of the scientific and technical spheres. In Russia, especially in the Republic of Tatarstan, engineering and technical areas are actively promoted among youths, the conditions for the formation of children's interest in scientific and technical creativity are produced from school years. The article «Factors of Appeal of Tatarstan's Prospects as a Region Suitable for Youth Technical Creativity and its Development», prepared by a group of authors (Muraveva et al., 2016), has modern approaches to the dissemination of scientific experiences in the spheres of science and technology. Presented methods, according to the authors, have given birth to the interaction between the various concepts in the growth of scientific and technical support and successful realization of children's and youth's potential in the Tatarstan.

2. Problem Statement

2.1. The elaboration of the problem

As noted above, currently there is no detailed scientific and applied researches on the study of the influence of technical creativity in the choice of profession and personal development of skills of young people in Russia. Most of the works devoted to the disclosure of scientific and technical creativity, are statistical in nature and reflect only the sociological data on the implementation of scientific and technical programs in various regions of the country. In this regard, we can conclude that the topic has not been developed in detail and requires more in-depth development in the aspects of identifying factors to develop scientific and technical potentials in youths, as well as in the construction of forecasts for the improvement of indicators in the region.

If we talk about of modern technologies it is very important to analyze needs of people in their spheres of life, needs of people who are involved into the modern technologies. Very important to involve new generations into the technical aspects of their professional activities and increase their possibilities in different fields.

3. Research Questions

3.1. Specialized education

In Russia, and especially in the Republic of Tatarstan, engineering and technical areas are actively promoted among the younger generation, and the conditions for the formation of children's interest in scientific and technical creativity are produced from school years. In turn, technical creativity generates interest in physics and mathematics, and Unified State Examination (USE) in these subjects determines admission to technical college. The preparation of the exam are based according to the subjects studied in educational institutions of physics and mathematics. According to the Ministry of Education, certain regions of Tatarstan presented a high performance of delivery of the USE in major subjects (Figure 01 and Table 01).

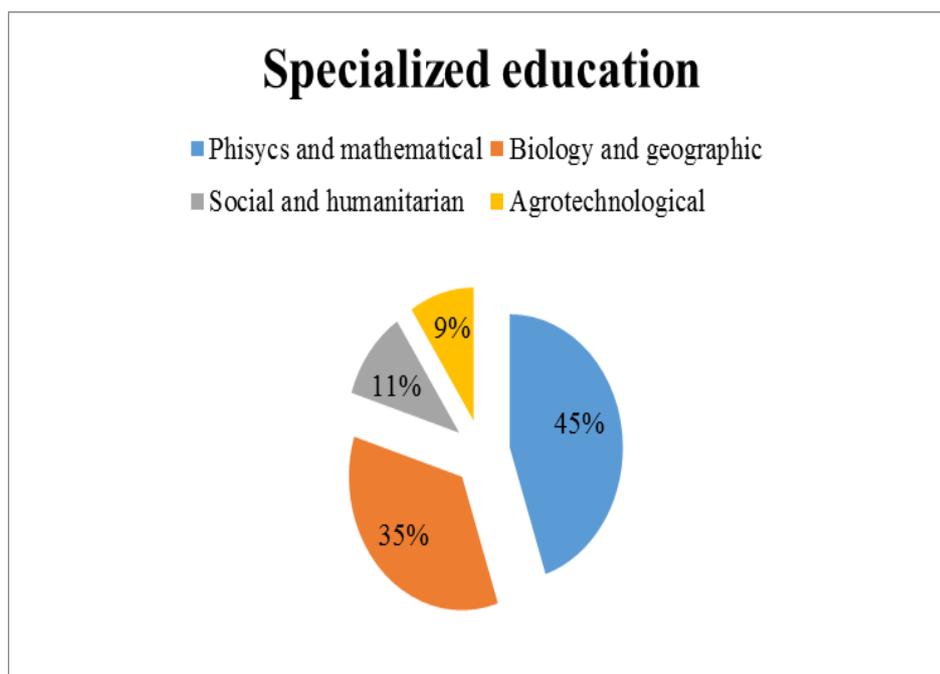


Figure 01. Specialized education

In the 2015-2016 school year, specialized education covers 75.5% of students (in the 2014-2015 academic year - 75%), the percentage of ninth-graders, from program of pre-specialized training during the last three years is 100%. High rates of coverage of specialized training were revealed in the cities: Naberezhnye Chelny, Agryz, Bugulma, Zainsk, Zelenodolsk municipal areas, and low levels - in Arsk, Baltasi, Kama-Ustyinsk municipalities.

3.2. USE results in specialized classes. Educational organizations of physical and mathematical profile

Analysis of the results of the state final attestation of students specialized classes shows that, as in previous years and in 2016, the coverage in some profile and number of graduates who passed the exam in major subjects, in general, are correlated. Many high school students study socio-economic and socio-humanitarian profile courses and mainly study subjects like social studies and history, respectively. These subjects occupy a leading position, and must be passed in USE. Basically, graduates who have studied subjects at the profile level in 2016, chose and successfully passed the USE on these subject. Their choice is not only due to the requirement of university, but also due to confidence in the successful completion of exam. Of the 24 graduates in Almetyevsk municipal district, who studied physics at the profile level, 23 (96%) passed the exam in physics, on the average score - 64. All 24 graduates, who studied mathematics at the profile level, choose exams in mathematics, and had average scores of 62.

Table 01. USE results in specialized classes. Educational organizations of physical and mathematical profile

Educational organization	Physics		Math	
	The proportion of passing students, %	Average score	The proportion of passing students, %	Average score
High school № 16, Almetyevsk municipal district of the Republic of Tatarstan	96	64	100	62
High school № 10, Elabuga municipal district of the Republic of Tatarstan	82,8	56,8	100	65,3
Lyceum № 1, Chistopol municipal district of the Republic of Tatarstan	96	67	100	69,5

A similar situation is presented in school number 10, Yelabuga municipal district: 82.8% of the graduates of the profile of physical and mathematical physics class decided to take physics, and got average scores of 56.8, 100% chose mathematics, the average score - 65.3.

In high school number 1 of Chistopol municipal district 96% of graduates of physical and mathematical class decided to take physics, the average score - 67, 100% chose the profile level math, the average score - 69.5. Thus, school performance profile training was organized efficiently.

Due to the increased interest of young generations in technical subjects (physics, mathematics) it can be predicted that the nearest future is likely to be filled with young professionals in technical related fields. Basing on this fact, the Republic of Tatarstan for the second consecutive year took part in the competition - World Skills Russia, and passed the Republican championship «Young Professionals» on Junior Skills standards, where 134 juniors from 17 municipalities of the Republic of Tatarstan competed for 16 High-tech expertise: aerospace engineering, engineering design, laboratory and chemical analysis, laser technology, roofing business, mechatronics, mobile robotics, neuro-piloting, prototyping, networking and system administration, turning and milling work with CNC machine tools, electrical work, and electronics, including two presentations: «roofing work» and «neuro-piloting».

4. Purpose of the Study

4.1. The purpose of the study

The aim of this study is to identify the scientific and technological potential of youths in the Republic of Tatarstan, through the study of various fields of educational and creative youth activities.

4.2. Objectives of the study

- 1) To analyze the dynamics of the development of scientific and technical creativity in youths in the Republic of Tatarstan;
- 2) Identify the factors affecting the increase in interest of youths to technical training issues;

3) Predict the possibility of further development of training programs for technicians, using methods of technical modeling , etc .;

4) Develop a strategy for the development of technical creativity programs of youth in the territory of the Republic of Tatarstan.

5. Research Methods

5.1. Research techniques

During the study following methods were used:

-Theoretical (analysis, synthesis, concretization, generalization) - on the basis of which questions and topics for the survey were compiled, collected and analyzed. Theoretical information about the problems of implementing projects aimed at the development of technical creativity of youth, allowed to formulate a questionnaire on the assumption of ability to confirm these possibilities in data and identify possible ways to solve the problem;

-diagnostic (questionnaire) - was conducted according to the established rules of confidentiality. The target group were high school students and students of universities of the city of Kazan. The task force was fully represented, the participants represented the social segment - the youth of the Republic of Tatarstan. Personal questions had as open and closed character (some of the questions included the choice of options, and some others involved free response on thoughts about a given topic), and the results were processed by the authors.

- Empirical (the study of experience of educational institutions, regulatory and instructional documents, pedagogical supervision) - allowed to identify the positive and negative aspects of practical activities of social institutions aimed at introducing elements of technical creativity in the educational process, as well as motivating students to develop their scientific potential.

- Experimental (methods of mathematical statistics and graphical representation of results) - the survey results were processed in Excel and PowerPoint universal programs with the aim of demonstrating the availability of the results by charts, tables and graphics to fully reflect the results of the study.

5.2. The experimental research base

Experimental research base is the territory of the Republic of Tatarstan, Kazan. Questionnaire base - young people of the city of Kazan, the age limit - 14-26 years. Tools of the survey - questionnaires and checklists.

5.3. Research stages

The study was conducted in three phases:

In the first stage, a theoretical analysis of the existing methodological approaches to the philosophical, psychological and educational research literature, dissertations on the issue, as well as the theory and methodology of educational research were carried out. The problem, the purpose and methods of research was highlighted, the plan of the pilot study was made.

In the second stage, experimental work was carried out, the findings obtained in the course of experimental work were analyzed, tested and refined.

The third experimental stage included the completion of theoretical and practical findings. The results were compiled and systematized.

6. Findings

Currently, there is a sharp jump in the field of technical creativity in innovative development and as a result we can see an increased interest in engineering professions in the world. In the Republic of Tatarstan, engineering and technical areas are actively promoted among the younger generations, and the conditions for the formation of children's interest in scientific and technical creativity are produced from school years.

Due to the increased interest of youths to technical creativity it can be predicted that in the nearest many youths would be associated with technical profiles, to be exact - robotics, because an active introduction of the mechanisms on our lives will require a large number of professionals who will implement and maintain it. For the period of 2015, 381 union covering 7458 people were created in the Republic of Tatarstan

The development of additional education systems was allocated 52.6 million rubles. The development of technical creativity of children, robotics, and development of technical competence - 34.7 million rubles. In the period of 2015-2016, the Republican festival of municipalities of the Republic of Tatarstan was held to support and develop children's technical creativity. In the final event of the festival more than 1,200 people took part (Table 02).

Table 02. Technical creativity of children

Indicator	2013-2014 year	2014-2015 year	2015-2016 year
Number of children, who engaged in technical and technological creativity in institutions, relative to the total number of students. (%)	11,2	12,9	12,9

Basing on the results provided by the development of scientific and technical creativity of the Republic of Tatarstan, it can be determined that the innovative potential of the young generation is on the path of progressive development. On the attractiveness of Tatarstan as a place to realize one's potential, we questioned students of technical universities and colleges. Survey results are presented below.

The competition of the Republic of Tatarstan with other cities of federal significance today is quite a serious matter. So the fact that 73% of respondents said that Tatarstan will be able to compete with most of the cities of federal importance in 10 years, and will be one of the major rich regions, was a pleasant discovery for the authors.

In addition, respondents believe that social security is much higher in Tatarstan than other regions. It noted 69% of respondents, while 31% disagreed. The author considers it a favorable moment, where 78% of respondents believe that the RT is an attractive region for investment.

One of the most important results of the survey was the response to the question: «Would you have returned to the Republic of Tatarstan after study abroad?», 34 respondents answered positively (Figure 02).

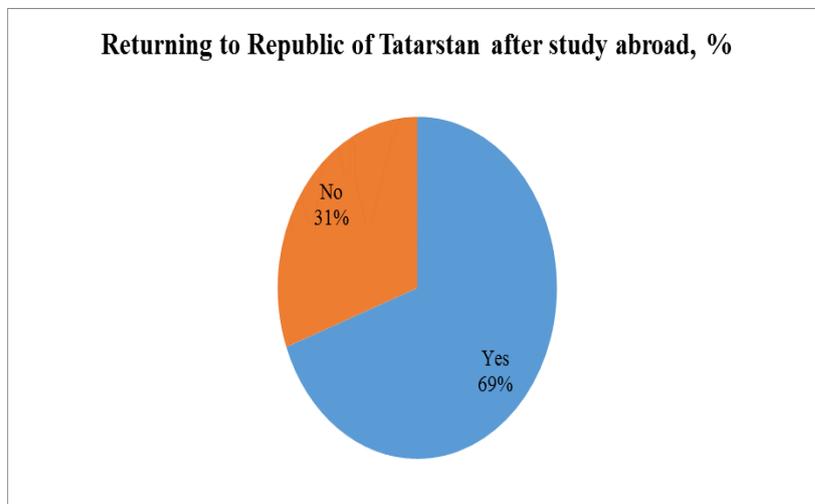


Figure 02. Respondents' opinion about further potential of RT after studying abroad

According to the study among youth of Tatarstan «Tatarstan attractiveness factors for youth», the following rankings of popularity among the youth of regions were received (Figure 03).

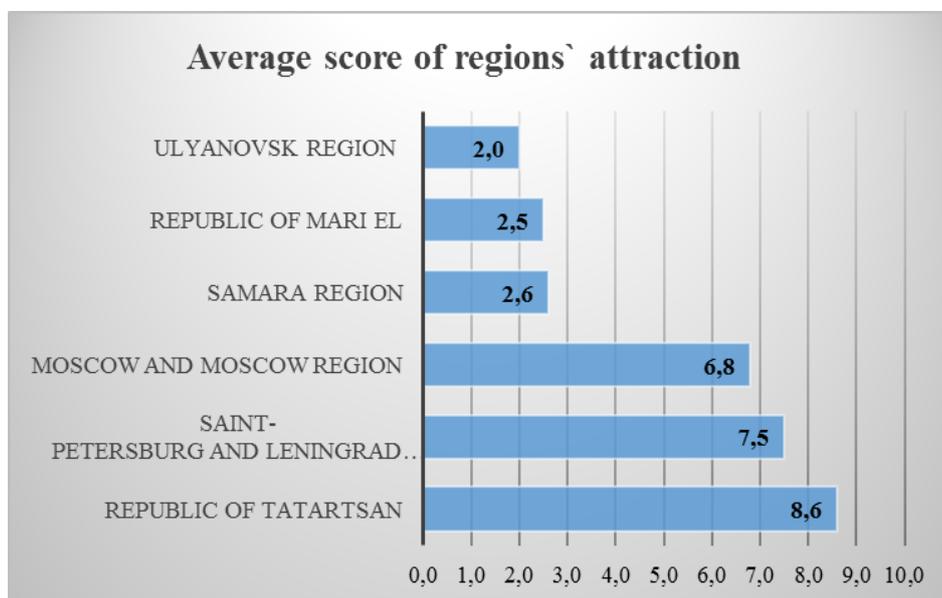


Figure 03. Regions' potential by the youth's opinion

Diagram of the most significant factors distribution were defined (Figure 04).

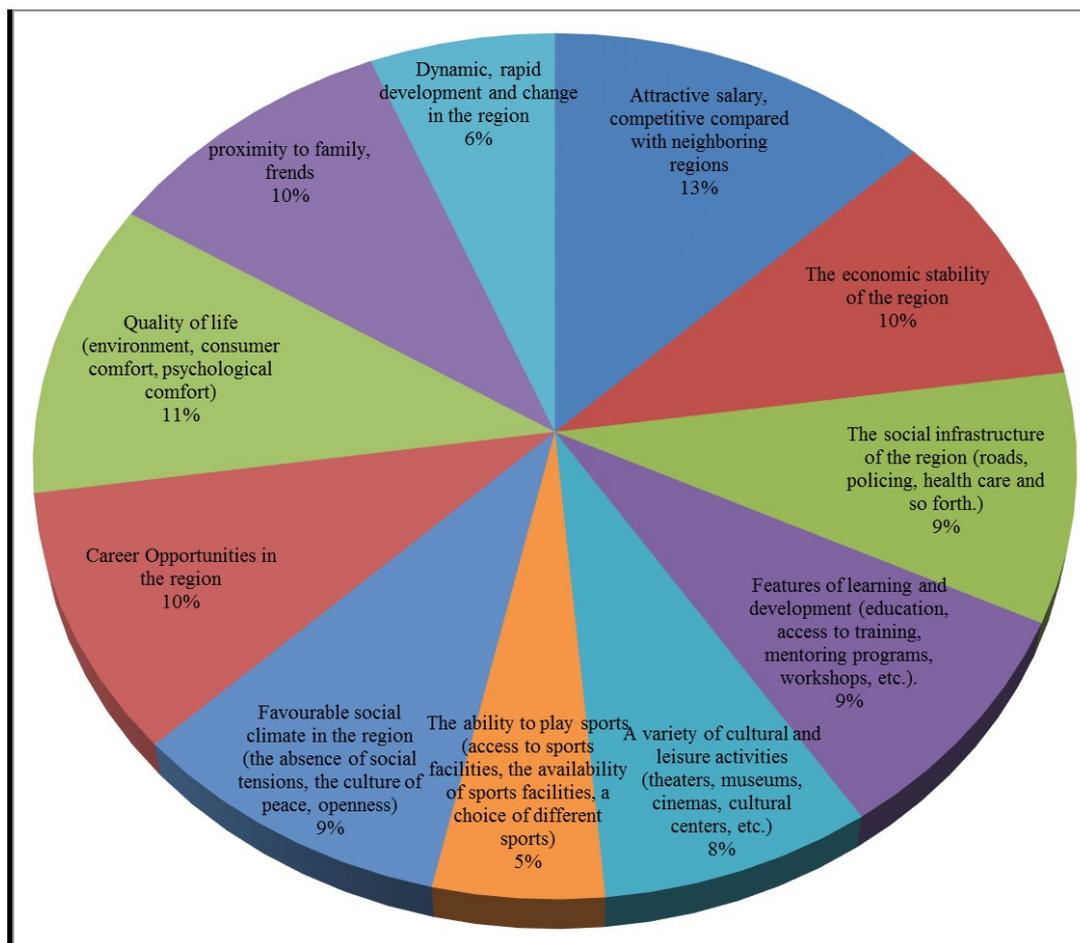


Figure 04. [Factors of attractiveness of the region for youth]

The theoretical contribution of this research to scientific and educational literatures is completed analysis of statistical data, reflecting the situation in the sphere of children's technical creativity, which, in turn, is the basis for applied research. Development programs aimed at attracting young people to the technical education at all levels of education, and predicting the influence of various social factors on the dynamics of development of youth potential in the field of technical creativity in the Republic of Tatarstan.

7. Conclusion

As a result, it is very important to affect young people into technical and scientific area of technical and scientific professions. One of the most important factor of the economic growth of regions is to provide that country is economy of engineering and technical business and organizations of the Republic. Assistance to increase technical creativity will be helpful for the future specialist to enhance their activity, and can promote professional self – determination, improve quality of work, productivity, accelerate development.

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