

Higher Education Interaction Factors in Improving Quality of Preparation

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Abstract

In Russian National Security Doctrine 2020, one of the improvements of higher education is the development of “interaction of educational organizations and research centers with industrial enterprises”. The document “development of secondary vocational education system in order to prepare qualified workers in accordance with the best world standards and advanced technologies” is interpreted as an important condition for ensuring national security in the field of science, technology and education. In our opinion, it’s cannot be realized without the involvement of the economic, technological and managerial resources of industrial enterprises, and, consequently, the organization of the network interaction of higher educational organizations and enterprises. This study is devoted to the organization of networking of institutions of higher education with enterprises, which was developed in accordance with the basic requirements of employers. The effectiveness of this approach to learning was proven during a research experiment.

Keywords: student-centered education, project activities, engineering and manufacturing activities, dual training, network cooperation

Summary

Nowadays Russian higher education is divided into two phases: Bachelor and Master's degree course. The tasks of developing and modernizing the education system are primarily related to the transition of the Russian Federation to the “high-tech industrialization” path, which is expressed in new approaches to the quality of training highly qualified specialists. The above path is directly related to the network interaction of higher education institutions and stakeholder enterprises, on the basis of which the implementation of dual training becomes possible. The need to introduce such training is also reflected in documents at various levels. This study focuses on the educational program for mechanical engineers, which was developed in accordance with the basic requirements of employers. The effectiveness of this training approach was tested during a research experiment. This demonstrated the hypothesis that an improved model of student learning leads to a more active and efficient learning process; includes an individual approach to each student and contributes to a more effective development of professional competencies.

1. Introduction

Nowadays the main goal of Russian higher education is to meet highly qualified experts capable of professional growth in the context of rapid technological changes and the introduction of new innovative equipment. Higher education in Russia recently switched to a two-stage education system, namely, a bachelor’s and master’s degree course. At the same time, the practice, which is still insufficient for the preparation of bachelors, shows that the use of traditional educational technologies and traditional didactic aids with significantly reduced training time is not able to provide high-quality training of qualified specialists for modern high-tech industries. The urgency of the problem of organizing network interaction of professional educational organizations and enterprises is due to the fact that the development of a higher education system in accordance with the demands of the market is impossible without attracting the economic, technological and managerial resources of industrial enterprises. The historical analysis of the problem of organizing network interaction between institutions of higher education and enterprises consists of the genesis of three directions: 1) the emergence and development of higher education; 2) analysis of the problem of network interaction of higher educational organizations and enterprises; 3) the formation and development of dual education in Russia. For this reason, this study is aimed at finding a solution to an important problem of higher education; there is an acute shortage

of engineering and technical personnel and skilled workers in the following industries: engineering, military-industrial complex and electronics. Studying the problem of training highly qualified personnel in the framework of the organization of network interaction between higher education institutions and the enterprise-stakeholder, we can conclude that it is necessary to improve this process by creating some kind of image - model. In our case, the model will act as a reference point for all subjects of interaction: representatives of higher education institutions (students, teachers, industrial training masters, administration) and stakeholder enterprises (managers, employers, mentoring workers), while the former provide human resources, and the latter provide material technical conditions. The development and implementation of the model will make it possible to anticipate goals and objectives select the necessary methods, means and forms of training future highly qualified and competitive workers, identify criteria and indicators for assessing the quality of dual education implementation within the network of higher education institutions and enterprises.

2. Literature Review

The study of foreign scientific literature shows that professional education is influenced by such factors as human self-development (SOARES, 2006), state educational policy (Washington Agreement), quality of education (CHALETA, 2018), etc. Based on the analysis of psychological and pedagogical literature (BATYSHEV, 1998; SLASTENIN, 1999; SOVOLOVA, 2003; SOVOLOV, 2006), and also on the basis of the pedagogical experience of the author, the author comes to the conclusion that it is possible to ensure a high level The development of professional competencies in bachelors is carried out this way:

1. Personality-oriented approach (SOKOLOVA; TEREKHINA, 2013; STEPHENSON; TROY, 2003) will help to theoretically weigh and calculate the strategy for developing and implementing a model of network interaction between institutions of higher education and the enterprise. The implementation of dual training based on the ideas of a student-centered approach will lead not only to the formation of students' knowledge and skills necessary for production, but also to developing their personal potential necessary for future socialization.

2. Technological approach (Self-study report for review of the program leading to the degree of Bachelor of Science in Engineering by the ABET, 2001), specially developed program-methodical and didactic teaching aids (GURGEL, 2013) in relation to our research answers for general tactics. With its help, we will be able to evaluate the effectiveness of the implementation of the developed network of interaction between the professional educational organization and the enterprise, as well as its main result - the quality of student training. The technological approach to the organization of dual education in the framework of network interaction presupposes its clearly defined goal, a rational approach to the selection of methods, forms and means of achieving it. The main advantage of using the technological approach is the diagnostics of the goal and controllability of the whole process of dual training.

improve the quality of training of students in the process of practical training, implemented as part of a network of institutions of higher education and the enterprise-stakeholder, it is important, in our opinion, to combine the efforts of industrial training masters, teachers, mentors from the company and the students themselves through coach technology. . The use of coaching technologies in the process of work experience in obtaining professional skills and professional experience (including production and technological practice) allows you to adapt the educational process to the individual characteristics of the student and make it more effective, is a promising form of improving the training of highly skilled workers based on the principle of problem and modeling future professional activities. Coaching in vocational education is considered as a method of training, educating and managing the development of the personality of students, aimed at shaping their activity, independence, initiative and "courage to act". Coaching technology allows you to unleash the personal abilities of students and teachers (mentors), their internal resources, and foster readiness for change. The use of coaching technologies by mentors and teachers during the traineeship of work experience helps to develop their subjectivity, expand the range of vision and understanding of various production situations, including freelance, life and professional problems, form responsibility for themselves and their actions, identify their individual style of professional activity (Talebi & Nejad, 2019; Kudaibergeneva et al, 2019).

3. Questions and Methods

3.1 Methods

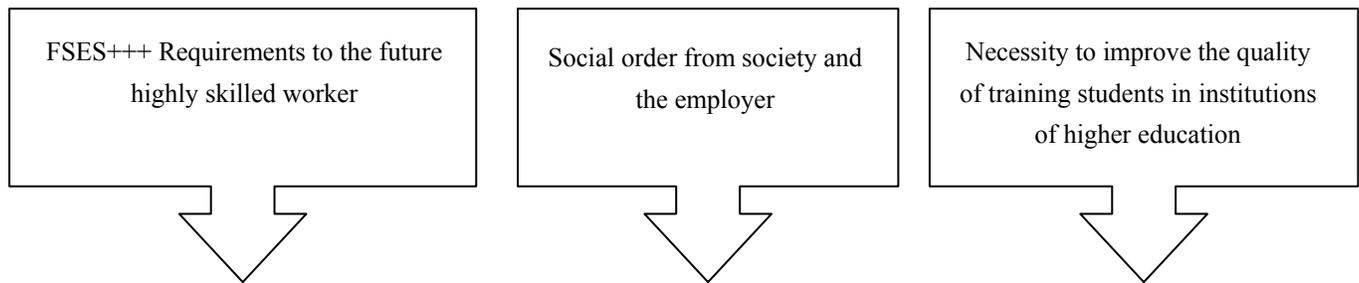
As part of the study, we used the following means of implementing coaching technologies in the process of internship at the enterprise. The method of "competition" or "professional competition." The students encounter this method even during the period of recruitment into groups in which dual training is being implemented jointly with the company, as in these groups students study the selection of technical disciplines with cases, and mentors from the enterprise. The developers determine the structure of the technical case and the rules for the implementation of each of them. The

problem proposed in the technical case does not have an unambiguous solution and requires students to have a number of skills: to determine their own selection criteria from a large number of alternatives, to come up with an appropriate solution based on them, to develop an algorithm of actions for its implementation and describe it in a competent technical language.

As objective prerequisites for building a model of network interaction between institutions of higher education with enterprises and enterprises in order to implement dual training, we can name:

- Presence of an employer in the region interested in implementing dual training at its base;
 - Availability of a higher education institution capable of fulfilling the order of the enterprise;
 - Presence of a professional educational organization of social partners; the possibility of carrying out all kinds of practices at the enterprise-stakeholder;
 - Possibility of internships for industrial education masters and teachers of special disciplines at the enterprise;
 - Participation of representatives of the enterprise-stakeholder in assessing the quality of training
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 - Possibility of internships for industrial education masters and teachers of special disciplines at the enterprise;
 - Participation of representatives of the enterprise-stakeholder in assessing the quality of training of students in the composition of the qualification commission of the final state certification;
 - Possibility of using the material and technical base of all participants in the network interaction;
 - Interest of the regional administration in the formation of an educational cluster with the participation of professional educational organizations, educational organizations and enterprises;
 - Possibility of selecting the best students for the conclusion of student and employment contracts;
 - Ability of an enterprise to influence the content of education and the organization of the educational process in a professional educational organization.

Taking into account these prerequisites, we have formulated the goal of implementing the model - improving the quality of training students in higher education institutions through network interaction with the enterprise and the implementation of dual education on its basis. The structural-functional model of network interaction between an educational organization and an enterprise that we developed is shown in Figure 1.



		Higher education institutions activities		Activities of the enterprise-stakeholder
Motivational block	<i>Functions: goal-oriented, motivational</i>	<ol style="list-style-type: none"> 1. Adjustment of selected educational programs in conjunction with representatives of the employer. 2. Conducting a substantive examination of professional modules by representatives of the enterprise. 3. Coordination of work programs of educational and industrial practices in the enterprise. 4. Work with applicants together with representatives of the company to include them in groups with elements of dual training 		<ol style="list-style-type: none"> 1. Order necessary for the production of workers. 2. Conclusion of a cooperation agreement with a professional educational organization. 3. Substantive examination of the work programs of special disciplines and professional modules by leading specialists of the enterprise. 4. Identification of mentors and their preparation for the implementation of dual training.
Organizational and informative block	<i>Functions: organizational, managerial, regulatory, methodical</i>	<ol style="list-style-type: none"> 1. Consolidation of students with managers from a professional educational organization. 2. Identification of the need for advanced training of teachers of special disciplines and masters of industrial training. 3. Conducting laboratory-practical classes on the basis of educational organizations with the involvement of representatives of the enterprise 4. Definition of production units and scheduling internships for teachers and industrial education masters. 5. Scheduling the distribution of students in industrial practice at the enterprise. 	The organization of dual training on the basis of the educational organization and the stakeholder enterprise Theoretical training takes place on the basis of a professional educational organization, practical - on the basis of a stakeholder enterprise	<ol style="list-style-type: none"> 1. Organization of mentoring and internships for students. 2. Securing the mentors of mini-groups of students for the transfer of production experience. 3. Organization of student jobs for the implementation of dual training. 4. Conducting extracurricular activities with representatives of the enterprise 5. Conducting substantive examination of special disciplines 6. Organization of temporary employment in the enterprise for the holidays 7. Organization of internship for teachers of special disciplines and masters of industrial training.

<p>Activity block</p>	<p><i>Functions: developing, cognitive, production methodical</i></p>	<ol style="list-style-type: none"> 1. Quality control of internship at the enterprise by its leaders from the technical school. 2. Input control of the level of knowledge and skills before practicing 3. Quality control of students' training during intermediate certification. 4. Internships for teachers and masters of industrial training at the enterprise. 5. Organization of the participation of students studying with elements of dual training in professional skill contests and WorldSkills contests. 	<ol style="list-style-type: none"> 1. Production activities of students under the guidance of mentors. 2. Mastering by students at the workplace a sequence of technological and production operations ensuring the assimilation of professional competencies. 3. Modeling the content of the professional activity of the worker, social and social working conditions 4. Assistance in the adaptation of the student to the conditions of the enterprise. 5. Assessment of the quality of production activities of students from mentors and company management.
<p>Estimated performance block</p>	<p><i>Functions: diagnostic</i></p>	<ol style="list-style-type: none"> 1. Estimation of the level of quality of preparation of students during the intermediate and final certification. 2. Monitoring the employment of graduates in the enterprise. 3. Deciding on the adjustment of the content of the network interaction model, based on its effectiveness. 	<ol style="list-style-type: none"> 1. The participation of the employer in the final certification of students studying with elements of dual training. 2. Recruitment of these students. 3. Decision making on further participation in network interaction.

Criteria for assessing the quality of the preparation of students of professional educational organizations: motivational and value, cognitive, personal, activity

The quality levels of training students studying with elements of dual education: low, threshold, medium, high

Result: assessment of the effectiveness of the network model of professional educational organization and enterprise through an assessment of the quality of training students studying with elements of dual training

Figure 1. Model of network interaction of institutions of higher education with enterprises

The author of this study defines the motivational unit as an integrative characteristic of the ability and readiness of a graduate to organize networking with an enterprise and to form a positive motivation for this process. At this stage, the enterprise's need for the necessary production workers is determined and an agreement is concluded with a professional educational organization. The pedagogical team, together with leading specialists of the enterprise, develop requirements for a graduate studying within the network interaction with elements of dual training, define criteria and indicators by which it will be possible to judge the quality of students' training, identify and describe the levels of training: low, threshold, average, tall.

Within the framework of this block, the following functions are implemented: goal-ensuring - the formulation of the goal of implementing the network interaction model and the main steps to achieve it; Motivational - the formation of a positive motivation for the implementation of the network interaction model among all stakeholders of this process, an explanation of the main prospects and advantages of its implementation; The organizational and informative unit assumes the content filling of the dual learning process. The students are assigned to supervisors from the technical school and mentors from among the leading specialists of the enterprise. Pupil jobs are organized at the enterprise;

mini-groups of students are assigned to mentors. The production units where the practice will take place are determined; internship schedules are drawn up in accordance with the availability of training places and production units.

The functions of the content block of the model are: organizational and managerial - making management decisions regarding the organization of network interaction and dual training; regulatory - the distribution of the roles of all subjects of network interaction (students, mentors, leaders of practice, management of the enterprise), the definition of requirements for them, as well as their capabilities, rights and responsibilities; methodical - development of the necessary methodological documentation for the implementation of dual training. The activity unit is focused on the development of production activities at the educational workplace: students master the necessary technological and production operations, become familiar with working conditions, adapt to the team, the process of exteriorization of production activity values takes place. The role of mentors consists in directing the students' production activities: they explain and show in practice the necessary production operations, starting with the simplest and gradually complicating it, help students to adapt in a team, to establish the necessary communication processes. Students adopt positive production experience mentors, aware of the dynamism and multitasking of the production process.

The evaluation and performance unit provides for the assessment and determination of the actual level of quality of student training, the formation of which was the process of dual training. The quality of students training is determined in the process of intermediate and final certification with the participation of representatives of the employer, as well as in the course of a special diagnostic study. The decision to assign a particular level of quality to the training of each student is based on expert judgment, in which representatives of professional educational organizations and enterprises participate.

The following functions are implemented within the framework of the evaluation and performance unit: diagnostic - assessment of the achievement of planned goals and objectives within the network interaction model (it is worth noting that not only formed competencies, but also personal qualities necessary for successful production, according to employers, are evaluated) ; control - comparison of the results with the criteria, the decision on the distribution of students in levels; analytical - a summary of the results obtained, their interpretation, the decision to adjust the content of the network interaction model. For the effective functioning of the model, it is necessary to single out the principles of its functioning based on the chosen approaches: system-activity, personality-oriented and technological. To improve the quality of training bachelors, a model was created to train bachelors in the technical field (Figure 1).

This training model was applied throughout the entire period of study. After being taught one program in their first year of study, each student chose one of the three training areas in the second year: research, industrial-technological, or design-engineering. During further training, students carried out all the projects in accordance with the chosen area. All the practical assignments and projects were performed on high-tech equipment assembled in the laboratory of the university. Practice in production was also carried out in accordance with the chosen educational trajectory. Teaching of all special disciplines was accompanied by teaching applied professional programs (AutoCAD, SolidWorks, Compass, etc.). Thus, all professional skills were obtained in the information field of the future specialty.

The peculiarity of this model is the expansion of the study of information technologies due to the variable component that will allow studying the fundamentals of general and special disciplines and then acquire professional abilities and skills in the use of information technologies and implement term projects and practical assignments only in an electronic version with the use of applied professional programs used in real production. This will allow students to form professional competencies for carrying out successful industrial activities in the future or pursuing a master's degree.

4. Results

The goal of the research was to confirm the effectiveness of the personality-oriented model of training bachelors for professional activities in high-tech enterprises.

For a long time, Russian higher educational institutions used the traditional system of education, which was aimed at developing solid professional knowledge. It formed exactingness and prepared in-demand specialists. The traditional educational system has a number of drawbacks, in particular, the reproductive ways of learning prevail, and the university eventually prepares a standard specialist who is not adapted to real industrial problems. Therefore, there is a need to reform higher education. As a consequence, Russia joined the Bologna agreement in 2003.

Within the framework of the effective implementation of the network model of interaction between professional educational organizations and enterprises, the condition we have provided provides:

- Improving the quality of training of students in the process of practical training through the variety of forms of their interaction with mentors and teachers;
- Adaptation of the process of practical training to the individual characteristics of each student;
- Development in students of independence, activity, initiative, necessary for the future effective production activities; - modeling of the production process, including non-staff production situations;
- Giving the process of practice the atmosphere of competition, which increases the motivation of students;
- Activity character of practical training;
- Substantial content of the model of network interaction with the forms, methods and means of interaction of mentors, teachers and students;
- Intensification of the process of network interaction through the focus of all of its subjects on the performance, i.e. to improve the quality of training students;
- Enrichment of the mentoring system at the enterprise by co-technology, which allows to reveal the personal potential of not only the students, but also the mentors themselves;
- Determination of criteria and performance indicators for the implementation of the network interaction model.

In her study of individual-psychological peculiarities of an engineer's personality, E.S. Chugunova notes: "[...] the nature and content of engineers' labor distinguish them into a specific socio-professional group, and the training of their activities requires a special approach" (Chugunova, 1991).

In addition, in conjunction with employers, it is important to form qualification requirements that graduates need for successful professional activity in high-tech enterprises. The qualification characteristics of future engineers should give the right to carry out engineering activities in the countries of Europe and America, in other words, they should meet international educational standards.

To use the proposed model in training, the author of the research developed unique training programs in the Borland Delphi environment, which are designed for students to solve problems in the modeling of various technological processes and operations in high-tech mechanical engineering enterprises. The training programs include: "selection of equipment and tooling for operations of technological processing", "modeling of operations of the technological process obtaining optimal parameters of accuracy", "modeling of the calculation of cutting modes", etc. At the same time, the programs provide an interactive mode of research, as well as allow students to examine production tasks and find optimal solutions to the established tasks and problems.

The materials obtained in the course of the research can be applied in the process of preparing future highly skilled workers for the organization of networked institutions of higher education and stakeholder enterprises and the implementation of dual training on their basis.

At the end of the experiment, the effectiveness of the development of professional competencies in students was evaluated by the results of ascertaining and formative experiments.

The study was conducted in 2012-2017 at the department "Technologies of automated engineering" of the Moscow Polytechnic University with the involvement of students studying mechanical engineering.

In accordance with the experimental plan, the following stages were carried out at the establishing, shaping and summarizing stages: - a zero slice, which allowed assessing the initial quality level of students' training at a professional educational organization and confirming the need to involve consolidated efforts of the organization of vocational education and the enterprise-stakeholder within the network; - the first and second intermediate sections, which revealed a positive change in the quality of training of students under the influence of the developed model and the identified pedagogical conditions; - the final slice, aimed at assessing the quality of training of students of professional educational organizations after the implementation of the model developed by us and the conditions for its successful implementation.

We notice that four experimental (EG1, EG2, EG3, EG4) and one control (KG) groups that had similar initial indicators took part in the pedagogical experiment, which was confirmed by statistical analysis using the χ^2 criterion. Consequently, the results obtained during the experimental work will be correct.

Analysis of the results of the first intermediate section confirmed our assumption that the implementation of dual training within the network of higher education institutions and enterprises will positively affect the quality of student training. We see that in all experimental groups the number of students with a threshold level of quality of training has

decreased and the number of students with an average and high level has increased. We assume that subsequent diagnostic cuts will also reveal an emerging trend towards improved performance across all criteria. During the implementation of dual training, students work under the guidance of mentors, on modern production equipment, they are trained in new educational programs - all these factors undoubtedly have a positive effect on the quality of their training, motivate them to obtain the necessary theoretical knowledge and practical skills to master the working profession. Students see with their own eyes how the production team of the enterprise works smoothly and efficiently, what good working conditions at the enterprise, try to work on the new high-tech equipment and begin to evaluate the prospects for their employment in this organization, which in turn becomes another motivating factor for successful study. The majority of students in experimental groups dominate the average level of development of all criteria. This means that their training and production activities cause them mostly positive emotions, students have formed ideas about their future professional activity and their role in it, about certain stages of the production process for the chosen working specialty, about worker's duties, the available body of knowledge and skills are sufficient for successful performance of production activities. Students of experimental groups are realistic about their capabilities in the production process, are confident in its effectiveness, but at the same time they do not always responsibly approach the fulfillment of the training and production tasks, adequately relate to failures. The quality of the fulfillment of educational and production tasks by students is of a normative character, the knowledge and skills obtained are transferred to the practice of production. We see that in the control group the quality of students' training also improved: the majority of students dominated the average level of the desired quality; however, students with a high level were 12% less than in the experimental groups. It can be concluded that the educational process, which takes place in the standard conditions of a professional educational organization, has a positive effect on the dynamics of the quality of students' training, but at the same time it is not as effective as dual training within the network interaction.

Comparing the results of the first and second intermediate sections, we see that in all experimental groups the number of students with medium and high levels of quality has increased. The highest results are predictably recorded in the EG4 group, where the number of students with a high level increased by more than 20%. It is worth noting that the implementation of the network model of interaction of professional educational organizations with enterprises against the background of special teaching conditions led to the fact that already at the second intermediate section in the experimental groups not a single student with a low level was identified. At the same time, we emphasize that the results of the control group practically did not change compared to the first intermediate section.

The distribution of students of professional educational organizations by the generalized level of the quality of their training at the second intermediate section is given in Figure 1.

Table 1. The general level of quality training in professional educational organizations during the mid-year assessment

Group	Number	Criteria Formation Levels							
		low		liminal		average		high	
		abs.	%	abs.	%	abs.	%	abs.	%
KG	25	1	4,00	8	32,00	13	52,00	3	12,00
EG1	25	0	0,00	3	12,00	11	44,00	11	44,00
EG2	23	0	0,00	2	8,70	12	52,17	9	39,13
EG3	25	0	0,00	3	12,00	12	48,00	10	40,00
EG4	23	0	0,00	2	8,70	8	34,78	13	56,52
Total	121	0	0,82	18	14,88	56	46,28	46	38,02

Analyzing the results of the second intermediate section, we found that in all experimental groups, in contrast to the control group, there were significant improvements in all the criteria we identified. We see that in groups EG1 and EG3 there is approximately an equal number of students with medium and high levels. Group EG2 is a little behind other experimental groups: 52.17% of students recorded an average level, 39.13% had a high level. In group EG4, the most intensive positive dynamics is observed: only 2 students have a threshold level, 8 have an average and 13 have a high level of quality in their preparation.

Table 2 presents the results of statistical analysis on the second intermediate section.

Table 2. Amount of Pearson's chi-squared test during the mid-year assessment

No.	Compared groups	Amount of chi-squared test	Table value of chi-squared test
1.	KG-EG1	3,947	
2.	KG-EG2	5,056	3,841
3.	KG-EG3	3,947	by p=0,05
4.	KG-EG4	5,056	

The study using the Pearson's chi-square test showed that during the mid-year assessment were statistically significant differences between the control and all experimental groups. The most significant differences were recorded between the control group and groups EG2 and EG4. This indicates that the observed significant changes in the quality of students' training did not appear under the influence of random factors, but were the result of the implementation of the pedagogical model developed by us and the pedagogical conditions that ensure its effectiveness. The final diagnostic slice took place within the framework of the generalizing stage of experimental work and coincided in time with the implementation of the estimated and effective unit of the model.

Table 2 shows the results of statistical analysis during mid-year assessment.

Table 3. Amount of Pearson's chi-square during the final assessment of students

No.	Compared groups	Amount of chi-squared test	Table value of chi-squared test
1.	KG-EG1	10,272	
2.	KG-EG2	8,600	6,635
3.	KG-EG3	10,272	by p=0,01
4.	KG-EG4	16,326	
5.	EG1-EG4	1,043	
6.	EG2-EG4	1,533	
7.	EG3-EG4	1,043	

As a result of applying the Pearson's chi-square test, we found that there are significant differences between the control and experimental groups. The most significant differences were recorded between the groups of the KG and the EG4. These results allow us to reject the null hypothesis and conclude that the differences in students' training levels in the experimental and control groups are not random, they were determined by the implementation of the model of network interaction between institutions of higher education and enterprises developed by us and the totality of pedagogical conditions ensuring its effective functioning. . The results obtained by us can be obtained repeatedly when implementing the developed model and the identified pedagogical conditions.

Summarizing the above, we note that the result of the approbation of the pedagogical model and the totality of conditions ensuring it was an increase in the quality of student training.

5. Discussion

The rapid development of society, the expansion of opportunities for professional choice, the transition to an information society and production, and the globalization of the international community require a change in professional education. Industry is on the way to reducing unskilled labor, which requires an increase in the level of professional training and mobility. In the European Union, for successful employment, a person has to change his qualifications for several times during his life (HUTMACHER, 1997).

A number of authors actively study the problem of training personnel for science-intensive high-tech industries (CHUCHALIN ET AL., 2006; EUROPEAN FEDERATION OF NATIONAL ENGINEERING ASSOCIATIONS, 2017; SAVELEVA, 2016b; SELF-STUDY REPORT FOR REVIEW OF THE PROGRAM..., 2001) and observe a change in the mechanisms of forming professional competencies in accordance with a students' individual inclinations.

In developed countries, the role of human capital (KEMBER, 1997) keeps growing, that enhances the requirements for the quality of professional training. Therefore, the tendencies of improving higher education are related to the expansion of students' ability to independently choose an educational trajectory, taking into account their inclinations

and potential (STEPHENSON; TROY, 2003). This implies flexibility and variability of educational programs, and their revision in accordance with the requirements of demand for specific categories of specialists (MEIJERS et al., 2005).

6. Conclusion

One of the results of this research carried out on the basis of the resource center of Tomsk Polytechnic University is related to the development of a model for training bachelors. The model successfully passed practical approbation and can be recommended for wide use in professional educational organizations. Further research on this subject may include the training of masters and post-graduates for high-tech industries. A study on the training of bachelors of technical profile for effective work in high-tech industries is currently being carried out at the Tyumen Industrial University Branch in Nizhnevartovsk. The author of the research deals with the problem of training workers and specialists for the high-tech oil and gas industry.

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