

Networking of educational institutions and commercial enterprises

Establecimiento de redes de instituciones educativas y empresas comerciales

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Abstract

Currently, in Russia there is a systemic gap between the educational service market and employers' requirements for a university graduate. Employers are not satisfied with the educational system, which cannot close this gap on its own. This situation requires access to an open educational system, which implies involvement in the training of both the educational institution and employer. As part of the research, a hypothesis about the greater efficiency of future specialist training in the format of network interaction between educational institutions and commercial companies was put forward. The purpose of the research is to prove that future specialist training in the format of networking between educational institutions and for-profit companies is more effective than the classical student training programme in Russia. As part of the research, with the case method, the essence of network interaction between educational institutions and for-profit entities and their optimal format were discovered by the example of communication between the Far Eastern State University of Communications and Russian Railways JSC. In addition, an

experiment to confirm or refute the hypothesis put forward was conducted. As a result of the research, the essence of networking between educational institutions and for-profit entities. The experiment carried out confirmed the hypothesis about the greater efficiency of future specialist training for the railway sector in the format of networking between educational institutions and the Russian Railways company.

Keywords: network education, universities, educational system, vocational education.

Resumen

Actualmente, en Rusia existe una brecha sistémica entre el mercado de servicios educativos y los requisitos de los empleadores para un graduado universitario. Los empleadores no están satisfechos con el sistema educativo, que no puede cerrar esta brecha por sí solo. Esta situación requiere el acceso a un sistema educativo abierto, lo que implica la participación en la formación tanto de la institución educativa como del empleador. Como parte de la investigación, se planteó una hipótesis sobre la mayor eficiencia de la futura formación de especialistas en el formato de interacción en red entre instituciones educativas y empresas comerciales. El propósito de la investigación es demostrar que la futura formación especializada en el formato de redes entre instituciones educativas y empresas con ánimo de lucro es más eficaz que el programa clásico de formación de estudiantes en Rusia. Como parte de la investigación, con el método del caso, se descubrió la esencia de la interacción en red entre las instituciones educativas y las entidades con fines de lucro y su formato óptimo mediante el ejemplo de comunicación entre la Universidad Estatal de Comunicaciones del Lejano Oriente y Russian Railways JSC. Además, se realizó un experimento para confirmar o refutar la hipótesis planteada. Como resultado de la investigación, la esencia del trabajo en red entre instituciones educativas y entidades con fines de lucro. El experimento realizado confirmó la hipótesis sobre la mayor eficiencia de la futura formación especializada para el sector ferroviario en el formato de networking entre instituciones educativas y la empresa Russian Railways.

Palabras clave: educación en red, universidades, sistema educativo, formación profesional.

1. Introduction

The Russian railway system is under the control of a railway transportation monopoly, the company Russian Railways JSC (hereinafter Russian Railways). Russian Railways is a Russian state-owned vertically integrated company, owner of the public infrastructure, and largest carrier of the Russian railway network. The company was founded in 2003 on the basis of the Russian Ministry of Railways; 100% of its shares belong to the Russian Government.

In the Russian railway industry, despite the sanctions pressure (Nusratullin et al, 2020; Nusratullin et al, 2021), the most sophisticated projects are being implemented, on which

the future of the national transport system in particular and the country's economy as a whole depend. Such projects include upgrading the Baikal-Amur Mainline and the Trans-Siberian Mainline, the development of approaches to the southern and northern ports of Russia, the construction of the Crimean bridge, approaches to it, and others. With that in mind, the level of challenges facing the Russian Railways company requires appropriate qualifications of employees, who should not only have the appropriate knowledge but also be capable of applying it in practice. However, there is currently a shortage of professional staff in the railway industry. In this regard, the transport universities of Russia face an objective need to solve the problem: how to arrange for professionally oriented skills of future specialists in the field of railway operation during their professional training at railway universities?

Within the framework of this research, a hypothesis about the greater efficiency of future specialist training for the railway industry in the format of networking between educational institutions and the Russian Railways company was put forward. The purpose of the research is to prove that future specialist training in the format of networking between educational institutions and for-profit companies is more effective than the classical student training programme in Russia.

To achieve the goal of the research, the following challenges were set:

- 1) determination of the essence of networking between educational institutions and for-profit organisations;
- 2) determination of the format of networking between educational institutions and the Russian Railways company for the railway specialist training;
- 3) conducting an experiment to assess the effectiveness of the networking implementation at a railway university.

2. Literature Review

Adamsky (2002) understands networking in education as "a set of educational activity entities providing each other with their own educational resources in order to increase the effectiveness and quality of education." Networking is carried out in order to meet the needs of an individual, educational organisations, society and contributes to the development of professional skills of future specialists that meet the requirements of the knowledge economy, an increase in the level of self-esteem of personal and professional qualities in the modern labour market. This form of collaboration is an effective innovative mechanism for the integration of the stakeholders in the field of education and business (Kutuzov, 2011).

In the context of Russia's integration into the global world economy, one of the leading areas in the development of the scientific and technological complex is the design of models for the training of engineering and technical personnel based on the communication between educational institutions that implement network forms of

educational programmes and social partners represented by potential employers that ensure the combination of theoretical training with practical training in production (Neretina, 2013).

It should be noted that in Russian engineering education there has long been a collaboration between a university and a large enterprise in order to improve the learning process. However, networking in the modern sense implies much closer cooperation (Loschilova, 2015).

In the implementation of educational programmes that involve networking, along with organisations carrying out educational activities, organisations that have the resources necessary to carry out training, conduct educational and industrial practices, and carry out other educational activities provided for by the corresponding educational programme can also participate. Due to networking, it is possible to receive a more diverse range of educational services and build an individual trajectory of development. The exchange of experience and competition between network enterprises are aimed at improving the quality of education in general (Kuzmina, 2017).

A condition for successful networking between the university and business is the maximum approximation of programmes for student progress monitoring and their intermediate certification to the conditions of future professional activities. For this, in addition to teachers of special disciplines, business representatives should be actively involved as external experts (Ling et al, 2021).

In Russia, an enterprise that participates in the educational process of a university is called a "base enterprise" for the purpose of future specialist training. The base company, as a future employer, is a party interested in the training results of a student, as well as a customer and an evaluator of the quality of education. When developing and implementing graduate training programmes, universities should focus on the needs of the base enterprise as a future employer and create mechanisms to respond to these requirements in the context of the content and quality of education (Roy, 1972).

The starting point of networking is the identification and coordination of the interests of the participants, which makes it possible to formulate a strategic goal and determine the final result of this networking, based on the existing potential capabilities of the network participants (Ehrismann & Patel, 2015). In turn, the coordination of the interests of networking participants in the field of education is based on the observance of certain principles:

1. The principle of integrity. It means achieving consistency in actions to solve the assigned tasks between all networking stakeholders, as well as in the possibility of using each other's resources. This principle is implemented through the development by the base enterprise of real topics by students for term papers and theses with the award of grants following the completion of these projects, providing its production resource capacity, provides all possible assistance in the ability to conduct

experiments on its equipment and testing grounds. The base enterprise supplies the latest technical equipment for university laboratories, in which students consolidate theoretical training with practical exercises as close as possible to real production settings (Shuklina & Pevnaya, 2018).

2. The "leading link" principle implies the presence of an integrator participant who is prepared to incur additional transaction costs for maintaining the network functioning (which pay off in the long term). The university provides intellectual resources for the development of projects and programmes relevant to the enterprise. 2. The base enterprise receives competent specialists who, without preparation or adaptation, begin their immediate duties after graduation, and during the internship, students work in paid workplaces, since there is no need to retrain them additionally and confirm their qualifications (Davydova & Fedorov, 2013).
3. The principle of voluntariness implies an independent determination of the structure of networking with other entities in the specific task implementation. This principle presupposes the freedom to choose the network form of relations between the participants as an institutional and organisational alternative (Vasilenko, 2014).
4. The principle of congruence (coordination of action). Network partners are different entities, each of which has its own leadership; therefore, interaction will be successful only when mechanisms for its coordination and coordination are developed, which can occur through the coordinating organisation or collegially in the case of cooperative ties, for example, through the board of organisations, network partners (Kutuzov, 2011).
5. The principle of freedom, that is, the ability to determine priorities in their own activities with responsibility for the ultimate outcome. The priority activity of the university is the development of a list of competencies among students, future specialists. The university develops educational programmes, implementation mechanisms, assessment tools, and assessment criteria to achieve the ultimate outcome. The priority goal of the base enterprise is to obtain graduates from the university who have shaped knowledge, skills, and abilities according to the qualification characteristics of the specialty. To achieve this goal, the base enterprise sets up for the university an order for targeted student training in specific specialties, to fill specific positions in certain areas of work. Targeted training of students or future specialists allows the company to develop its staff according to the development plans. At the same time, the targeted training of students or future specialists makes it possible for the university to plan its educational activities for training in certain specialties, and, based on those goals, develop its personnel potential, facilities, and resources (Elagina et al, 2017).
6. The principle of feedback. Reflection is one of the most important stages of any activity; understanding how the process is going, what helps and what hinders its optimization, contributes to the timely elimination of its risks; therefore, reflection "on the ground" and regular analysis by the coordinating body of the details of the process on the basis of the established features of practical activity help to adjust the organisational, technological, and content sides of an activity (Kozyr et al, 2021).

In higher education, networking takes place not only between the educational process participants but also between the customers of the educational service, such as employers, on the one hand, and universities, on the other. The purpose of networking is to train a student, future specialist according to the requirements for the specialty and taking into account the requirements of a particular enterprise for the qualitative characteristics of a specialist in the professional field. With such networking, the employer or the base company, along with the university, are a party to the specialist training. The networking possibilities are determined and depend on the usefulness that this organisation of the educational process provides for each party to the network.

By summarising the implementation of the principles of networking between the university and the employer, the base enterprise, one can conclude that during networking, all the prerequisites are created for the implementation of professional and educational goals for training students or future specialists with obtaining significant professional educational results (Rayevnyeva et al, 2018). As part of education upgrading, it is expedient to rethink the basic forms of professional training of future highly qualified specialists. One of the most effective areas is the integration of employers into the educational process as social partners of educational institutions that implement a network form of communication. The involvement of employers in young specialist training through the provision of conditions for professional trials, industrial practice, and engagement in the labour collective contributes to the acquisition of knowledge about the production process and skills at educational institutions with a lack of facilities, resources, or production sites for practical training, as well as the creation of supra-professional competencies for future specialists (Usmanov et al, 2021).

3. Methods

As part of the research, with the case method, the essence of networking between educational institutions and for-profit entities and their optimal format were revealed by the example of collaboration between the Far Eastern State University of Communications and Russian Railways. In addition, an experiment to confirm or refute the hypothesis about the greater efficiency of the future specialist training for the railway industry in the format of networking between educational institutions and the Russian Railways company was carried out. For this, groups of students of 128 people were selected and called control ones for reference (67 people) and experimental ones (61 people). The control group studied during the academic year according to the classical educational programmes, while the experimental one did so according to the programmes jointly made by the Far Eastern State University of Railways and Russian Railways JSC. At the beginning and at the end of the academic year, questionings were conducted to determine the readiness of students or future specialists for professional activities according to the following criteria:

- 1) a positive attitude towards professional activities and motivation to study at a technical university;
- 2) management skills and abilities;

- 3) design and engineering skills and abilities;
- 4) The ability to solve professional problems.

4. Results and Discussion

Networking between the Far Eastern State University of Railways and Russian Railways is manifested in the educational and scientific fields. In the educational field, networking is manifested as follows (Kuzmina, 2015):

- in determining the real topics of terms papers and final qualification papers of students/future specialists as ordered by the base enterprise. The development of real topics of terms papers and final qualification papers allows students/future specialists during theoretical studying at a university to immerse themselves in a professionally oriented environment, collect material for research directly at an enterprise, and get to know production technologies, tools, equipment. The development of real topics makes it possible for students to engage in not abstract educational activities but real practice-oriented activities;
- in the engagement of the heads of the base enterprise in the activities of state examination commissions with an expert assessment for final qualifying papers;
- in organising and conducting internships for students at the base enterprise, developing requirements for the goals and outcomes of internships with the determination of the required list of learned practical professionally oriented knowledge, skills and practical experience.

In the academic field, networking of the Far Eastern State University of Railways and Russian Railways JSC is manifested as follows (Kuzmina, 2015):

- in organising and participating in scientific and practical conferences;
- in providing university teachers with resources and facilities for conducting scientific experiments.

The Far Eastern State University of Railways has developed a set of conditions and a regulatory framework in the form of local regulations, where the idea of networking is clearly indicated. The problem of the quality of specialist training is directly related to the content of education and the technology of implementation of curricula that allow graduates to engage in the performance of their immediate duties without any additional preparation and adaptation to the conditions of real production. This interaction, which satisfies the principles of voluntary entry into the network, willingness to share resources, multiple levels of interaction based on a unifying goal, contributes to the formation of professionally oriented skills due to:

- joint determination of a list of real topics of term papers and final qualification works of students by order of the base enterprise;

- immersion of students in a professionally oriented environment and pedagogical support by a mentor from an enterprise of internship;
- jointly organising and holding research-to-practice conferences;
- using resources and facilities of the enterprise for conducting scientific experiments;
- participation of the heads of the base enterprise in the final state certification of graduates.

Networking of the Far Eastern State University of Railways and Russian Railways provides the opportunity:

- for Russian Railways to influence the quality of specialist training in determining the requirements for competencies, participation in the educational process and assessing the level of creation of the professionally oriented skills; using the intellectual potential of a university; experience in applied research and methodological work;
- for the Far Eastern State University of Railways to understand the real problems and features of the professional activities of railway transport specialists, participating in the solution of them and orienting the educational process towards their elimination; enriching teachers with promising technical and methodological ideas and stimulating the creation of new pedagogical technologies;
- *for students* – active participation in the process of learning and professional development, the formation of working skills in a team, and the acquisition of experience in solving professional problems.

All of the above determines the need to arrange for the engineering and technical personnel training, providing an effective result by combining theoretical training with the development of professionally oriented skills in production in the context of networking interaction educational institutions and base enterprises. Meeting the employer's graduate training requirements with professionally oriented skills is an urgent task of training future specialists.

To substantiate the tasks, it is necessary to proceed from the fact that the learning outcome will be achieved if the composition and content of professionally oriented skills are specified, a professionally oriented educational environment is created and joint pedagogical support of practices is organised by an experienced mentor. This is carried out at the stage of goal-setting with cooperation between the university and base enterprise as the key stakeholders in the process. The goals indicated in the form of the formation of the composition and content of professionally oriented skills are achieved in the conditions of the created professionally oriented educational environment. The variety of possibilities of this environment is determined by a set of working specialties which is chosen by the student taking into account personal needs and the design of a life situation. The three-level practices conducted (educational, station-technological, and production-technological) allow a student to present his/her activities in building a personality-oriented educational trajectory for shaping professionally oriented skills. The

professional orientation of the educational environment allows students to obtain theoretical knowledge, to form the required minimum of skills and abilities, to develop professional mobility according to the educational requirements and qualification characteristics of the specialty and affects the competitiveness of graduates.

The joint organisational and pedagogical support for practices by a qualified mentor adapts students to the conditions, content, and results of professional activities in the specialty according to the base enterprise's requirements. Pedagogical support is understood as providing assistance and support in overcoming difficulties arising in passing the internship. To do this, it is necessary to be accompanied by a teacher, on the one hand, pursuing the goal of consolidating theoretical knowledge, on the other hand, an experienced specialist mentor, emphasising the skills of practical activities and shaping the professionally oriented skills.

For this, internship programmes focused on the said goals are developed through competitive selection, qualified mentors motivated to improve the quality of specialist training are specially selected, and as a result, adapted to the conditions of real production of a student or a future specialist.

The network education is spreading at Russian Railways JSC; its integral part is the creation of basic departments at enterprises. In such a way, students are getting closer to production, which means that the percentage of real engineering solutions in graduation projects will grow. However, this process is still in its initial stage at the Far Eastern State University of Railways. The networked system provides a powerful research base and a host of opportunities for talented students. For example, students in their educational work can work out "bottlenecks" in the operations of the enterprise.

To confirm or refute the hypothesis about the greater efficiency of future specialist training for the railway industry in the format of networking between educational institutions and the Russian Railways company, an experiment was carried out. For this, groups of students of 128 people were selected and called control ones for reference (67 people) and experimental ones (61 people). The control group studied during the academic year according to the classical educational programmes, while the experimental one did so according to the programmes jointly made by the Far Eastern State University of Railways and Russian Railways JSC. At the beginning and at the end of the academic year, questionings were conducted to determine the readiness of students or future specialists for professional activities according to the following criteria: 1) a positive attitude towards professional activities and motivation to study at a technical university; 2) management skills and abilities; 3) design and engineering skills and abilities; 4) the ability to solve professional problems. The results of the experiment are presented in Table 1.

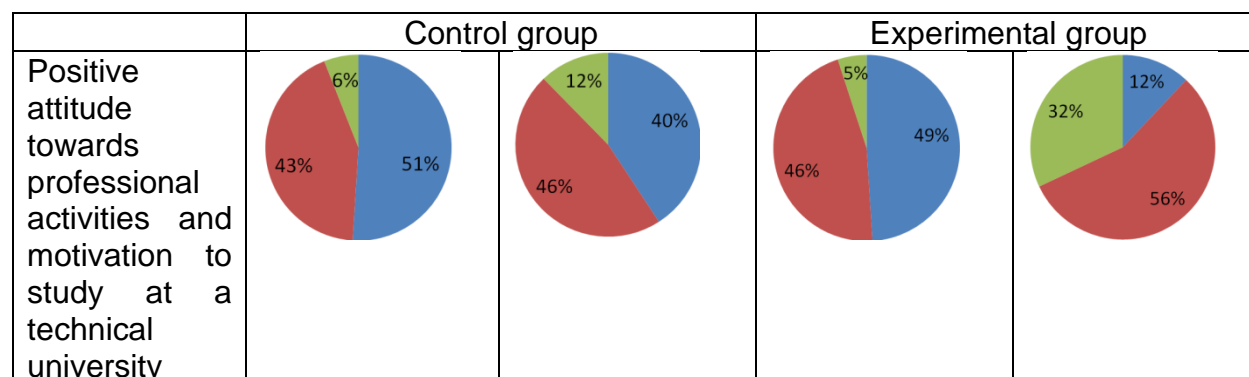
Table 1.

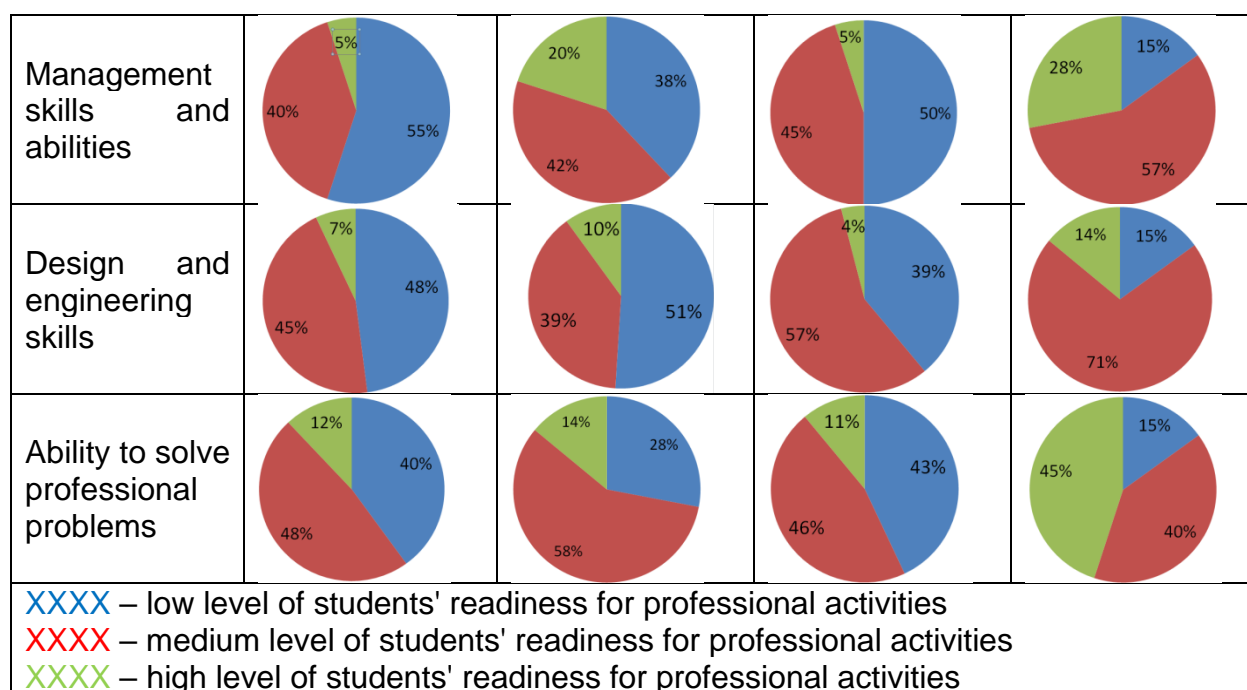
Dynamics of the readiness of students or future specialists for professional activities at the beginning and end of the experiment.

Levels		Before experiment						After experiment					
		Control group			Experimental group			Control group			Experimental group		
		Low, %	Medium, %	High, %	Low, %	Medium, %	High, %	Low, %	Medium, %	High, %	Low, %	Medium, %	High, %
Criteria													
Positive attitude towards professional activities and motivation to study at a technical university		51	43	6	49	46	5	40	46	12	12	56	32
Management skills and abilities		55	40	5	50	45	5	38	42	20	15	57	28
Design and engineering skills		48	45	7	39	57	4	51	39	10	15	71	14
Ability to solve professional problems		40	48	12	43	46	11	28	58	14	15	40	45

Source: data obtained by the authors on the basis of a questionnaire

As part of the experiment, it can be seen that according to all indicators of the readiness of students or future specialists for professional activity (positive attitude towards professional activities and motivation to study at a technical university, managerial skills, design skills and abilities, the ability to solve professional problems), there is significant growth in the experimental group as opposed to the control group. This can be seen more clearly in Figure 1.





Source: data obtained by the author on the basis of a questionnaire

Figure 1. Dynamics of the readiness of students/future specialists for professional activities at the beginning and end of the experiment.

The conducted experiment showed that two groups, control and experimental, had approximately the same indicators at the beginning of the experiment. For example, according to the indicator “Positive attitude towards professional activities and motivation to study at a technical university” in the control group, 51% of students showed a low level of readiness for professional activities, 43% an average level and only 6% a high level. In the experimental group: 49% showed a low level of students’ readiness for professional activity, 46% – average and 5% – high.

However, the situation changes dramatically after the experiment. In the control group, the indicators slightly increased, 40% of students showed a low level of readiness for professional activities, which is 11% lower than the same indicator before the experiment, 46% of students showed an average level, which is 3% higher, 12% showed a high level, which is higher by 6%. The experimental group’s indicators are much better, 12% of students showed a low level of readiness for professional activities, which is 37% lower than the same indicator before the experiment, 56% of students demonstrated an average level, which is 10% higher, 32% showed a high level, which is higher by 27%.

A similar situation is developing in terms of such indicators as management skills and abilities, design and engineering skills, ability to solve professional problems. All this suggests that networking between educational institutions and the Russian Railways company leads to specialist training at much higher levels of readiness for professional activities than the classical student training patterns. Thus, the hypothesis about the

greater efficiency of future specialist training for the railway industry in the format of networking between educational institutions and the Russian Railways company has been confirmed.

5. Conclusions

Networking between universities and business is aimed at training a professional theoretically literate, professionally oriented, encouraged to network, and, as a result, a professional competitive in the labour market. Networking opportunities open up new prospects for further cooperation between educational institutions and social partners in the implementation of advanced training.

Networking is carried out in order to meet the needs of individuals, educational institutions, society and contributes to the creation of professional competencies of future specialists that meet the requirements of the knowledge economy, increase the level of self-esteem of personal and professional qualities in the contemporary labour market. This form of networking is an effective innovative mechanism for integrating the participants in relations in the field of education and production.

As part of the research, the essence of networking between educational institutions and for-profit entities has been determined, and the optimal format for such networking has been determined. The experiment carried out confirmed the hypothesis about the greater efficiency of future specialist training for the railway industry in the format of networking between educational institutions and the Russian Railways company.

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