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Methodology and experience of evaluating the innovativeness of student projects

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ABSTRACT
Introduction. The main problem raised in the article is related to the lack of scientific information and research results on the effectiveness of innovative structures created in Russian universities, as well as educational courses aimed at developing innovative competencies among students. One of these courses, taught in most Russian universities, is a course on the basics of project activity (the name may vary depending on the content of the educational program). As an assignment in these courses, students develop their own projects. The aim of the study was to evaluate the innovativeness of student projects developed within the framework of the course on the basics of project activity implemented at Petrozavodsk State University.
Materials and methods. The article provides an analysis of 378 projects, which were developed by 1019 students from different educational institutions of Petrozavodsk State University from 2018 to 2020. The authors analyze and evaluate projects on the basis of three minimum criteria of innovation: novelty, implementation and social significance. The main research method was an expert survey.
Results. The results of the study allowed us to determine the share of innovative projects, projects that contain signs of innovation, as well as projects that do not contain signs of innovation. Innovative projects are classified by the type of innovation.
Discussion and conclusion. The article presents the author's approach to the definition and calculation of the index of innovation of student projects, the development of tools and the interpretation of research results, on the basis of which conclusions and recommendations are formulated to improve the content and organization of courses on the basics of project activity. The results of the study are consistent with the trends of the all-Russian innovation practice.

Keywords: innovation; innovation competencies; innovation project; innovation criteria; innovation index; novelty; implementation; social significance.

INTRODUCTION

The formation of an innovative person is the key, strategically important task of Russian society in the conditions of transition to an innovative path of development. Development of human resources in the field of science, education, technology and innovation; increasing the innovative activity of business and the accelerated emergence of new innovative companies; increasing the sensitivity of the population to innovations; increasing the number of innovative entrepreneurs; creating an atmosphere of risk tolerance in society; promoting innovative entrepreneurship and scientific and technical activities; adaptation of the education system in order to form the knowledge, competencies, skills and behaviors necessary for an innovative society and an innovative economy from childhood, as well as the formation of a system of continuing education – these and other tasks were set by the developers of the Strategy for Innovative Development of the Russian Federation for the period up to 2020. The analysis of the Strategy implementation results leads to disappointing conclusions [1]. It is obvious that one of the conditions for successful innovative development is the creation of new organizational structures and institutions, but the key factor is the person who makes the connection between the sphere of innovative developments and real social needs, social demands. At the same time, we do not mean individual categories of employees associated with scientific research and innovation (scientists, engineers, constructs). We are talking about the formation of an innovative personality as a special social type and its dissemination in all spheres of public life.

In this regard, within the framework of the Strategy, the creation of conditions for the formation of the following competencies of innovative activity among citizens was rightly highlighted as one of the main tasks of innovative development: ability and readiness for continuous education, continuous improvement, retraining and self-study, professional mobility, striving for new things; ability for critical thinking; ability and readiness for reasonable risk, creativity and entrepreneurship, ability to work independently, readiness to work in a team and in a highly competitive environment; foreign languages skills, which imply the ability to freely communicate in everyday, business and professional life.

One of the ways to solve this problem was the implementation of certain areas of socio-economic policy, primarily in the field of higher education, aimed at accelerating the formation of these competencies among students. To implement these tasks, special organizational structures were created in Russian universities (technoparks, innoparks, creative spaces, collective work spaces, etc.), special academic disciplines, accelerator programs, etc. were developed.

To date, the issues of the effectiveness and efficiency of the activities of these organizational structures in Russia have not been studied. Conclusions about this can be drawn based only on indirect quantitative indicators that characterize the dynamics of the number of innovative enterprises in the country and individual regions, innovation development indices, the amount of funding for research and development, etc. The scientific papers do not present the results of research on the effectiveness of special training courses aimed at the formation of individual innovative competencies of students of Russian universities, as well as an analysis of the conditions and factors affecting the effectiveness of these courses.

The purpose of our research was to assess the innovativeness of student projects developed as part of the course on the basics of project activity implemented at Petrozavodsk State University.

Main research tasks:

1) To determine the criteria for the innovation of projects developed by students who have been trained as part of the course on the basics of project activity;
2) To get an expert assessment of the innovativeness of projects developed by students;
3) To determine the number of projects developed by students as a result of passing the course on the basics of project activity, characterized as innovative; to classify them according to the "type of innovation";
4) To analyze the main factors affecting the effectiveness of the training course on the basics of project activity;
5) To determine the main directions for improving the content and organization of the course on the basics of project activity.

REVIEW OF SCIENTIFIC LITERATURE

The concepts of "competence", "innovative competencies" in the global understanding turn us to the works of R. Daft [2], S. Covey [3], K. A. Nordstrem [4]. In different semantic meanings, these concepts are used within the framework of various theoretical approaches [5]. In Russia, an attempt to extract the semantic trends of the concept of "competence"" was made by psychologists of Moscow State University, understanding competence as "such a combination of knowledge, skills, motivational factors, personal qualities and situational intentions that ensures the effective solution of tasks of a certain class by the performer in a certain organization, at a certain workplace, in a certain production team" [6]. This definition includes the social, psychological and organizational characteristics of a person that allow them to achieve success in performing professional tasks.

T. Blummart [7], T.V. Kondratyuk [8], N.P. Krasochenkova [9], N.N. Malakhova [10], Yu. Pukha [11], K. Shvab [12], J. Dromey, C. McNeil [13], Le Deist F. Delamare, J. Winterton [5], C.B. Frey, M.A. Osborne [14], M. Hirooka [15], R. Lipsey, K. Carlaw, C. Bekar [16], X. Pan, J. Zhang, M. Song [17], R. Rohrbeck, J.O. Schwarz [18] turn to the study of an innovative personality's competencies in accordance with the requirements of the technological development of society of the XXI century.

The classical definition of the term "innovation" was first introduced into the economic science by Y. Schumpeter, understanding under innovations changes for the purpose of introduction and application of new types of products, new technical means, forms of organization in the industry, focusing on the economic impact of these changes. J. Schumpeter identified five types of innovations, including those that form the appearance of a qualitatively new individual who accumulates the main qualities and competencies of the subject of innovative activity [19].

One of the most successful, from a methodological point of view, the definition of innovation activity is given by V.I. Lisov: "Innovation activity is a process aimed at implementing the results of completed research developments or other scientific and technical achievements into a new or improved product sold on the market, into a new or improved technological process used in practical activities". In other words, an innovation is a product created in the process of innovation activity, which really gives a qualitatively different commercial or practical significance [20].

This understanding of innovation is reflected in the Oslo Manual. Innovation is the introduction of a new or significantly improved product (product or service) or process, a new marketing method or a new organizational method in business practice, workplace organization or external relations. Innovation activity is all scientific,

technological, organizational, financial and commercial actions that actually lead to the implementation of innovations or are conceived for this purpose ([1] The Oslo Manual. Recommendations for collecting and analyzing data on innovations. Third edition. A joint publication of the OECD and Eurostat. Organization for Economic Cooperation and Development "Statistical Office of the European Communities". Moscow, 2010. pp. 31-32.). The analysis of this Manual allows us to identify the minimum signs (criteria) of innovation:

1) novelty (the product, process, marketing or organizational method must be new or significantly improved for the practice of this enterprise). Thus, products, processes and methods created by enterprises for the first time, and/or products, processes and methods borrowed from other enterprises or organizations are considered innovative.

2) implementation (an innovation must be put into use, i.e. integrated; a new or improved product is considered to be put into use after it has appeared on the market; new production processes, marketing and organizational methods are considered to be integrated after they have become actually used in the activities of the enterprise).

MATERIALS AND METHODS

The main method of research is an expert survey when determining the criteria for the innovation of student projects, their weight, as well as when carrying out an expert assessment of projects developed by students. The maximum objectivity of the assessment is achieved by the fact that two groups of experts were involved in the work, carrying out different stages of work independently of each other.

The experts on determining, ranking and evaluating the weight of the criteria for innovation of student projects were the vice-rector for international affairs of PetrSU M. Gvozdeva; head of the Department for intellectual property protection and invention of PetrSU, director of the Regional center for technology transfer P.V. Budnik; director of the Venture investment fund of the Republic of Karelia, founder of the web studio and head of the Internet service for managing organizations "RosKvartal" B.M. Valit; director of the State Budgetary Institution of the Republic of Karelia "Resource Center" N.A. Okuneva.

Four experts were simultaneously and independently asked to name three criteria by which they could assess the innovation of the project. All four experts identified three evaluation criteria: the novelty of the project idea, the implementation potential (feasibility of the project), the social significance of the project. Further, to determine the weight of each criterion, the experts were asked to evaluate the significance of each of them on a 10-point scale from 1 to 10, where 1 point is the lowest score (minimum significance), and 10 points is the highest significance of the criterion assessment. Each of the experts evaluated the above three criteria. Then the sum of the scores for each of the criteria was calculated, after which the weight of the criterion was determined for each of the criteria (the share of the total score for each of the criteria from the total sum of all the scores for all the criteria). Thus, for the criterion "Novelty" of the project idea, the weight of the criterion was 0.3, for the criterion "Implementation potential (project feasibility)", the weight of the criterion was 0.3, for the criterion "Social significance" of the project, the weight of the criterion was 0.4 (Table 1).

Table 1: Weight of the project innovation criteria (based on expert assessments)

Criteria	Expert 1	Expert 2	Expert 3	Expert 4	Sum of ratings	Share by valuation
Novelty	7	8	8	8	31	0,3
Implementation potential (project feasibility)	6	9	7	9	31	0,3
Social significance	9	10	10	10	39	0,4
	22	27	25	25	101	1,0

When analyzing student projects based on expert opinion, we added a third criterion – "social significance" – to the minimum criteria of innovation (novelty and implementation) specified in the Oslo Manual. The analysis according to the second criterion (implementation) is carried out in two directions: real implementation (i.e. a new product is presented on the market, marketing or organizational methods are used in the activities of the enterprise) and the potential for implementation in the near future.

Thus, the innovation index of the student project is calculated by us according to the formulas:

IISP = N×WC + RI×WC + SS×WC

or

IISP = N×WC + PI×WC + SS×WC, where

IISP – Innovation index of the student project;

N – Novelty (evaluated on the basis of expert opinion by fixing the presence of novelty elements in the binary system: 1 – contained; 0 – not contained);

RI – Real implementation (evaluated by fixing the real experience of implementing the project in practical activities using the binary system: 1 – the project is implemented; 0 – not implemented);

PI – Potential implementation (evaluated on the basis of expert opinion by fixing the potential possibility of implementing the project in practice, the assessment is carried out according to the binary system: 1 – the project has a potential for implementation, taking into account internal resources and external context; 0 – the project has no potential for practical implementation).
WC – Weight of the criteria.
Thus, the maximum possible Innovation index of a student project can be 1. A project is considered innovative if IISP ≥ 0,70. The project has signs of innovation, if IISP = 0,31 – 0,69. The project does not have signs of innovation, if IISP ≤ 0,30. The average Innovation index of student projects is calculated by deducing the average value of the IISP for 378 projects.
There are four types of innovations: product, process, marketing and organizational ([1] The Oslo Manual. Recommendations for collecting and analyzing data on innovations. Third edition. A joint publication of the OECD and Eurostat. Organization for Economic Cooperation and Development "Statistical Office of the European Communities". Moscow, 2010. P.33.). In this regard, those projects that were evaluated by experts as innovative were classified according to the object of innovation activity.
The experts who evaluated student projects according to the proposed criteria were R.V. Zagidullin (public representative of the Agency for Strategic Initiatives for the promotion of new projects in the Republic of Karelia in the direction of "Youth Entrepreneurship", expert consultant on business planning, entrepreneur), A.P. Konovalov (program Director of the "Boiling Point – Petrozavodsk" Center, PhD in Technical Sciences, public representative of the Agency for Strategic Initiatives for the promotion of new projects in the Republic of Karelia in the areas of "Youth Entrepreneurship" and "Tourism", expert consultant on business planning), S.S. Melekhov (acting entrepreneur since 2010, director of the Center of the implementation and support of uouth initiatives, director of the PetrSU Student business incubator).
Each expert received a matrix of projects that needed to be evaluated based on the criteria of innovation. The assessments were made by a collective decision of the experts as a result of the discussion. The quantitative data was processed using the Microsoft Excel. The methods of cluster and factor analysis were used.

RESULTS.
Description of the sample.
For further analysis, 378 projects developed by students of Petrozavodsk State University (PetrSU) as a practical task within the framework of an educational course on the basics of project activity for 2018–2020 were accepted. These are all student projects prepared during the three years of teaching the course (Fig. 1).

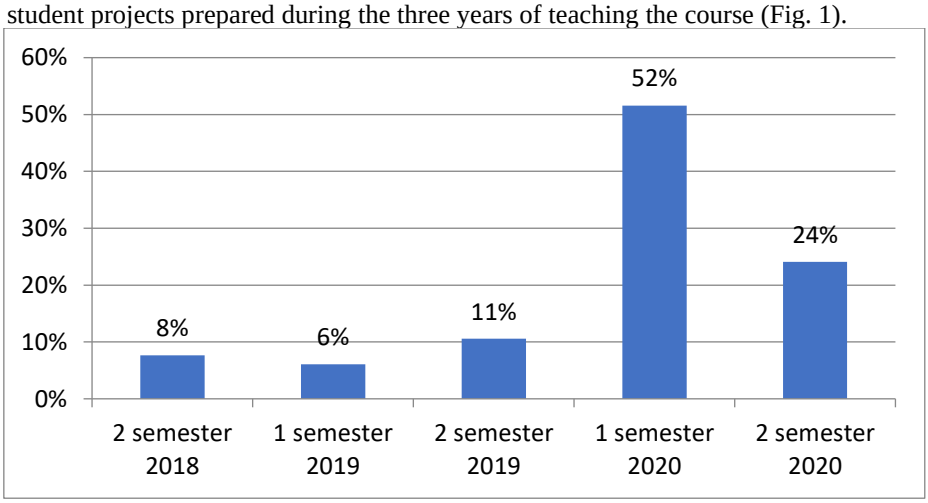

Fig.1: Number of submitted projects (in %)

Classifying the projects presented in different years according to the nature of the tasks (problems) to be solved, among them we can distinguish technological, business projects, educational, social, environmental and cultural projects (Fig. 2).

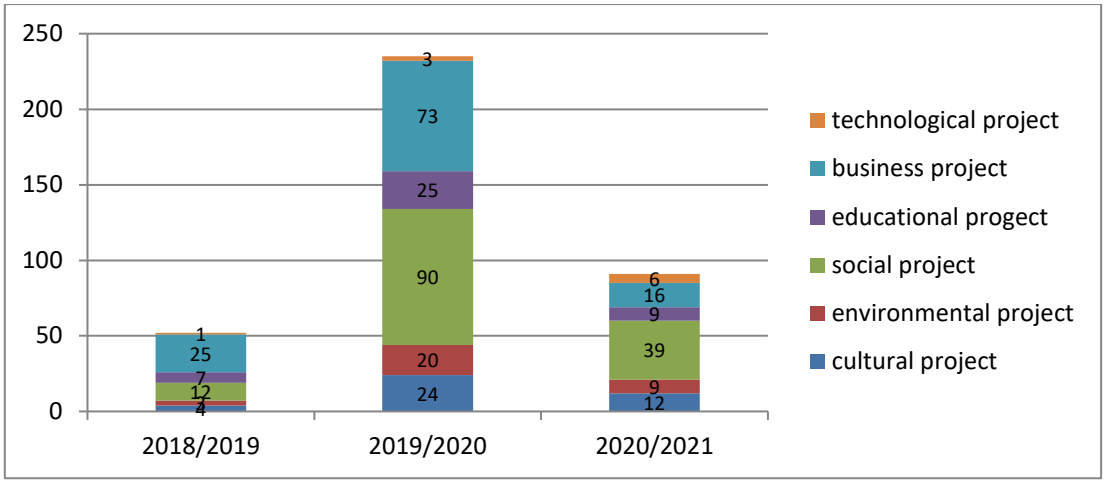

Fig.2: Types of projects by the nature of the problems to be solved (in absolute numbers)

The educational course has been implemented at PetrSU since 2018 and is designed for a different number of hours for different areas of training: from 72 (for one semester) to 144 (for two semesters). The course on the basics of project activity is taught mainly to second-year undergraduate students, and since 2020, in rare cases, to second-year master's students of the Institute of Physics and Technology. The projects taken for analysis were developed by students of the following areas (Table 2).

Table 2: Directions of training of students who carried out work on projects

Educational institute	The direction of training
Institute of Foreign Languages	44.03.05 Pedagogical education (with two training profiles – English and German); 44.03.05 Pedagogical education (with two training profiles – English and French); 44.03.05 Pedagogical education (with two training profiles – German and English);
Institute of Pedagogy and Psychology	44.03.05 Pedagogical education (with two training profiles-English); 44.03.01 Pedagogical education (primary education); 44.03.05 Pedagogical education (with two training profiles – Karelian language); 44.03.05 Pedagogical education (with two training profiles – technological and additional education); 54.03.01 Design; 44.03.05 Pedagogical education (with two training profiles – art and art culture); 44.03.02 Psychological and pedagogical education (teacher-psychologist); 44.03.03 Special (defectological) education (preschool defectology); 44.03.02 Psychological and pedagogical education;
Institute of Physical Culture, Sports and Tourism	44.03.01 Pedagogical education (physical culture); 49.03.02 Physical culture for people with disabilities (adaptive physical culture); 44.03.05 Pedagogical education (with two training profiles: Life safety and physical culture); 43.03.02 Tourism; 43.03.03 Hotel business (hotel service); 43.03.03 Hotel business (restaurant activity); 43.03.01 Service (representative activity in the service sector); 20.03.01 Technosphere safety.
Institute of Forest, Mining and Construction Sciences	44.03.05 Pedagogical education (with two training profiles – geography and economics)
Institute of Mathematical and Information Technologies	44.03.05 Pedagogical education (with two training profiles – mathematics and computer science)
Institute of Philology	42.03.02 Journalism

Institute of Physics and Technology (Master's degree)	09.04.01 Computer Science and Engineering; 11.04.04 Electronics and nanoelectronics; 12.04.01 Instrumentation; 11.04.04 Electronics and nanoelectronics (industrial electronics).

In total, during the period from September 2018 to December 2020, 70 groups of full-time students of Petrozavodsk State University, with a total number of 1019 of students, were involved in studying the course on the basics of project activity.

During the training, students performed tasks for the preparation of group (no more than 5 people), pair and individual projects (Fig. 3).

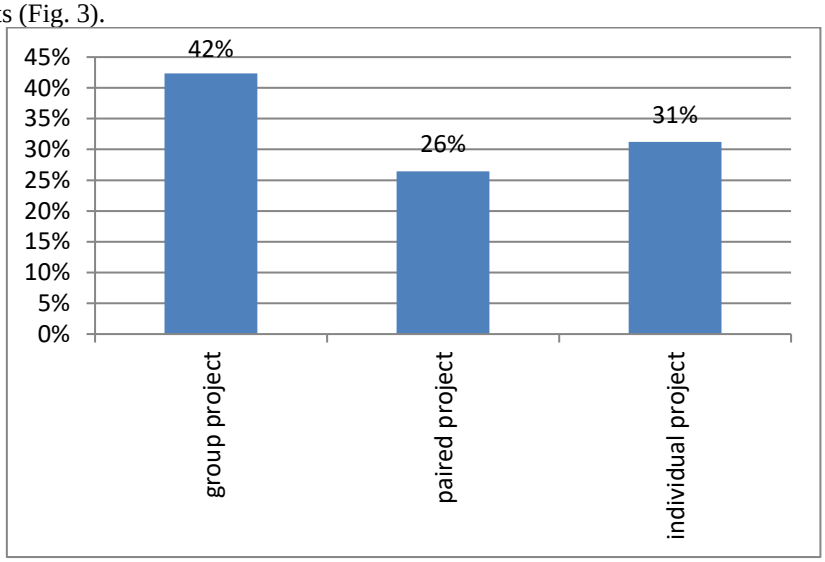

Fig.3: The number of submitted projects with a different number of developers (as a percentage)

Characteristics of the educational course.

The discipline devoted to the basics of project activity has various names ("Fundamentals of project activity", "Project activity", "Project activity as a basis for the development of professional self-determination", etc.), depending on the direction of training of students and the expected result. Its teaching is carried out within the framework of the curriculum in accordance with the federal state educational standard of the corresponding field of training. Thus, we see that the educational result of teaching a course can be a variety of competencies. The course has a different duration (1 or 2 semesters) for different areas of training and mainly consists of practical classes and independent work of students. The main sections of the course are: Fundamentals of project management. Basic concepts and definitions; Project lifecycle; Project initiation; Project implementation; Project completion; Project presentation.

The practical classes cover such issues as: the definition of the concept of "project"; project classification; basic concepts of project management; the art of effective project management; the feasibility of switching to project management; the history of project management development; the relevance of project management in modern Russia; professional project management organizations; project lifecycle; project participants; project structure and structuring; building a hierarchical structure of work; standard steps in project structuring. Practical tasks are solved on the formation of a problem field, the preparation of project goals and objectives, the formation of a project team, the description of target groups, the formation of a Gantt chart, the methodology for evaluating the effectiveness of the project, the development of activities and activities for the project, the development of information support for the project, the preparation of budget estimates, the formation of project indicators. A separate block of questions is devoted to reporting documents on the status of the project, project implementation control, project implementation risks, major errors in project activities, experimental evaluation of project activities, standard project implementation documents, project design rules, project evaluation, project sustainability, documentation of the final stage of the project, standard project reporting documents. Students receive instructions on the rules for presenting the project presentation and technical requirements for the design of the final project.

Within the framework of the course, a competence-based approach is implemented, which involves the use of active and interactive forms of conducting classes in the educational process in combination with independent work of students. Students are included in the studied situation, are encouraged to take active actions. The educational process is organized taking into account the involvement in the process of cognition of all students of the group without exception; the activity of students, relying on group experience and mandatory feedback. Iterations at the initial stage focus on defining the project field and describing specific problems that the project

is dedicated to solving / reducing the severity of. Further work is carried out using a workbook, where 19 sections are filled in step by step: “Project name”, “Project team”, “Project Geography”, “Start of implementation / End of project implementation”, “Brief summary”, “Main target groups”, “Problem”, “Main goal”, “Project name”, “Project Objectives”, “Implementation Methods”, “Quantitative indicators / Quality indicators”, “Cost estimates”, “Multiplicativity”, “Experience of successful implementation”, “Project partners and own contribution”, “Information support of the project”, “Additional information about the project”, “Documents confirming the costs of the project”. When conducting practical classes, the teacher takes into account the level of preparation of the group, offers questions and tasks that are feasible for independent training of students. The greatest difficulties for students in studying this discipline, as a rule, are caused by sections related to setting goals and objectives, as well as identifying the problems of the project. In this regard, teachers need to focus on the study of these sections. The course is provided with a working program of the discipline, presentation materials on all topics, tasks for independent work, a workbook. Within the course, each student learns how to prepare three types of projects: a group project, a pair project, an individual project. Meaningful fulfillment of the tasks of the workbook involves the active use of the brainstorming method, as well as the method of analyzing specific project situations. The presentation of teamwork takes place in front of the whole group using the “Three experts” method (critic, positivist, realist). The course is accompanied by the author's educational and methodological developments.
Assessment of the innovativeness of the submitted projects.
The evaluation of the Innovation index of student projects was carried out according to the formula given earlier. The average Innovation index of the analyzed student projects was 0.33, i.e. it is included in the range of 0,31–0,69 (a project with signs of innovation). In the total sum of the analyzed projects, 5 % (19 projects out of 378) turned out to be innovative, their IISP is from 0,7 to 1. 1,9 % (7 projects) have signs of innovation (IISP is from 0,31 to 0,69). The majority – 93,1 % – does not have signs of innovation. It should be noted that the third sign of innovation of projects (social significance), proposed by experts, somewhat smoothed the results of the assessment. If the assessment was carried out according to the two criteria prescribed in the Oslo Manual (novelty and implementation), then innovative projects would make up 3,7% of the total number.
In most cases, group projects were recognized as innovative. There were no innovative projects among the individual projects. Among the 19 projects evaluated by experts as innovative (IISP $\geq$ 0.7), the majority (8 projects) contain organizational innovations, 5 projects contain product innovations, 3 projects contain process innovations, 3 projects contain marketing innovations.
Of the total number of submitted projects (378), the largest number of innovative (1,6 %, i.e. 6 projects) were presented by students of the Institute of physical culture, sports and tourism, however, in relation to the number of projects submitted by students of this particular institute (120), this is 5 %, while students of the Institute of physics and technology presented 12 projects, of which 4 projects, i.e. 33% were evaluated as innovative. Since the course “Basics of Project activity” is taught mainly to second-year students, it is quite understandable that among the works of these students, the largest number of both innovative projects and projects of the other two categories have been identified. At the same time, if we analyze the works of physics students studying in the master's program separately and in more detail, these projects demonstrate a higher level of novelty, implementation and social significance, and therefore the share of innovative projects among them is 33% of the number of projects submitted by these students in comparison with the works of second-year students, among which 4% are rated as innovative. It is interesting that among the projects prepared by third-year students, there is not a single innovative one, according to experts.

CONCLUSION

The Russian innovation culture, as well as the world one, excessively mythologizes success, demonstrating the “success stories” that have already become typical, motivating new generations to choose the risky path of an innovative startup. In Russian science and practice, the validity of ambitious goals and the absence of defeatist complexes is absolutized, while in reality, success in the innovation field is a rather rare phenomenon that faces many difficult, and sometimes critical circumstances, especially in the field of technological startups that require serious financial investments already at the initial stage of implementation. Only a few technological startups reach the stage of real financing and implementation [21].
The results of the study reflect general situation in the field of youth innovation projects in the Republic of Karelia and are due to the peculiarities of the formation of innovative competencies among Karelian youth, as well as the peculiarities of the innovation environment. The formation of these competencies requires not only the implementation of certain areas of socio-economic policy (primarily in the field of education), but also the preparation of the social environment as a whole, the creation of conditions for the realization of the innovative potential of young people.
Federal state educational standards of higher education are still focused on the industrial model, and therefore they focus mainly on the formation of narrow professional competencies.
In the current circumstances, it seems appropriate to teach a course on the basics of project activity at senior courses, since its implementation requires students to have knowledge in the field of marketing, market analysis,

mathematics, research skills, etc. In addition, we propose to unify the final result of teaching the course in the form of competencies for all areas of student training, linking it, first of all, with universal competencies.
As the experience of implementing the courses "Project activity", "Basics of project activity", etc. shows, in the structure of the course, based on the characteristics and needs of students, a large amount of academic time is devoted to the allocation, analysis and development of project issues. This is one of the most difficult sections for students. Because of this, less time is devoted to the analysis of the proposed solutions, the search and study of world analogues of these solutions, the generation of new ideas, which should be given more time and attention.
Out of 378 submitted projects, only 3 projects received real financial support and were implemented. In most cases, the development of projects within the framework of the training course is considered by students only as a study task and is not planned for further implementation. Perhaps this is due to the lack of its own regional infrastructure and tools to support innovation in the Republic of Karelia, demonstrating real practices for the development of innovative youth projects.

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