

Model for implementing project-based learning at a regional university

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Abstract. The project idea is to create a management model of student project activity in a particular University based on empirical research of universities that implement student project activities and analysis of accumulated theoretical data. The purpose of the master's thesis is to form a management model of student project activities at the State Humanitarian University of technology. The developed model is based on the empirical experience of implementing student project activities in both domestic and foreign universities, as well as the results of a pre-project study that analyzed potential stakeholders. The main elements of the management model are: the formation of a digital project platform, the formation of a motivation system for students and teachers, the creation of a new structural division of the University-the project office and the criteria for evaluating the planned activities. The results of the work are: a management model of student project activities at the State Humanitarian University of technology.

1 A problem statement

The transition of the Russian Federation to the digital economy is reflected in the requirements for education, the construction of the educational process, its results, forms and methods of implementation. Decree No. 204 of May 7, 2018 clearly defines the requirements for the educational process, which must ensure high quality of education and provide for the use of new methods and forms of education [1].

An important problem of the modern higher education system is the personalization of educational trajectories [2]. The main factors of personalization of educational programs are [3]: project activities, research activities, criteria-based assessment, blended learning and individual curriculum training [5].

Personalization of the learning process is understood as: creating an individual profile of the student [6]; developing individual educational routes that take into account the abilities and interests of the student; consistent development of skills and competencies; evaluating

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the progress of the student; creating a flexible educational environment using technologies [7].

1.1 The objective of the work

In recent years, benchmarking technologies have become widespread [8], or the use of best practices in modeling the University's own activities. These technologies are not new for business, but they are not widely used in education yet [9]. There are vivid examples of the introduction of student project activities not only in foreign [10, 11], but also in domestic universities, which have led to an improvement in the quality of education: Higher school of Economics, Moscow Polytechnic University, Far Eastern Federal University, Ural Federal University, Southern Federal University, Lobachevsky state University of Nizhny Novgorod [12]. In our work, we used benchmarking elements, using both domestic [13] and foreign experience [14] in managing students' project activities [15].

The analysis of the typology of the organization of project activities in different universities include the following types of organizations: type in which the leading role played by the faculty, coordinating all project activities [16], the type in which as the basis for the implementation of project activities that are platform and educational design laboratory [17], the third type involves the creation of a design centre for the management of operations, the fourth type is the creation of design schools [18] and the fifth most common type is the realization of interdisciplinary projects in teaching process, which is used by most Western universities [19]. Since each University only has its own special model of management activity, we conducted a pre-project study. The analysis of the region's stakeholders will allow us to predict the possible attraction of businesses and enterprises for the implementation of joint projects. It will also give an understanding of the need to form new competencies of students, which are formed in the course of project research and educational research activities [20].

An important element in the formation of the management model of student project activity is the creation of new systems for motivating students and teachers to involve them in the competitive environment of project development and implementation [21].

Establishing project activities at the University is an integrating factor that will increase the practice orientation in training [22], attract medium and large businesses as stakeholders to the educational process [23] (additional funding, order), increase the level of educational research and research activities [24], attract grants for project implementation, train young qualified personnel [25], create new joint laboratories [2]. The above factors form the relevance of the formation of a management model of student project activities at the State Humanitarian University of technology.

2 Materials and the results of the research

The project idea consists in the possibility to form a management model of student project activity at a particular University based on empirical research of universities that implement student project activities and analysis of accumulated theoretical data.

The aim of the research is to form a management model of student project activities at the State Humanitarian University of technology.

Research problem:

- analysis of theoretical and empirical mechanisms for forming the management model of student project activities;
- analysis of the state of the University, assessment of internal and external opportunities for the implementation of project and research activities;

- formation of a management model of student project activities at The State Humanitarian University of technology.

To solve these tasks, it is necessary to collect the following data: collection of information about research, project and financial and economic activities of the University; collection of information about University stakeholders; collection of information about the system of motivation for project activities at the University.

Analysis of resource potential. The state University of Humanities and technology is located in the city of Orekhovo-Zuyevo, Moscow region. University has 2 branches, 4 colleges and 9 faculties.

The University conducts educational activities in the following areas of training and specialties of higher education: pedagogical education; psychological and pedagogical education; special (defectological) education; pharmacy; linguistics; law; management; state and municipal administration.

The University implements programs for training scientific and pedagogical personnel in postgraduate studies. The University has a large package of programs of additional professional education: professional retraining, advanced training. The number of students enrolled in all educational programs is just over 9,000 people.

Analyzing the main indicators of the University, progress in most indicators is clearly visible. The number of students enrolled at the University decreased from 4,721 students in 2015 to 4,616 students in 2019, including full-time students from 2,475 in 2015 to 2,423 in 2019. The quality of admission to the unified state exam scores has significantly increased, if in 2015 the average score was 63.29, then in 2019 it was 69.43 points. The competition for applicants for the 1st place in the average University grew from 2.2 people in 2015 to 8.1 people in 2019. Analyzing the percentage of applicants enrolled in targeted training, you can also see significant progress from 6.5% in 2015 to 25.11% in 2019. The proportion of undergraduates has increased significantly. In 2015, the University did not have a master's degree, in 2019, the development of a master's degree began, the proportion of undergraduates was 1.6%. But at the same time, the share of postgraduate students has fallen significantly, if in 2015 it was 3.1%, then in 2019 it was 0.87 %.

There is a small, but still growing financial and economic indicators of the University. The University's income over the past 3 years has grown from 753721 rubles to 835096 rubles, the share of University income from educational activities in the total income of the University has increased from 77.83% to 80.53%, but the share of University income from research and development in the total income of the University has changed from 6.29% to 6.87%.

If we analyze extra-budgetary revenues, the share of extra-budgetary funds in income from educational activities changed from 25.64% to 25.20%, and the share of extra-budgetary funds in income from research and development increased from 11.99% to 14.5%.

Analyzing the resource base of GSTU, we can say that it is extensive, but at the moment the mechanisms of its use for project activities of students are not implemented. The first powerful resource structure is the teacher's IT Park, which is represented by laboratories: educational robotics, web design and development, psychological and pedagogical, telecommunications, and the Cisco Academy. All these structures are certified by World skills laboratories for these competencies.

The second resource structure is the STEAM-education center, which was created in October 2019 as a joint training center of Moscow State University and our University within the framework of the Vernadsky Moscow region project. The education center is equipped with modern equipment and consists of three laboratories: a biological laboratory with modern microscopes, Steam education facilities, virtual laboratories, a smart

greenhouse, and equipment for chemical analysis of the environment; a physical laboratory for working with nanomaterials, as well as a virtual and augmented reality laboratory.

The third structure is the resource center for teacher education in the Moscow region, which includes several other structures – the center for the development of distance technologies (the center for Internet education in the Moscow region), the Moscow regional center for preschool education (working directly with Russian Academy of Science), the center for practical psychology and the Green-street linguistic school.

The fourth structure consists of chemical laboratories with modern equipment for working with pharmaceuticals, organic and inorganic substances, as well as an agrobiostation designed for growing experimental plants.

After analyzing the possibilities of interaction between the University and the main stakeholders in the region for the development of student project activities and the University as a whole, we focused on two main areas – natural science and pharmaceutical. Based on the possibility of attracting a powerful educational partner of Moscow state University, we analyzed the market of companies that are engaged in development and metrological research in the field of biology and chemistry and at the same time have a significant shortage of personnel, which the University will be able to fill with its graduates. Opportunities were considered, including professional retraining.

The first potential partner was the testing center OZ Test, which implements its activities in spectrometric, physico-chemical, chromatographic, toxicological and microbiological analysis methods. The acute shortage of personnel in this region in the announced areas of activity makes the University a very attractive educational partner for the testing center, as part of the holding.

The second potential partner was Eco-lab, a large pharmaceutical company located near the University, in the city of Elektrogorsk near Moscow. The company is engaged in the production of diagnostic kits, ready-made medicines, as well as engaged in developments in the field of diagnostics and medicines. The company has 4 large research laboratories. The company also has a shortage of personnel specializing in chemical and pharmaceutical developments. The company employs a large number of students still studying.

Another potential partner was identified as a major pharmaceutical manufacturer Veropharm. Veropharma's interest in cooperation with the University is primarily due to the location of one of the company's facilities in the vicinity of the University, in the Vladimir region, where scientific laboratories are located in addition to production. The shortage of personnel in the field of chemical and pharmaceutical technologies in this region creates the need for interaction with an educational organization.

Analysis of human resources. Data that show the human resources potential of the University are reflected in monitoring the performance of universities. The total number of University professors has decreased slightly since 2015 – 177 people to 171 people in 2019. The share of teachers who have an academic degree and title increased from 72% in 2015 to 87.88% in 2019.

Over the past 5 years the indicators of research activity of University teachers have changed significantly. In 2015 publications in journals included in the list of Scopus and Web of science were completely absent, then in 2019 the number of citations in Scopus increased to 24.45, in Web of Science to 27.27, and the number of publications per 100 teachers, respectively, to 10.82 and 10.35. The indicators are not high, but they show significant progress, primarily due to the renewal of the University's staff, which over the past 5 years has amounted to approximately 20%. Another significant indicator is the receipt of RFBR grants and the publication of their own scientific journals, which in 2020 will be submitted for consideration for inclusion in the list of publications recommended by the higher attestation Commission. Income from conducting research activities is practically non-existent – this is a significant field for future activities. There is an increase

in the number of student publications, the main indicator is the growth of their quality. In 2015 students published exclusively in conference collections, in 2019 15 articles were already published in publications from the list of the higher attestation Commission, there were no publications in international scientometric databases yet.

The greatest achievement of the University was the receipt in 2019 of three Federal grants at once. This projects within the framework of the National project "Education". This is the Federal project "Teacher of the future", "Support for families with children" and "Equal opportunities for everyone", and a grant is also being implemented under the Federal project "Social activity".

As part of the "Teacher of the future" project, two mini-centers for continuous professional development of teachers with the latest equipment have been opened at the University, which are designed to improve the skills of teachers in the region.

At the moment, out of 171 teaching staff members, 32 people participate in project activities in various forms, only 20 participate in research projects, and the prospects are to increase this figure to 75% of the teachers.

Having considered the experience of implementing student project activities, as well as management models used in its implementation in domestic and foreign universities, we developed our own model based on the real material, technical and human resources of the University and its potential stakeholders.

To form a management model, it is necessary to implement the following stages: creating a State Humanitarian University of technology project office; creating an electronic platform for University project activities; creating an expert Commission on project activities; making changes to the curriculum; creating a motivation system.

The activities of the project office should include the following tasks: creating a database of projects, selecting a pool of personnel for creating and implementing projects, a database of stakeholders, creating a pool of electronic student portfolios for selecting participants and a reserve of projects, creating expert commissions for selecting projects, creating a motivation system for project participants, developing a development plan for da 2024, conducting a competitive selection of projects and participants for their implementation, appointing project coordinators, developing a system for monitoring the progress of projects, evaluation of project implementation.

The project office provides for the following positions: Director of the project office, Manager of the project office, programmer, all other specialists are attracted by combining positions.

Creating an electronic platform for University project activities is one of the main stages in creating a management model. With the help of the platform, you can solve a large number of issues that arise in the course of conducting project activities. digitalization of the portfolio of all project subjects will speed up the processes of both team selection and solving most organizational issues.

The platform should consist of the following blocks: implemented projects; ongoing projects; potential projects; expert evaluation of projects; interests of stakeholders; projects for the development of the University; potential project participants.

Stages of operation of the project platform:

1. Creating a page on the University website with a description of the conditions for organizing project activities.

2. Creation of an expert Commission to review the quality and prospects of projects.

3. The involvement of the stakeholders for the formation of project requests

4. Announcement of a competition for the selection of projects for implementation.

5. Creating a project database.

6. Expert evaluation of projects and selection of viable projects.

7. Announcement of a competition for participation in projects.

8. Creating a database of people who want to participate in projects.

9. Selection of project participants by the expert Commission, forming a pool of spare ones to participate in projects.

The next stage of work is the creation of an expert Commission to assess the potential for project implementation and its acceptance in the future. The Commission consists of three permanent members: the Vice-rector for research, the Vice-rector for academic Affairs, and the Director of the project office. The remaining three members of the Commission are subject to review depending on the focus and nature of the project, make sure one of the members of the Commission is the representative of the stakeholder, the second expert in the project activities either the humanitarian or technical profile, and the third an expert in the specifics of a particular project. The Commission's decision is made using a rating sheet.

The next stage is to change the curriculum, with the introduction of 15 credits for the implementation of project activities in the training of students. In the first year, 3 credits will be allocated, for which you must either complete a creative educational project in the group, or develop a project selected by the Commission for implementation in the group. During this module, in addition to independent work on the project, trainings, business games and case studies with project curators are conducted. In the second year, 3 credits are also allocated for the implementation of project activities. In this case, it is also possible to close credits by implementing an educational creative project, or participate in the implementation of an approved project, the module is also accompanied by training activities.

From the third to the fifth (or 4) undergraduate courses are also allocated mandatory credits for project activities, a total of 9. In this version, students are required to participate in the creation and implementation of the project approved by the expert Commission. The special feature is that the teams are required to be interdisciplinary. The score for project activities is set in accordance with the requirements of the rating sheet.

The next stage in the life cycle of the management model of student project activity is the formation of a motivation system for students and teachers. For teachers, the motivation system is divided into 2 blocks: work with educational and research projects. Teachers who work with educational and research projects are motivated in two ways: an additional training load, if it is part of the training course, and an additional 10% of the salary, if the projects are implemented in extracurricular activities. With special success in the implementation of educational and research projects, teachers may be awarded, on the recommendation of the Director of the project office approved by the Vice-rector for research.

In the management, development and implementation of research projects, the motivation system is represented by several blocks: implementation of projects that have as a result publication of articles in journals of Russian science index (at least 2 per year) - 10% surcharge; implementation of projects that end with the publication of articles in Scopus/Web of science journals (at least 1 per year) - 20% surcharge; implementation of projects that end with a victory in national and international competitions - 20% surcharge and a bonus; implementation of projects that end with publications, receiving grants and winning competitions – individual conditions for consideration.

For students, the motivation system is represented by several aspects, depending on the level of achievement of students: crediting credits for academic subjects; increased scholarship; scholarship of Academic Council of the University; Vice-rector's scholarship for science; scholarship Of the Governor of the Moscow region.

Since the projects will be reviewed, the number of them will be significantly reduced at the first stage, but the quality will increase. This table presents quantitative indicators that characterize the efficiency of the project office. It is expected that in the first five years of

the project implementation, the number of projects that have passed expert evaluation will increase by 2 times. After analyzing potential stakeholders, the sequence of opportunities for interaction with the main ones was determined, since simultaneous work is not possible based on the University's human resources potential. The Appendix also indicates the interests of stakeholders not only in the implementation of projects, but also in the formation of educational programs for their order. Interest is aroused by professional development programs, professional retraining and master's programs that can be implemented jointly with our stakeholders from the educational environment.

Considering that at the moment 20 teachers are fully prepared for the implementation of research and project activities, the roadmap includes training and professional development of the same number of teachers to expand the scope of project activities. Analyzing the indicator of teachers' involvement in educational and research projects, we can say that within 5 years at least 75% of teachers should be involved. Over 5 years, the number of student research projects is planned to grow by at least 2 times, subject to selection by the expert Council. Another topical issue of the roadmap is to attract students to project activities on a competitive basis. using motivation systems, we plan to achieve a minimum of 2 students per place in the project by 2024.

Attracting students to various types of project activities should make up 100% of students by 2024. It is planned to attract fundraising funds for the implementation of projects initiated by representatives of stakeholders (OZ-Test, Eco-lab, Veropharm). Expanding the grant Fund of the University at the expense of extra-budgetary revenues will allow more effective motivation of project participants. A very important indicator for us of research projects is the number of student publications in peer-reviewed publications, which is planned to increase by more than 2 times in 5 years, and publications in international journals are planned. To implement the roadmap, a model of the project office was built.

Model of the project office. After completing the formation of the project office, creating and launching an electronic platform for project activities of the University and forming the composition of expert commissions, it is necessary to form a model for the work of the project office. We have identified four mechanisms that will be included in the project office model. The mechanisms of work are described on the example of the 2020-2021 academic year.

Mechanism for approving the list of projects. 10.05 in the 1st semester and 19.11 in the second semester, registration of projects on the electronic platform of the University begins, 10.06 and, respectively, 19.12 pre-registration for participation in projects that are already posted on the platform, but have not yet been approved by the expert (Council) Commission. On 17.08 and 22.12, the composition of expert commissions is appointed, on 20.08 and 24.12, a meeting of expert commissions is held to review projects for the corresponding semester of the academic year. On 27.08 and 28.12, a second meeting of the expert commissions is held to approve the list of projects implemented in the current academic year, if the project is longer-term, the terms of its implementation are approved.

At the second meeting, the expert Council distinguishes between projects related to research and educational research activities.

Project initiation mechanism. To initiate the project, you must submit an application for project implementation and submit the project passport in electronic form before 17.08 in the first semester and 22.12 in the second semester. Project initiators are necessarily external stakeholders, teachers and heads of structural divisions, as well as students of the University. Teachers, as well as stakeholders, as well as students, can initiate both research and educational research projects. Educational and research projects are implemented in the form of applied projects, research projects in the form of applied or fundamental projects. A

separate category of projects that can be initiated by teachers and students is projects that are aimed at the development of the University.

The mechanism of motivation of students to work actively in project activities. As described in the mechanism for approving the project list, projects are first selected through a competitive selection process, through a meeting of expert commissions that are part of the expert Council, which divides projects into educational and research projects. With the effective participation of students in educational and research projects, they are credited with a certain number of credits in the implementation of the curriculum and an increased scholarship, and priority when allocating vouchers for summer holidays, if there are results in the form of scientific publications, presentations at conferences and victories in competitions, it is possible to award a scholarship of the Academic Council. For students who implement research projects, there is a slightly different, more extended system of motivation. Students who effectively participate in the implementation of projects, receive appropriate credits for the implementation of their individual curriculum, can count on a grant system, the funds of which are distributed in accordance with the decision of the expert Council. A separate opportunity for students working in research projects of University stakeholders is the use of fundraising funds allocated by stakeholders for each project on specific conditions. Also, students who have achieved results in research activities in the form of published scientific papers, wins in scientific competitions, presentations at national and international conferences can apply for the scholarship of the Vice-rector for research and the scholarship of the Governor of the Moscow region. Special consideration and motivation system are presented to projects aimed at the development of the University and received external grants, or funds from stakeholders for implementation. Also, students who are engaged in research projects have priority over other students in increasing the increased scholarship, getting vouchers for summer holidays and submitting to the scholarship Of the academic Council of State Humanitarian University of technology.

Also, once a semester, a competition is held for projects of research and educational research activities, in several categories. The results of the competition are evaluated by an expert Commission, which includes representatives of stakeholders and social partners: Moscow State University, Ecolab, Verofram, OZ-Test, etc. The winners of the contest receive cash prizes, as well as special prizes from stakeholders. External part - time teachers, professors from Moscow state University, and Moscow Institute of physics and technology teachers also participate in the preparation of projects for the competition.

A mechanism for motivating teachers and employees to engage in project activities. As it was already described earlier, the expert Council divides projects in the following areas: educational and research. The system of motivating teachers to develop and implement educational and research projects is represented by two blocks: this is an additional training load with hourly pay, if the project is performed within the framework of the "project activity" disciplines, or it is payments for performing additional work, in the amount of 10% of the salary Supplement.

In the case when the teacher is engaged in the development and implementation of projects of the research focus, the incentive system is expanding: there are two main mechanisms of stimulation. There is a system of University grants created to facilitate the implementation of the most promising projects, which is distributed by the expert Council for research projects. Teachers are also paid a salary Supplement for performing additional work. Another possibility is to receive fundraising money from external stakeholders. There is a possibility of awarding teachers, if the project won competitions, the project results were published in publications included in scientometric databases, students made presentations at leading scientific conferences, the possibility of awarding is considered by the Vice-rector for science, on the recommendation of the Director of the project office.

In addition to managing student project activities, the project office should actively search for stakeholders and interact with them to improve and expand the University's infrastructure. The main joint activities with stakeholders are: the creation of new educational programs, including joint ones, as well as the creation of new laboratories and participation in the implementation of Federal projects, of which there are currently four at the University. Within the framework of interaction with stakeholders, it is planned to open 1 postgraduate program "plant Physiology and biochemistry", jointly with Moscow state university, and 2 master's programs: the program on innovations in biotechnologies, jointly with MSU, as well as the program clinical chemistry until 2024. It is also planned to launch several professional retraining programs in the field of biotechnology, chemistry, and molecular biology, also together with stakeholders. By 2024, it is also planned to launch at least 15 new professional development programs that are necessary for stakeholders, almost all programs in the field of pharmacy, chemistry, biology and biotechnology, these programs are planned to be launched for the interests of specific stakeholders. The result of the introduction of new educational programs should be new in-demand personnel and the formation of educational programs for the customer.

The launch of new scientific laboratories should result in the creation of new scientific personnel, the creation of new intellectual products, publications in leading scientific journals, the formation of scientific communities at the University, conferences, round tables, seminars of national and international significance. A significant factor is the involvement of professors from partner universities (Lomonosov Moscow State University, Physical-technology Moscow Institute, Russian University friendly of Nations) of the base in teaching disciplines and conducting student projects, as well as the possibility of using their material and technical base.

A separate block is the active participation of the project office in the implementation of Federal projects, involving students, both as volunteers and as project participants.

A very important element in the work of the project office is the implementation of the Vernadsky Moscow region project jointly with Moscow State University. The main tasks of which until 2024 are: to create 2 new innovative laboratories for biotechnologies and growing plants in experimental conditions, and, accordingly, to obtain products and results of these laboratories. It is also a priority to attract leading scientists from Moscow State University, both in the educational process and in project activities. Cooperation with leading scientists should lead to a significant improvement in the quality of scientific publications, including joint developments, as well as obtaining grants for the implementation of research activities. These conditions will also help prepare new research and teaching staff at the University. As mentioned earlier, it is planned to create a whole line of joint educational programs based on a commercial basis.

An important aspect of implementing a project-based training system is saving financial resources for implementing project activities. If in 2019, the University management spent about 3000000 rubles from the extra-budgetary Fund to stimulate project activities, held competitions for the best projects among professors and students, then based on the project plan, we can say that by 2024, costs will decrease to 1500000, since most activities will be carried out at the expense of the salary Fund, since project activities will be part of the main load of teachers.

Based on the fact that each year the educational process will include 3 credits for project activities, the payment of teachers based on the norms of hours for project activities for all faculties will reduce payments from the extra-budgetary Fund by approximately 300,000 rubles each year and will lead to the possibility to use these funds for the grant support Fund for the most relevant projects.

3 Conclusions

In the course of the work, the analysis of theoretical and empirical mechanisms for the formation of a management model of student project activity was carried out. The analysis revealed several types of management models for student project activities:

- when the main coordinator of project activities of students are the faculties (Ural Federal University, Northern Federal University);
- creation of educational and project laboratories and an information platform (High School of Economics);
- creation of a project center in close cooperation with stakeholders (Moscow Polytechnic University);
- creation of a project school (Novgorod State University);
- implementation of interdisciplinary projects during the educational process (University of Twente, Sam Houston State University, Buck Institute for Education).

The analysis of the state of the University in terms of development of project activities, the assessment of opportunities (personnel and resources) in terms of implementation of student project activities, both educational and research nature, was carried out. It is revealed that the material and technical base of the University is used for student project activities only by 15%, 15% of students and approximately the same number of teachers are involved in project activities.

A management model of student project activities at The state University of Humanities and technology has been developed, the main elements of which are: creating a project office, creating an electronic platform for project activities of the University, creating an expert Council on project activities, making changes to curricula, creating a motivation system, developing mechanisms for the work of the project office and active interaction of the project office with stakeholders for the formation of projects, laboratories and educational programs. A road map of the project office has been formed, which shows the criteria for the success of the planned activity. The main indicators of the road map are: creation of new innovative laboratories, involvement of leading scientists in the educational and research process, development of new technologies for growing and fertilizing plants, development of new biotechnologies, publications in Scopus and WoS, grants for research, young scientists and teachers, income from educational and scientific activities. The financial benefits of implementing projects in the educational process are obvious. this process will save about 1500,000 from the extra-budgetary Fund within 5 years and transfer these finances to the grant Fund to support the most promising projects.

A scheme of interaction with the main stakeholders within this model has also been developed: creation of new educational programs, creation of new laboratories, participation in Federal projects, implementation of the Vernadsky project jointly with Moscow State University.

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