Organizational and technological features of professional training of student construction brigades

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Abstract. Modern student construction brigades (SCB) are a significant source of labour resources and have significant potential, the disclosure of which largely depends on the processes of their professional and organizational training effectiveness. Professional training and the expansion of the list of competencies of SCB students at the stage of preparation for the working season can significantly increase the efficiency of attracting students to perform construction, installation and design and survey works, however, the implementation of professional training has a number of organizational and technological features. The level of professional and organizational training of students has a direct impact on the interest of organizations in the construction industry in attracting student construction teams, an increase in the qualitative and quantitative indicators of labour performance and its payment. The authors of the study analyze the results and features of the implementation of the project “Engineer - a working profession”, within the framework of which, from 2015 to 2019, more than 600 students from NRU MGSU underwent professional and specialized industry training. Within the framework of the study, a list of conditions necessary for the effective implementation of professional training of students was formed, the most acute problems and difficulties arising in solving organizational issues were described, and possible ways of solving them were formulated, a relationship was established between the evolution of the project and the most significant achievements of the SCB movement of NRU MGSU. The authors of the study broadcast the accumulated experience of the SCB NRU MGSU in the implementation of professional training of students. The accumulated experience and its structuring will serve as the basis for further improvement of approaches to professional training of SCB students, improving its quality and the effectiveness of attracting students to perform construction, installation and design and survey works in the format of student construction teams.

1. Introduction
The transformation and rebirth of student construction brigades (SCB) [1] in recent history are closely related to the new challenges facing the construction sector of the economy. The vector of the industry development and the requirements for specialists today should be the determining factors in building a hierarchy of goals [2] for the existence and functioning of the entire movement of student construction
brigades, as well as in the election and systematic transformation of the organizational structure \([3,4]\) of the SCB of an educational organization with the greatest development potential.

Along with increasing the efficiency of the academic educational process, professional orientation and early integration of students into production activities play a key role in the formation of the personnel potential of the industry \([5]\). Today, the transformation of low-skilled labour teams into competitive student construction teams, prepared for the effective implementation of construction, installation and design and survey work should be the main goal of the movement.

Students of specialized educational organizations, who in the future will become engineering and technical workers and designers, have a number of advantages over ordinary workers, namely, the desire to gain new experience, initiative, a high degree of dedication and a desire to prove themselves. However, the lack of relevant experience calls into question the possibility of profitable use of students when performing qualified work, on which the quality and timing of the implementation of investment and construction projects depend \([6,7]\).

In 2015, the management of the Headquarters of the SCB NRU MGSU for the first time made a decision to organize vocational training in three specialties: “concrete worker”, “bricklayer” and “plasterer”. Based on the results of training, the SCB fighters were assigned a professional qualification \([8]\) of the corresponding category and a certificate of the established form was issued. In addition to obtaining a working specialty \([9]\), students were offered to take a lecture and practical course on labour protection and safety precautions for performing construction and installation work with obtaining admission to work at height using paving equipment, as well as for work performed on sites with a fence 1.1 m or more. The project “Engineer - a working profession” \([10]\) was implemented jointly with the NOU DPO “UCPR”.

In parallel with the introduction of blue-collar training programs into the training process for SCB fighters, the SCB Headquarters of the NRU MGSU took an active part in the Russian Student Detachments organized by the Youth All-Russian Public Organization (MOOO RSO) \([11]\) “(SC “Rosatom”) Schools for commanders of student construction teams of the nuclear industry. The participants of these schools were representatives of the SCB movement of the flagship universities of the State Corporation “Rosatom” \([12]\), sent both for leadership in the third labour semester \([13]\) by the headquarters of all-Russian and zonal student construction projects \([14]\), and for participation in the implementation of projects for the construction of nuclear facilities \([15]\).

The main direction of training for SCB fighters within the framework of the schools for commanders of student construction brigades of the nuclear industry has invariably been an industry program that provides for the study of the basic foundations of the Rosatom Production System (RPS) \([16]\) as a culture of lean construction production in the nuclear industry.

The positive experience of 2015, the high marks of the host organizations and the interest of the students themselves served as an incentive for the subsequent evolution of the project and its implementation on an ongoing, mandatory basis.

Professional training and industry knowledge and skills of students allowed to significantly increase the interest of the host organizations of the construction complex in attracting student construction teams of NRU MGSU, expand the geography of work and the scope of fighters, and also became a good reason for starting cooperation for organizations that have never had experience of interaction with the movement SCB.

In subsequent years of the project, the following professions were added to the list of specialties: “bar benders” and “formwork system installer”, while the training of students in other professions did not stop, but on the contrary increased the quantitative indicators.

In 2018, as part of the expansion of the project “Engineer - a working profession”, twenty students are provided with a unique opportunity to undergo training in the specialties “electric welder of manual welding” and “inspector of welding works”, simultaneously receiving all the necessary permits for full-fledged work in the construction industry. The positive experience and success of 2018 made it possible in 2019 to include in the list of specialties the unique and rare professions of an electric welder and a NDT inspector, which are unique and rare for students of higher educational institutions.
Thus, already in 2018, the SCB NRU MGSU managed to achieve absolute indicators: 100% of the students sent to perform construction, installation and design and survey work as student construction teams had a wide list of working professions and the necessary admissions. In total, more than 600 students of NRU MGSU received blue-collar occupations in the period from 2015 to 2019.

2. Materials and methods

Analysing each stage of the implementation of the project “Engineer - a working profession”, the authors of the study highlight a number of characteristic problems.

In addition to the formal availability of qualification certificates for students, real knowledge and skills in the profession declared in the certificate are required, so that the experience of working with host organizations becomes positive and not the last. Accordingly, special attention should be paid to the quality of educational services when choosing a training centre.

Training in the specialties of reinforcement, concrete worker, bricklayer, plasterer, installer of formwork systems, implemented by the SCB NRU MGSU within the framework of the project “Engineer - a working profession”, was organized at the production facilities of the Non-state educational institution of additional professional education “Training centre for vocational training of workers” (NOU DPO “UCPR”).

The duration of training in most specialties was 5 days, with daily lessons of 6-10 hours and a final theoretical and practical exam. The group of students in each of the specialties was formed from 10-15 people. This approach made it possible, depending on the workload of the training centre, to ensure the development of blue-collar occupations by 10 - 45 students in one week.

The first experience in 2015 demonstrated the difficulties in combining the professional training of SCB fighters with the educational process at the university. In this regard, it was decided to organize practical training during the summer examination session in order to minimize the number of missed classes at the university. The schedule of the summer session theoretically made it possible to free up 5-7 free days in a row in case of early delivery of 1-2 exams or tests to students, which was enough to obtain a working specialty. With all the inconveniences, this format was used in 2015 - 2016 and was feasible with a relatively small number of students involved as SSOs in the performance of work in the third labour semester.

Apart from obtaining the main working profession, training on the safety of work was organized for the soldiers of the SCB NRU MGSU, followed by admission to work at height [17]. This course involved lectures with a total duration of 8 hours and one day of practical training of the same duration. To minimize possible collisions with the educational process, by mutual agreement with the training centre, it was decided to hold all lectures on one of the days off in the cohort lecture hall of NRU MGSU with a total group size of up to 120 people. The practical part of the course, students took place on the basis of the training centre on one of the weekdays in groups of 15-20 people. This format of occupational health and safety training was recognized as the most convenient and effective and was applied annually without changes.

With the popularization of the SCB movement at the NRU MGSU and the growth in the number of fighters, the previous format of organizing professional training during the summer session was recognized as imperfect for two reasons. Firstly, one month was actually not enough to train all SCB fighters, and, secondly, the number of desperate situations when early passing exams or tests would have been impossible would have become too great.

Since 2017, it has been decided to implement the project “For an Engineer - a working profession” in the spring. This format implied absences by students of at least 6 school days in the educational organization (5 days during the receipt of the main working specialty and 1 day during the practical course on the safety of work).

This format became final and was applied until 2019, inclusively, however, it required both independent replenishment by students of knowledge that they had not received in the days they missed, and a certain level of support from the leadership of the University to eliminate the formal negative consequences of students’ absence from classes. Despite the above, individual conflicts with insufficient
support from the administrative and managerial staff often had to be resolved manually, especially during the years of the peak number of SCB fighters (2018).

An alternative solution when conducting vocational training can be the implementation of training during the winter holidays lasting 5-7 days at a site that has the ability to organize accommodation and meals for both students and teachers of the training centre, as well as if there is a large, closed area on this site for classes. Such a platform could be the recreation centre of the NRU MGSKU in the city of Bronnitsy, which meets all the requirements and can accommodate up to 120 people.

The plan for the implementation of vocational training in this format, including resource [18] and calendar-network [19] models, was developed by the Headquarters of the SCB NRU MGSKU, was repeatedly submitted for consideration to the management of the University, but has not yet been implemented.

Thus, by 2017, a satisfactory solution was found for organizing vocational training within the entire list of blue-collar occupations. However, in 2018, the implementation of a pilot project to train electric welders for manual welding and welding inspectors required finding a solution to a new question: how to organize training, which requires a month of daily classes, without significant damage to the educational process?

The way out of the situation was the transformation of the monthly course into a three-month cycle of classes 2 times a week - on a weekday and on Saturday. It should be noted that the financing and solution of a number of organizational issues of this project was carried out by the partner organization of the SRO NP “Soyuzatomstroy” [20] with the personal participation of the President of the SRO of the nuclear industry, Adviser to the General Director of the State Corporation “Rosatom” V.S. Opekunov. The implementation of this training was the result of many years of cooperation between NOU DPO "UCPR" and SCB NRU MGSKU.

The next significant problem in the expansion of the project “Engineer - a working profession” and the growth in the number of those wishing to undergo vocational training was the fact that after receiving a working specialty, each student is guaranteed to go to one of the facilities in the summer working season. In addition, he must be provided with a job in accordance with the profession acquired at the training centre.

With the increase in the number of NRU MGSKU SCB fighters (222 people in 2018), objective planning of the balance between the labour market demand in the construction industry for certain specialists and the number of trained fighters became possible only after the SCB NRU MGSKU Headquarters reached a long-term and reliable level of cooperation with partner organizations.

Together with the consolidation of professional relationships with the key partners of the SCB NRU MGSKU - JSC TEK Mosenergo, JSC CONCERN TITAN-2, GC PIK and minimizing the role of mediators in the negotiation processes, the headquarters of the SCB NRU MGSKU made a transition to the most efficient and logical scheme training of labour resources.

At the beginning of the spring period, on the basis of negotiations with enterprises of the construction industry, the need of organizations for specialists was determined, and then vocational training was implemented during the spring period. This approach made it possible to guarantee the employment of SCB fighters of the NRU MGSKU in exact accordance with the received working profession.

It should be noted that when implementing professional training, the issue of financing the project requires special consideration. The authors of the study are convinced that at the current stage of the evolution of the movement of student construction brigades, the high practical value of the professional integration of student youth into the working environment and the creation of conditions for the formation of human resources in the construction industry predetermine an absolutely free nature, which should have a professional training of students - SCB fighters.

With an increase in the quantitative indicators of the project “Engineer - a working profession” implementation in 2016, the funds allocated by the administrative and managerial staff of NRU MGSKU to cover training costs became insufficient. In this regard, the question arose: which of the students should receive a working specialty for free, and who should pay for the service on their own? The solution to this problem can be the use of third-party funding, participation in competitions and grants.
However, in this case, too, a problem arises in the discrepancy between the moment of receipt of funds under the grant with the moment when these funds are needed to pay for training.

In 2016-2018, the headquarters of the SCB NRU MGSU actively participated in competitions for programs for the development of student associations [21] and repeatedly became one of the winners, which made it possible to allocate significant resources to improve the processes of vocational training and provide free training in working specialties for the maximum number of representatives of the movement.

In the course of the evolution of the project, the management of the Headquarters of the SCB NRU MGSU found the following solution: payment for vocational training was initially made by all students independently. Further, based on the results of the labour semester, on the basis of a comprehensive assessment of the activities of each SCB fighter, compensation for training costs was made to the extent that the total funds allocated by the educational organization and received using third-party funding allow.

3. Results

As part of the analysis of the SCB NRU MGSU of the project “Engineer - a working profession” implementation stages from 2015 to 2019, the authors of the study formed a list of related problems and formulated possible ways to solve them. The data are presented in table 1.

**Table 1.** Typology of problems of the student construction teams fighters professional training implementation and possible ways to solve them.

| Problems classification | Problem name                                                                 | Necessary conditions and solutions                                                                 |
|-------------------------|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| Administrative          | 1. Difficulty in combining educational process and professional training;     | 1. Search for the most suitable format for organizing professional training, depending on the number of trainees; |
|                         | 2. The negative reaction of teachers to students missing classes in an educational organization without official release; | 2. Increasing the level of provision of the process of professional training of students with regulatory and administrative documents; |
|                         | 3. Low level of the administrative and managerial staff support of an educational organization for a centralized search for solutions to problems with absenteeism; | 3. Ensuring the consistency of all organizational issues through support at the highest level of the leadership of the educational organization. |
|                         | 4. With an increase in the number of students aimed at vocational training, the volume of bureaucratic procedures increases, leading to an increase in the number of conflicts between structural units of an educational organization. |                                                                                                      |
|                         | 1. Insufficient financial support from the educational organization;         | 1. Payment for the services of the training centre at the expense of students with subsequent autumn compensation of costs based on the results of the working season and a comprehensive assessment of the activities of the SCB fighters; |
|                         | 2. Inconsistency in the actions of the structural units of the educational organization when paying for the services of the training centre and, as a result, the failure to pay; | 2. Attraction of third-party funding sources, participation in competitions and grants. |
|                         | 3. Late receipt of funds from third-party funding sources.                   | 1. Professional training for students only in the most demanded working professions; |
| Financial               | 1. Difficulties in providing each student with a job in accordance with the received working profession; | 2. Striving for long-term cooperation with host organizations and early |
|                         | 2. Difficulty in predicting the exact number of trained professionals in each profession, which will be supported by the demand of |                                                                                                      |

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the host organizations during the summer working season.
1. Unfair attitude of students towards attending classes in the training centre;
2. Refusal or untimely payment by students for educational services provided by the training center for reasons not related to the quality of services provided.

Identification of the need for specialists of each profile;
1. Prepayment for educational services before starting vocational training;
2. A radical policy in the field of selection of candidates for joining the student construction brigade movement. An integrated approach to preparing students for the working season, including a cycle of meetings explaining all organizational issues, including those related to professional training.

Personal

Regular participation of NRU MGSU students in educational events, as well as in all-Russian and international labour projects of the State Corporation Rosatom has allowed the Headquarters of the SCB NRU MGSU since 2017 to annually organize industry-specific in-depth training in the Production System “Rosatom”, aimed directly at the fighters of the SCB NRU MGSU.

As a result of this project, over 30 students of NRU MGSU in the period from 2017 to 2019 have mastered and learned to apply in practice the RPS tools, knowledge of which is a prerequisite for the professional and career growth of employees of the nuclear industry. This factor played a significant role in the process of participation of SCB fighters of NRU MGSU in numerous competitions for participation in international student projects of Rosatom, as well as in the subsequent employment of graduates of NRU MGSU at enterprises of the nuclear industry.

Focusing on the professional training of students, expanding their competencies and improving the qualifications of fighters allowed the SCB NRU MGSU to become a guarantor of quality for host organizations and achieve significant success in the all-Russian movement of student groups:

- Increase the number of SCB fighters of the NRU MGSU by 2018 to 222 people.
- To annually hold up to 50% of the quota of the State Atomic Energy Corporation “Rosatom” as part of international student construction teams.
- The first of the capital’s universities to take an organized part in the Moscow Renovation project.
- Twice, in 2016 and 2017, forming the core of the Central Federal District team, become winners of the All-Russian competition of professional skills among student teams # TRUDKRUT.
- To raise the average wage level for the SCB fighters of the NRU MGSU from 30 thousand rubles up to 60 thousand rubles per month.

4. Conclusion
The authors of the study broadcast the experience of the implementation of the project “Engineer - a working profession”, in the framework of which, from 2015 to 2019, more than 600 students from NRU MGSU were trained in the specialties “reinforcement worker”, “concrete worker”, “plasterer”, “installer of formwork systems”, “bricklayer”, ”electric welder”, “controller of welding” and were involved in the implementation of construction, installation and design and survey work in the format of student construction teams.

The creation of a trend of professional, competitive construction teams that have undergone a full cycle of vocational training from general construction specialties to industry specific features, and the reinforcement of this trend with the real competencies of students should form the basis of construction teams of recent history, whose activities are moving away from low-skilled labour and are increasingly being replaced by qualified, specialized labour.

The experience of the SCB NRU MGSU demonstrates that the implementation of professional training of students has a number of organizational and technological features and has a certain
problems, within which the authors highlight the obstacles of an administrative, financial, organizational and personal nature, and also provide recommendations for overcoming them.

The accumulated experience and its structuring will serve as the basis for further improvement of approaches to professional training of SCB fighters, improving its quality and the effectiveness of attracting students to perform construction, installation and design and survey works in the format of student construction teams.

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