

# *Integration of education and science through the organization of basic departments and scientific and educational centers*

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**Abstract**—The results of the scientific activity of the Interdepartmental Research and Education Center “Perspective Technologies and Materials” and the basic Department of ecology and ecological problems of chemical technology of Vladivostok State University of Economics and Service in 2015-2017 have been analyzed. The received results testify to expediency of creation of the scientific and educational centers and basic departments as a whole, which promotes effective integration of educational and scientific institutions.

**Keywords**—*basic departments; scientific and educational centers*

## I. INTRODUCTION

The social and economic development of Russia's regions largely depends on the introduction of competitive science-intensive innovative technologies in various fields of activity, industry, in the system of public administration and education. The new, so-called innovative economy, or, as it is often called, “knowledge-based economy”, involves a sharp leap in the development of intellectual capital, in improving the quality of education, ensuring high performance of scientific activity, and using high-tech industries on this basis [1-4].

The institutes of the Russian Academy of Sciences (RAS) and universities are the largest centers of innovation activity and play an important role in the development of a modern innovation economy, both individual regions of the Russian Federation and the whole country [5-7]. An effective tool for the integration of educational and scientific institutions is often the creation of basic departments of universities at

various enterprises and the organization of scientific and educational centers.

Many authors note that the basic departments (BD) and scientific and educational centers (SEC) act as integrators of scientific and educational activities participate in the training of personnel in inseparable connection with the research process in important scientific areas and are the points of growth and development of a fundamentally new higher educational institution [8-11].

In 2013 Vladivostok State University of Economics and Service (VSUES) switched to a new model of training young professionals - “practice-integrated learning” or “PIL”.

The idea of practice-integrated learning consists in the acquisition by a student of a real work experience at an enterprise for 8 months. For students, to pass a professional internship, the educational process was organized in such a way that:

a) practices of all types have been combined in a single time period;

b) the students of the graduate course were provided with the opportunity to combine work and study by minimizing the classroom hours (subject that the provisions of the educational standard are complied with) and the respective schedule of contact work is made (classes in evenings and on Saturdays) [12].

The objectives of the practice-integrated learning implemented at VSUES are: ensuring the guarantees of high

quality training in accordance with the current labor market requirements; effective formation of professional competencies in students; ensuring continuous professional growth and improvement of teachers; ensuring effective interaction between the university and the business community; wide involvement of faculty and researchers, students and postgraduate students of VSUES in project activities; development of skills and competencies for students, postgraduates, teachers associated with entrepreneurial and project activities; development of personal skills and competencies for students and postgraduates, related to team work, business communications, labor relations and relations in the team; obtaining scientific results, creating prototypes of innovative products / services that have replication potential; increase in the number of entrepreneurial projects initiated by employees, postgraduate students and students of VSUES; attraction of extra-budgetary incomes, increase in the level of income of scientific and pedagogical workers of VSUES [13].

In the context of the implementation of PIL, an effective tool is the creation of basic departments of higher educational institutions at enterprises in various areas of training, as well as scientific and educational centers.

The overall goal of establishing basic departments and scientific and educational centers is to conduct research, develop the educational process, and involve researchers, as well as specialists who may not have an academic degree and experience in scientific and pedagogical work, but have sufficient practical experience in the field of their professional activities being relevant to the activities of the educational organization, from commercial and non-profit organizations in science and business.

As a rule, the BD and SEC are of a profile nature of the main scientific directions and educational programs being implemented. Creation of the BD and SEC enables to form a certain set of professional competences, accelerate the adaptation of graduates to the corporate culture, to bring them to the optimal professional level [14]. At the same time, the development and implementation of educational programs take place with the participation of specialists from enterprises that are co-tutors in production and pre-graduation work experience and graduate qualification works of bachelors and masters.

Many Russian universities note a positive experience in creating BD and SEC [9, 15, 16]. In [15], experience of Nizhny Novgorod Alekseev State Technical University was considered in the creation of basic departments in high-tech enterprises. It is noted that the basic departments are the basis for quality training of students, guaranteed employment of graduates and reducing the period of field adaptation of young professionals. This is achieved due to the fact that high-tech enterprises provide manufacturing laboratories and room for practical classes of students, while highly qualified employees of enterprises and organizations participate in the formation of basic educational programs and in the implementation of the educational process, supervising term and diploma projects. In [9, 16], examples of successful organization of SEC by various universities and institutes of the Russian Academy of

Sciences are given (the Moscow Institute of Physics and Technology, the Institute of Applied Physics, the Vologda Scientific Center, the Sholom-Aleiheim Amur State University).

It is quite common to create a BD and SEC in conjunction with the Russian Academy of Sciences as an institutional form of interaction between the university and the institutes of the Russian Academy of Sciences. In this paper, the experience of creating the Interdepartmental Research and Education Center "Advanced Technologies and Materials" (hereinafter – SEC ATM) and the Department of Ecology and Ecological Problems of Chemical Technology of VSUES (hereinafter – BD EEPCT) at the Institute of Chemistry of the Far Eastern Branch of the Russian Academy of Sciences was considered.

## II. RESULTS AND DISCUSSION

Establishment of SEC ATM and BD EEPCT was preceded by the contract on scientific and technical cooperation between VSUES and the Institute of Chemistry of the Far-Eastern branch of RAS (ICH FEB RAS) signed in 2013 seeking to unite the scientific and technical potential and do research in the following:

- complex processing of mineral, technogenic and plant raw materials to manufacture functional materials with specified properties;
- energy and resource-saving chemical-technological processes and problems of their intensification;
- environmental problems of chemical technology and related areas;
- technology of inorganic substances and materials;
- making functional materials for the purpose of detoxifying environmental objects contaminated with heavy metals and radionuclides.

In 2013, with the aim of implementing the project "Obtaining new functional materials and developing methods for cleaning liquid media from ions of heavy metals and long-lived radionuclides" within the Strategic Development Program in 2013-2015, Interdepartmental Research and Education Center "Perspective Technologies and Materials" was established at VSUES. In a relatively short period, high scientific results were achieved: 20 papers were published in Russian and foreign peer-reviewed journals; 3 patents for invention were received; 3 PhD theses were defended.

After the completion of the project, the heads of VSUES and ICH FEB RAS decided to continue fruitful scientific cooperation by creating a basic department of ecology and ecological problems of chemical technology for further research and active involvement of students in research activities.

The implementation of the BD EEPCT educational process is carried out in accordance with the mission and strategy of VSUES, the requirements of the educational standards of the Ministry of Education and Science of the Russian Federation and the personnel policy of ICH FEB RAS.

The main tasks of BD EEPCT in educational activities are:

- combining efforts in the development and implementation at a high educational and training-methodological level of programs for the preparation of bachelors and masters in the field of ecology, environmental problems of chemical technology (including complex processing of mineral raw materials and man-made waste), and the creation of functional materials with specified properties;
- organization and execution of graduate qualification works of bachelors and master's theses at the department, as well as field experience and pre-diploma practice of bachelors, research practice of masters;
- attracting to the educational process in VSUES highly qualified scientific staff of ICH FEB RAS.

Scientific researches on BD EEPCT are conducted in accordance with the priority directions of development of science and technology of the Russian Federation, scientific research of VSUES and ICH FEB RAS and are aimed at solving the following tasks:

- organization of research works of bachelors and undergraduates, conducting laboratory works and practices using scientific equipment ICH FEB RAS;
- implementation of joint scientific and innovative projects;
- training of scientific personnel in postgraduate and doctoral studies in specialized scientific fields.

In 2015-2017, 11 undergraduate students of the major 05.03.06 "Ecology and Nature Management" and 3 undergraduates of 05.04.06 "Ecology and Nature Management", profile "Ecology and Environmental Protection" of the Department of tourism and ecology of VSUES had department-based training, field and pre-diploma practice. The research was carried out in the following scientific directions: studying the patterns of formation of calcium silicates under various synthesis conditions; study of the sorption properties of compounds obtained from components of various types; processing of boric acid production waste with obtaining materials for the construction industry; purification of aqueous media from heavy metal ions using an electrochemical method.

Based on the results of the research conducted at the basic department, 3 master's theses were successfully defended.

Bachelor and master students studying at the basic department have shown a number of scientific achievements in 2015-2017:

- winning Vladimir Potanin's Scholarship contest;
- winning the competition for an advanced scholarship for achievements in research and development;
- prize-winning places in the annual International scientific and practical conference of students, graduate students and young scientists "Intellectual potential of universities for the

development of the Far-Eastern region of Russia and the Asia Pacific", Vladivostok;

- winning in the project "Granite of Science" in the nominations "First Steps in Science" and "In search of scientific truth";
- winning the competition of student research papers "Young Scientist" in the nominations "Step into science" and "Through thorns to the stars" [17, 18].

The important achievements of the department in 2017 include the victory at the Third Interdisciplinary Youth Scientific Forum with international participation "New Materials" (Moscow, November 21-24, 2017) and the awarding with the Vernadsky Order of the department's head Yarusova S.B. (award from the Non-Governmental Vernadsky Ecological Fund).

The activity of BD EEPCT is characterized by rather high publication activity. In 2015-2017, more than 20 articles were published, indexed in the Web of Science and Scopus databases, including together with students.

Over the past three years, BD EEPCT has participated in 15 scientific conferences, most of which are international. From international conferences, oral reports were made in 2015 and 2017 at the IV and V International Conferences on Chemistry and Chemical Technology, respectively, held in the Republic of Armenia (Yerevan) and in 2016 at the VII International Conference on Environmental Engineering and its applied aspects in Malaysia (Kuala Lumpur). At the same time, oral reports prevail among the total number of reports. In 2017 the share of oral reports was 92%, reports with the participation of students accounted for 58.3% of the total number of reports. The share of reports presented directly by students is 42%.

It should be noted that among the plenary reports one report was presented by the 1st year master student at the XVIII International Scientific and Practical Conference of Students, Postgraduates and Young Scientists "The Intellectual Potential of Universities for the Development of the Far-Eastern Region of Russia and the Asia Pacific" (Vladivostok, April 27-29, 2016). This indicates a high level of preparation of undergraduates, since at most conferences the largest scientists act as plenary speakers.

In 2017, the department participated in the organization of two foreign conferences held in Italy and Indonesia:

- 8th International Conference on Environmental Engineering and Applications (ICEEA 2017, Italy, July 18-20, 2017, participation in the Technical Program Committee);
- The 3rd International Conference on Chemical Engineering Sciences & Applications 2017, (Indonesia, September 20-21, 2017, participation in the Scientific Committee).

The basic department actively cooperates with Russian and foreign universities and research organizations. Among foreign partners, China, Vietnam, the Republic of Armenia, and India are traditionally left. New universities and scientific organizations of Algeria, Latvia and Lithuania have become

new foreign partners. Among the permanent scientific partners of the department is the Far-Eastern Federal University, on the basis of which part of the scientific research is carried out.

In 2015-2017. BD EEPCT participated in the execution of work under the agreement between JSC "Vostochnaya Neftekhimicheskaya Company (VNHK)" and ICH FEB RAS of 12.08.2015 № 1421015/0121D on the development of polymer-based sorbents for the trapping of petroleum products and under the contract for research on the topic "Obtaining and investigating the properties of aluminosilicate materials" with the participation of undergraduate and graduate students.

BD EEPCT conducts career-oriented work. In 2017, oral presentations were made at the Regional Scientific and Practical Conference "Modern approaches to school career guidance as a system of interaction between the individual and society in the context of regional development" (VSUES, Vladivostok) and the V All-Russian Conference on Environmental Education (the Ministry of Natural Resources and Ecology Russian Federation, Moscow). The reports were devoted to the role of the basic departments of the university in the professional orienting of youth and the solution of personnel problems.

The basic department took part in conducting excursions to ICH FEB RAS for schoolchildren as part of events timed to the Day of Russian Science within the school "Week of Science" at the International Linguistic School.

Since 2015, the BD EEPCT has been participating as an expert in the Regional Scientific and Practical Conference held by the University's "Gymnasium-College" complex of the FEFU, selecting for schoolchildren who plan to enter universities in specialties close to the scientific areas of the basic department (chemistry, biology, ecology, chemical technology).

The development of new scientific topics, expansion of the material and technical facilities, increase in the proportion of bachelors, undergraduates, graduate students in the performance of research and preparation of publications, increase in the publication and grant activities of the department, development and strengthening of scientific ties with Russian and foreign partners remain the priorities.

### III. CONCLUSIONS

Thus, the example of the Interdepartmental Scientific and Educational Center "Perspective Technologies and Materials" and the Basic department of ecology and ecological problems of chemical technology showed the expediency of creating scientific and educational centers and basic departments in general, which contributes to the effective integration of educational and scientific institutions.

## References

- [1] A.S. Shurupova, "Strategy of social and economic development of the region on the basis of knowledge management," *Fundamental research*, No. 8, pp. 1168-1172, 2014. (In Russ.)
- [2] Yu.S. Avramenko, "Prospects of innovative development of the Russian regions' economy," *Business in law. Economic and legal journal*, No. 5, pp. 308-310, 2009. (In Russ.)
- [3] N.D. Guskova, I.N. Krakovskaya, and S.M. Vdovin, "Model and algorithm for the development and implementation of the sustainable development strategy of a region," *National interests: priorities and security*, No. 20 (209), pp. 18-25, 2013. (In Russ.)
- [4] Yu.K. Akchulpanov, "Problems and prospects of innovative development of the Russian regions' economy," *Vector of science of TSU*, No. 3 (21), pp. 105-107, 2012. (In Russ.)
- [5] G.A. Untura, "The role of regional branches of the Russian Academy of Sciences in the innovative development of regions," *Economy of the region*, No. 3, pp. 85-95, 2010. (In Russ.)
- [6] T.V. Lonsky, and Ye.G. Erlygina, "The role of university complexes in the regional innovation system," *Journal of Russian Entrepreneurship*, No. 5 (1), pp. 35-39, 2011. (In Russ.)
- [7] D.S. Tereshchenko, and V.S. Shcherbakov, "The place and role of universities in the innovative development of Russian regions," *Regional economy: theory and practice*, No.12, pp. 165-177, 2016. (In Russ.)
- [8] V.M. Filippov, "Functioning and development of sectoral basic departments," *International Journal of Applied and Fundamental Research*, No. 4, pp. 625-627, 2016. (In Russ.)
- [9] B.E. Fishman, "Scientific and educational center – a tool for the development of the university," *Higher education in Russia*, No. 3, pp. 113-119, 2015. (In Russ.)
- [10] A.K. Klyuev, "Structures for the development of the university: research and educational centers," *University management: practice and analysis*, No. 5, pp. 64-70, 2009. (In Russ.)
- [11] I.R. Pleva, A.E. Khramov, A.V. Ivanov, M.V. Khramova, and O.I. Moskalenko, "Scientific and educational center as a "growth point" of a technical university," *Higher education in Russia*, No. 5, pp. 5-11, 2014. (In Russ.)
- [12] O.O. Martynenko, Z.V. Yakimova, and V.I. Nikolaeva, "A methodological approach to the evaluation of graduates' competencies," *Higher education in Russia*, No. 12, pp. 35-45, 2015. (In Russ.)
- [13] Methodical recommendations for practical-integrated learning in Vladivostok State University of Economics and Service, <http://cpo.vvsu.ru/pio/>, last accessed 2018/06/01. (In Russ.)
- [14] Methodical recommendations for practical-integrated learning in Vladivostok State University of Economics and Service, <http://cpo.vvsu.ru/pio/>, last accessed 2018/06/01. (In Russ.)
- [15] S.M. Dmitriev, T.I. Ermakova, and E.G. Ivashkin, "Experience of work of a technical university with basic departments," *Higher education in Russia*, No. 2, pp. 73-81, 2014. (In Russ.)
- [16] L.O. Kocheshkova, "Experience and prospects of integration of science and education (in the format of the scientific and educational center)," *Problems of Territory Development*, No. 6 (74), pp. 7-22, 2014. (In Russ.)
- [17] K.O. Shornikov, S.B. Yarusova, R.D. Yashchuk, and I.G. Zhevtun, "Creation of the basic department as one of the forms of realization of practice-integrated education in the modern university," *Proceedings of the XVIII International scientific and practical conference of students, graduate students and young scientists "Intellectual potential of higher education institutions for the development of the Far-Eastern region of Russia and the Asia Pacific"*, Vladivostok, vol. 2, pp. 250-254, Publishing house of VSUES, 2016. (In Russ.)
- [18] A.A. Narbutovich, S.B. Yarusova, O.S. Vasilenko, and I.G. Zhevtun, "Research and educational activity of the basic department of ecology and ecological problems of chemical technology VSUES: results and prospects," *Proceedings of the XIX International scientific and practical conference of students, graduate students and young scientists "Intellectual potential of universities for the development of the Far-*

Eastern region of Russia and the Asia Pacific”, Vladivostok, vol. 3, pp. 184-188, Publishing house of VSUES, 2017. (In Russ.)