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FORMS OF INTERNATIONAL COOPERATION IN ENVIRONMENTAL EDUCATION: THE EXPERIENCE OF SAINT PETERSBURG STATE UNIVERSITY

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The authors analyse different forms of environmental education projects and programmes implemented in the Baltic Sea region. The first one is "The Baltic University" programme taught in English. The "Baltic University" is a network of more than 200 universities from 14 counties of the Baltic Sea region. This education programme offers an opportunity for students to enroll on bachelor and master degree programmes related to environmental and social problems of the Baltic Sea region. The Polar and Marine Sciences, POMOR master programme, represents the second form of international environmental education. Russian and German researchers from six universities and four research centres have developed the programme. The target group of the programme are Russian and international students, studying together during the whole duration of the programme. It is the first internationally accredited MA programme taught in English. International accreditation proves the compliance of the programme with international education standards. The same cooperation model is used in a new international master programme — Cold Regions Environmental Landscapes Integrated Science (CORELIS). The programme started in 2016. It is implemented jointly by Hamburg university (the lead partner of the project), and university professors from Helsinki (Finland) and Lisbon (Portugal). Researchers from the Austrian National Institute of Polar Research (Austria, and Lund University (Sweden) will join the programme at a later stage. Such an approach will help achieve the synergy of the European and Russian approaches to environmental education. The Russian-Norwegian master programme "Geo-ecological monitoring and rational use of natural resources in the Northern oil and gas production regions" is a good example of the third form of international environmental education. The programme similar to POMOR and CORELIS. However, it has one distinctive

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feature — Russian and foreign students study together from the second term only. The authors describe the ways of achieving the learning objectives of these master programmes depending on the students' language skills and their basic knowledge of ecology and nature management.

Key words: Baltic Sea region, Arctic, Northern seas, ecology, international cooperation

International environmental cooperation of Northern states has long been a priority in Russia. The Convention on the Protection of the Marine Environment of the Baltic Sea Area signed and adopted in 1974 and the Presidential Address to the Federal Assembly are evidence of the country's commitment to cooperation in environmental protection. Both documents emphasise the need for joint efforts to protect marine environment [1]. Training qualified specialists in ecology and sustainable environmental management is one of the priority objectives for Russia and other countries across the world. The collaboration between UNESCO and UNEP is aimed at developing an international educational programme in environmental protection (1975). The concept of environmental education has been developed at the international level. Current global processes of educational system integration, development of international strategies for environmental education, and coordination of efforts to protect the environment have a direct bearing on environmental education.

In view of national approaches to and requirements for qualified specialist training, the Strategy for Education prepared by the United Nations Economic Commission for Europe stresses the need for strengthening subregional cooperation and including education into bilateral and multilateral programmes. This is required for ensuring sustainable development. Although the development of environmental education is an important international objective, this area of university activity still experiences numerous problems. In Russia, problems of environmental education are discussed in the context of devising socioeconomic programmes for regional sustainable development and introducing a new higher education paradigm based on the Bologna declaration [2—12]. Over the past 25 years, Saint Petersburg State University (SPBU) has developed a number of environmental education programmes in collaboration with European partner universities. Most of these programmes are delivered at the Institute of Earth Sciences primarily within the 'Ecology and nature management' field of study. We believe that the international academic community can benefit from this experience.

International cooperation in environmental education and its forms that seemed most effective in view of the current changes in Russian universities' development strategies were first tested in the Baltic region. It is a transnational economic environment, which necessitates close international cooperation not only in environmental protection, but also in relevant training.

In 1991, SBPU joined the Baltic University Programme (BUP). It was the first step to attain this goal. This international project aims to develop fundamentally new regional cooperation with a focus on education in environmental protection and sustainable development of the Baltic region. It

includes creating and introducing university courses concerning problems common for the Baltic Sea states. Today, the programme brings together over 200 universities from 14 Baltic Sea region countries. Territorially, the region coincides with the territory of the Baltic Sea drainage basin — i. e. the area, whose rivers flow into the Baltic Sea. Thus, alongside the coastal countries — Finland, Sweden, Denmark, Germany, Poland, Lithuania, Latvia, Estonia, and Russia — the programme involves Belarus, Ukraine, Slovakia, the Czech Republic, and Norway. The training process takes advantage of the opportunities offered by satellite TV. It brings together several thousand students from dozens of partner universities across the region. Cooperation statistics is published in the BUP's annual reports (http://www. balticuniv. uu. se/index. php/annual-reports). It has been updated at the end of each year since 2001. The most recent 2015 report is available on the Programme's website.

SPBU was among the first thirty regional universities to join the Programme in autumn 1991. Students from 30 Saint Petersburg higher education institutions applied for the Baltic University courses. The first course was 'The Baltic Sea Environment'. It aimed to familiarise students with the key causes of environmental degradation in the Baltic region. Ten televised lectures were delivered by experts from all partner universities.

The key Programme components are as follows:

- bachelor's and Master's university courses in the English language, based on the recent research findings in the Baltic region and individual countries [13];
- research and professional cooperation between students and professors on sustainable development, environmental protection, and GIS technology applications [14];
- using current information and telecommunications technology in the training process (video lectures, audio- and videoconferencing, web-based student research).

Conferences bringing together students from across the region are an important element of the Baltic University Programme. Usually, such events are held from April to September. Important events include student conferences in Borki or Rogów, summer course at Hel Marine Station, and SAIL course on board STS Pogoria or STS Fryderyk Chopin.

Courses offered by the BUP Secretariat to SPBU students include two elective courses for bachelor's programmes — Environmental Science and Baltic Sea Region — Cultures, Politics, Societies — and two Master's course — Sustainable Water Management and Sustainable Community Development.

SPBU has also participated in another international environmental education project since 2002. It is a collaboration project with six German universities. The project's mode of training differs from that offered within the BUP. In this case, it is not an elective course but part of SPBU's Master's degree programme Polar and Marine Sciences (POMOR). At first, this Russian-German programme was included into the Hydrometeorology field of study. Since 2007, it has been part of Ecology and Nature Management.

Within this programme, Russian and international students study together in English from the first semester. It is based on an agreement between SPBU and the University of Hamburg in collaboration with other Russian and German research organisations and universities (for more detail, see http://pomor. spbu. ru/partners/). This programme is in line with a major global and European trend in higher education development — internationalisation and increasing academic mobility [14]. The programme concept was devised in 2001 based on European educational trends and the Bologna Declaration principles. One of its key objectives is training young researchers and specialists to foster long-term Russian-German partnership.

In 2012, the POMOR programme received international accreditation. Independent experts of the Accreditation Agency for Degree Programmes in Engineering, Informatics/Computer Science, the Natural Sciences, and Mathematics (ASIIN e. V.) performed an audit based on the following criteria: 1) concept, content, and implementation; 2) structures, methods, and implementation; 3) exams: system, concept, and organisation; 4) resources: staff, funds, and equipment; 5) transparency and documentation; 6) quality management; 7) equal opportunities; 8) students' prospects.

Receiving international accreditation confirmed the high status of the universities and research organisations taking part in the programme and recognition from the professional and research community and students (for more detail, see http://pomor. spbu. ru/learning/curriculum. html). The two-year (four semesters) programme is designed according to a modular system. The first two semesters are taught at SPBU's Institute of Earth Sciences and the Otto Schmidt Russian-German Laboratory for Polar and Marine Research of the Arctic and Antarctic Research Institute of Russia's Federal Service for Hydrometeorology and Environmental Monitoring. Six thematic and one basic modules (for more detail, see http://pomor. spbu. ru/learning/modules/) are delivered in collaboration by Russian and German professors. German professors come for three or more days and give lectures in series. Note that only few professors have left the programme since its start. Most academic staff who contributed to the curriculum and who manage the modules today still take part in the programme and strive to engage new specialists. Overall, since 2012, the training process has involved approximately 130 researchers, professors from over 15 German, Russian research centres, and universities.

After the second semester, students go on field trips. The project management encourages students to join marine and terrestrial expeditions of Russian-German polar and marine research projects and gives them an opportunity to take part in other international endeavours [15]. In 2014—2015, the sixth cohort of POMOR students went on field trips on board the German icebreaker *Polarstern* (ARK-XXVIII/4 expedition), the Russian RV *Viktor Buynitskiy* (TRANSDRIFT XXII expedition), and the Norwegian RV *G. O. Sars* (EUROFLEETS-2 expedition). They carried out fieldwork at the research station *Ostrov Samoylovski* in the delta of the River Lena (LENA-2014 expedition), the Barentsburg hydrometeorological observatory (Spitsbergen-2014 expedition), the research station of the Institute of Plant and

Animal Ecology of the Ural branch of the Russian Academy of Sciences on the Yamal Peninsula, the Leibniz Institute for Baltic Sea Studies in Warnemünde, Alfred Wegener Centre for Polar and Marine Research — a member of the Helmholz Association, and the Mock Research Laboratory at the University of East Anglia. In the first two semesters, students accrue 60 ECTS credits.

The third semester is traditionally spent in Germany, where students study courses offered within partners' English-language Master's degree programmes. This is the period of academic mobility. Students can select from the following programmes at four universities — the Integrated Climate System Sciences at the University of Hamburg, the Marine Biology and Marine Geosciences Master's programmes at the University of Bremen, the Marine Geosciences Master's programme at the Christian Albrecht University of Kiel, and the Geosciences Master's programme at the University of Potsdam. During the exam period following the third semester, students accrue 30 ECTS credits. Today, the programme includes only outgoing regular mobility. Incoming mobility will be one of its key objectives in the future.

The fourth semester is devoted to the graduation project in the English language. Theses are supervised jointly by German and Russian colleagues. Graduation projects focus on current issues in polar and marine sciences. Students' research is conducted at SPBU and various research organisations that offer the necessary data. If a need arises, for instance, if some tests can be run only at German institutes and laboratories, students have an opportunity to spend part of the semester abroad. After 22 weeks, students have to submit their works to SPBU and the University of Hamburg (see guidelines for students of the Faculty of Mathematics, Informatics, and Natural Sciences of the University of Hamburg of October 26, 2015 published on August 15, 2006 in the 64th issue of the *Vedomstvenniy vestnik,* pp. 1931—1938 http://pomor. spbu. ru/learning/rules. html). Authorised departments of both universities send registered works to reviewers — at least two on either side. They have to present two reviews — one in the Russian language according the SPBU guidelines and the other in English. This review period is half the traditional period for German universities. Theses are usually defended at SPBU during a session of the joint panel attended by German colleagues.

Students who have successfully completed the courses and defended their thesis receive two degrees — Master of Ecology and Nature Management from SPBU and Master of Science from the University of Hamburg.

Over the 15 years, six cohorts of students — approximately 60 people — have graduated from the programme. A 2015 survey showed that most of the graduates continued their research career [15]. Eight graduates defended PhD theses — six of them in Germany. In 2016—2017, six more graduates will defend their PhD theses. The POMOR programme contributed to finding a compromise between the Russian and German education systems; increasing academic mobility helped graduates to continue their research career in Russia and abroad. The challenges t which the universities and research organisations have responded to and will respond in the future, cement the success of the POMOR programme.

In 2016, SPBU enrolled students on another international English-language Master's degree programme — Cold Regions Environmental Landscapes Integrated Science — CORELIS. It was inspired by students' interest in studying Polar Regions and their terrestrial ecosystems. The programme focuses on training specialists capable of carrying theoretical and applied research on hydrometeorological, palaeographical, landscape, pedagogical, and ecological phenomena and processes in the Arctic, Antarctic, and mountainous regions. Training will cover not only the major Ecology and Nature Management programme but also elements of the Hydrometeorology, Geography, and Pedagogy fields of study. The key partners are SPBU and the University of Hamburg.

During one semester, students will study at one of the partner universities and take part in expeditions to polar regions (the delta of the River Lena, the Yamal peninsula, deltas of the Rivers Kolyma, Tura, etc.). They will also do fieldwork at the facilities of SPBU's Institute for Earth Sciences in the Leningrad region, at the Lammi biological station of the University of Helsinki, and the University Centre in Svalbard.

Courses will be taught by professors from German and Russian universities and research institutes — SPBU, the Arctic and Antarctic Research Institute, Institute of Physics of the Earth of the Russian Academy of Sciences (Moscow), Forest Institute of the Siberian branch of the Russian Academy of Sciences (Krasnoyarsk), Kazan Federal University, University of Hamburg, University of Potsdam, Alfred Wegener Institute, Helmoholz Centre for Poland and Marine Research, and University of Helsinki.

The interdisciplinarity of the CORELIS programme required a module structure of the curriculum. Students immerse themselves in a certain aspect, which gives them an opportunity to examine course objectives in detail. General courses required by the National Standard of Education are one of the key elements of the curriculum. For CORELIS, it is not only English language and philosophy but also the English language in Earth Sciences and Scientific Writing and Communication in Polar Science and Knowledge Dissemination, which were adapted to the international programme, and the Philosophical Problems of Natural Science and History of Polar Research providing general knowledge shaping the worldview of future polar researchers.

The curriculum includes six special modules — Fundamentals of Comprehensive Polar Studies, Periglacial Landscapes, Quaternary Paleogeography of Polar Regions, Waters Bodies of Polar and Mountainous Regions, Soils of the Permafrost Zone, and Biogeochemsitry of Polar Ecosystems.

During field trips, student obtain knowledge on fieldwork methodology for studying soil, aquatic, and biological processes, using terrestrial and aquatic ecology techniques. They have an opportunity to develop analytics skills working with the most sophisticated equipment at the laboratories of SPBU and other partner universities. The programme's course Special Chapters of Advanced Mathematics (object-oriented programming and statistics) and GIS also contributes to the competitive ability of students.

The above degree programmes cover a wide range of relevant issues in ecology and sustainable nature management in the North. One of the key requirements for sustainable nature management is ensuring environmental safety, which is impossible without information on anthropogenic changes in the environment. Northern territories are rapidly developing; thus, many countries of the world are in need of specialists who are familiar with the current methods of assessing and forecasting anthropogenic changes in the Northern environment. SPBU trains such specialists within another Master's degree programme — Geoecological Monitoring and Rational Use of Natural Resources in the Northern Oil and Gas Production Regions. This is a collaborative Russian-Norwegian programme. It has been running at SPBU since 2009. It is supported by grants from the Royal Norwegian Ministry of Foreign Affairs and the Norwegian Centre for International Cooperation in Education (SIU). The key partner is the University of Stavanger. In line with the grant conditions, the programme has a number of business partners interested in training such specialists. On the Russian side, these are Gazprom Transgaz Saint Petersburg, OAO Proekson, the I. S. Gramberg National Research Institute for Oceanology, and the Sevmorgeologiya research and manufacturing association. Norwegian business partners are STATOILHYDRO and the International Research Institute of Stavanger (IRIS).

Due to differences in the partner universities' requirements for compulsory Master's degree disciplines, the curriculum is structured in such a way that students can stay at their home universities during the first semester. Russian students have time to improve their command of English necessary for further studies.

During the second semester, Russian and Norwegian students jointly attend courses in English on the premises of SPBU's Department of Geoecology and Nature Management. At the end of the semester, all students go on field trips to study methods of environmental research. The third semester is taught in English at the University of Stavanger and IRIS. In Norway, students gain field and laboratory experience in the framework of Natural Water Systems and Aquatic Ecotoxicology disciplines.

During field and laboratory work in Russia and Norway, Master's students familiarise themselves with a wide range of techniques of geoecological monitoring. These include sampling and bioindicator studies of terrestrial ecosystems, aquatic biomonitoring, current high-precision instrumental laboratory techniques (UV/IR spectrometry, atomic absorption spectrometry, mass spectrometry, nuclear magnetic resonance, gas chromatrography, high-performance liquid chromatorgraphy), and computer-assisted research methods (geochemical process modelling, GIS technology). Students acquire expertise in environmental surveying for economic purposes, in environmental protection at production facilities, environmental review and auditing, organising environmental projects, decision-making, and basic engineering, and economic calculation techniques for oil and gas offshore extraction.

The programme's curriculum, disciplines, student research, and fieldwork are discussed at least twice a year by the Programme Council, which brings together Russian and Norwegian professors.

At SPBU, students focus on such disciplines as Modern Approaches to Ecology and Nature Management, Introduction to Oil Geology, Environmental Safety and Nature Management in the Russian Arctic, Geoecological Monitoring in Oil and Gas Producing Regions, Modern Approaches to the Assessment of the Anthropogenic Load on the Environment, Environmental Project Management.

The University of Stavanger offers the following disciplines — Environmental Microbiology, Aquatic Ecotoxicology, Offshore Field Development, and Instrumental Analysis.

The ultimate stage of the programme is the fourth semester, which is devoted to the graduation project written with the support of the collaborating universities and business partners. Students defend theses at their home universities, where they receive a degree.

Overall, the three forms of international partnership in environmental education implemented at SPBU offer students ample opportunities to select their own path to up-to-date knowledge and skills, to establish research contacts with international environmental organisations, and to find their niche in international science or applied ecology and nature management. Depending on their command of languages, they can study in English from the first or the second semester (Master's degree programmes within the second and third collaborations). If they lack basic knowledge in ecology and sustainable natural management or they want to obtain additional knowledge on environmental protection and sustainable development in the Baltic region, Master's students have an opportunity to study BUP courses as elective modules.

Experience suggests that a promising area for further international education partnerships is interdisciplinary Master's and non-degree programmes focusing on social and environmental issues, sustainable regional development, and the 'human dimension' in the Baltic and Arctic regions. Such programmes can be developed by departments of ecology and geography at partner universities.

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