Features of the Development and Implementation into the Educational Process of VSTU of the International Master’s Program in Innovative Technologies in Energy-Efficient Buildings for Russian and Armenian Universities and Stakeholders in the Framework of the International Project + MARUEEB 2015–2018

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ABSTRACT

The article describes the phases of familiarization, development and implementation of the international master’s program in innovative technologies in energy-efficient buildings for Russian and Armenian universities and stakeholders in the framework of the international project Erasmus+ MARUEEB 2015-2018 into the educational process of Voronezh State Technical University. The specific features and uniqueness of this program for the university and the city of Voronezh are revealed, and the concept of teaching methods developed according to the recommendations of the European partner universities on the Erasmus+ MARUEEB grant are also presented.

THE CONCEPT OF THE MASTER’S PROGRAM IN INNOVATIVE TECHNOLOGIES IN THE FIELD OF ENERGY-EFFICIENT BUILDINGS FOR RUSSIAN AND ARMENIAN UNIVERSITIES AND STAKEHOLDERS

In 2015, Voronezh State Technical University had the opportunity to participate...
in the international grant of the Erasmus+ program, the project MARUEEB (Master Degree in Innovative Technologies in Energy-Efficient Buildings for Russian and Armenian Universities and Stakeholders). The goal of the program is the introduction of an environmental education program into Russian and Armenian universities, the exchange of experience and the training of young teaching staff of Russian universities basing on materials of existing energy-efficient construction programs in the European Union.

The Erasmus+ program covers fields of education, vocational and sports training for young people, offers a synergistic development way aimed primarily at international exchange and new forms of cooperation, tending to “become a more effective tool for addressing real needs in terms of human development and social capital in Europe and beyond” [1]. The program is led by a grantee - the University of Genoa (Genoa, Italy), along with such consortium members as the University of Naples, Technical University of Iasi (Iasi, Romania), Slovak University of Technology in Bratislava (Slovenia), Kaunas University of Technology (Lithuania). Armenian universities are represented by National Polytechnic University of Armenia, American University of Armenia and Armenian International Academy of Engineering. From Russian side, the program includes: Ural Federal University, Peter the Great St. Petersburg Polytechnic University, Tambov State Technical University, South Ural State University of Chelyabinsk, and Voronezh State Technical University (hereinafter referred to as VSTU).

Construction and architectural enterprises potentially interested in new personnel trained by European standards were indicated in order to develop international exchange between students and professors, to disseminate the results of the educational program during its life cycle (2015-2018), as well as to test the educational program for the specific features of the labor market in the Voronezh region.

Based on the statistical survey of potential employers of the Voronezh region, recommendations of the educational and methodical management of VSTU, as well as the directions of the Department of technology, construction organization, expertise and property management (TCOEPM), the Erasmus+ master’s program was given the name “Buildings of Energy-Efficient Life Cycle (ERASMUS+)” in the direction 08.04.01 Construction. In accordance with the Federal State Educational Standard (FSES), the main professional educational program of higher education was developed - the master’s program, which includes the general characteristics of the educational program, curriculum, calendar training schedule, work programs of subjects (modules), practice programs, evaluation and teaching materials.

The curriculum of the educational program includes the following mandatory disciplines/basic part: Philosophical problems of science and technology, Methodology of scientific research, Business foreign language, Mathematical modeling, Eco-conceptual architectural design (part I and part II), Design, construction and operation of low-energy buildings, Ecological architecture and
design of energy-efficient buildings, Bim-technology of energy-efficient buildings, Energy and environmental monitoring of the state of construction objects; elective disciplines: Economic features of life-cycle design of energy-efficient real estate objects, Decision theory, Design of engineering systems for energy-efficient buildings, Innovative building materials, Principles of ecological urban planning, Special issues of acoustics, lighting and heat engineering, Integrated biosphere compatibility of urbanized spaces, Energy management of the enterprise; practices: the practice of obtaining primary professional skills and abilities, research work, the practice of obtaining professional skills and professional experience, final state certification. The program is implemented in English with the assistance of a qualified bilingual faculty.

The methodological approach of the master's program tends to involve the students in an open pedagogical process in the most commonly used form that is free exchange of views. The goal of this approach is not only to establish pedagogical control over what students have learned, what they strive for, what they are looking for in the new disciplines. It is important to create conditions for self-education, the expansion of students' consciousness in the field of energy saving and solving environmental problems. The basis of this method of teaching students is to work in teams throughout the entire period of study. Thus, a synergistic interdisciplinary approach to solving energy saving problems is used in the process of work, at the same time students enrich each other with skills and knowledge in various fields.

In the market economy, this method of working in teams is also a strong prerequisite for the possible formation of small joint business firms by the members of these groups after graduation, and this is a direct contribution to the development of the Russian economy and private entrepreneurship. Moreover, after graduation, the MAs of this particular program will already have, according to our expectations, a different level of qualification and a different paradigm of consciousness in matters of ecology and the preservation of the Earth. Also, the concept of this program involves the participation of the student groups in international student eco-competitions, where the students can check the level of their creative abilities at the international level.

For teaching and methodological support of the master’s program "Buildings of Energy-Efficient Life Cycle (ERASMUS+)" with the direct participation of VSTU three manuals were written:

- “Eco-conceptual Architectural Design” (under the general editorship of E.V. Rodina, I.N. Mal’tseva);
- “Biosphere Compatible Energy-Saving Technologies” (under the general editorship of E.V. Rodina, Dušan Petráš);

All the developed study guides within the framework of the Erasmus+ (MARUEEB) program are intended for undergraduates studying in the direction
08.04.01 Construction, as well as for bachelors, graduate students, professors and scientific and technical workers specializing in energy saving.

IMPLEMENTATION OF THE MASTER’ PROGRAM “BUILDINGS OF ENERGY-EFFICIENT LIFE (ERASMUS+)” AT THE VORONEZH STATE TECHNICAL UNIVERSITY

Based on the admission tests and the Order of accepting the applicants in the number of first-year students of full-time education to the direction 08.04.01 Construction, the program "Buildings of Energy-Efficient Life Cycle (ERASMUS+)" 15 students were accepted at the beginning of the 2017-2018 school year, and 10 students - at the beginning of the 2018-2019 school year. Admission to study for the master's program was carried out according to personal applications of citizens with higher professional education, according to the results of entrance tests conducted by the University independently in accordance with the Regulations on admission to the magistracy.

During the 2nd semester of the 2017-2018 school year, professors from European universities of the consortium visited VSTU (Table 1, Figure 1), as well as young professors from our university went to Europe for an internship.

TABLE 1. INFORMATION ON THE CONDUCTED SEMINARS BY EUROPEAN PARTNERS AT VSTU.

<table>
<thead>
<tr>
<th>Date</th>
<th>Information about the scientific and pedagogical worker, university, country</th>
<th>Seminar topic</th>
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<tbody>
<tr>
<td>16-17 May</td>
<td>Ph.D., Associate Professor of Energy and Thermal Science Vincenzo Bianco</td>
<td>«Evaluating Energy Efficiency in Buildings. A technical and economic analysis»</td>
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<tr>
<td>2018</td>
<td>The University of Genoa, Italy</td>
<td></td>
</tr>
<tr>
<td>26-27 May</td>
<td>Ph.D., Associate Professor Michal Krajcik (Slovakia)</td>
<td>«Energy Efficiency and Energy Saving in Urban Environment»</td>
</tr>
<tr>
<td>2018</td>
<td>«Energy Efficiency and Energy Saving for Sustainable Development»</td>
<td></td>
</tr>
<tr>
<td>9-10 April</td>
<td>Ph.D., Associate Professor, Oronzio Manca (The University of Genoa, Italy)</td>
<td>«Thermal Insulation, Thermal Bridges, Moisture, Condensation and Thermo-Hygrometric Verification»</td>
</tr>
<tr>
<td>2018</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23-24 May</td>
<td>Ph.D., Associate Professor Nicanor Cimpoesu («GHEORGHE ASACHI» Technical University of Iasi, Rumania)</td>
<td>«Renewable energy and sustainable solutions»</td>
</tr>
<tr>
<td>2018</td>
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<tr>
<td>14-15 May</td>
<td>Associated Prof. at Kaunas University of Technology (KTU) Institute of Environmental Engineering (APINI) Irina Kliopova</td>
<td>«Energy efficiency through Sustainable industrial development»</td>
</tr>
<tr>
<td>2018</td>
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<tr>
<td>17-18 May</td>
<td>Arthur Khalatyan American University of Armenia</td>
<td>«Use of mobile data for smart urban development and management»</td>
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<tr>
<td>2018</td>
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</table>
As a result of the seminars and study of the disciplines of the curriculum of the master’s program "Buildings of Energy-Efficient Life Cycle (ERASMUS+)", the necessary competencies are formed among the students. Students acquire theoretical knowledge about the life cycles of energy resources and real estate objects, stages of the life cycle of energy resources and real estate objects. They learn to choose the energy efficient resource supply option taking into account the service life and chronological age of the property, to apply methods for assessing the introduction of energy saving measures and their results to the environmental situation at all stages of the life cycle of objects, using skills to calculate the energy saving potential of the property taking into account its life cycle, to demonstrate the results of the analytical work with the help of a visual presentation.

Today, the students, divided into teams, devote their time and energy to solving the environmental and energy-efficient problems of Voronezh, having chosen the topics of the master's theses related to the reconstruction of individual residential buildings of public worship in Voronezh in order to improve their energy efficiency, environmental friendliness and viability, and also topics related to the design of new ecological neighborhoods in the vicinity of the city, as well as to solving the problem of water purification in the Voronezh reservoir, etc.

Figure 1. Training workshops by professors from European universities of the consortium.
REFERENCES

3. The film “Earthlings” (2005) ([https://www.youtube.com/watch?v=EQ2rhZ3ZTo](https://www.youtube.com/watch?v=EQ2rhZ3ZTo)).