

Development of Polytechnic Education at Admiral Makarov State University of Maritime and Inland Shipping

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Abstract— The principles and approaches of polytechnic education are continuously developing all over the world and combine studies in natural and applied sciences with broad practice. The historical aspects of the development of polytechnic education in Europe, as a set of professional engineering skills with entrepreneurial and managerial knowledge, have proved itself well over the past 150 years. We present the results of researches of changes in polytechnic education, which was developed on example of Admiral Makarov State University of Maritime and Inland Shipping, where studies are based on the formation of skills in the field of design, technological and research activities for water transport facilities and infrastructure. Shipping companies and enterprises from the water transport complex have been increasing the volumes of cargo transportation for the last 15-20 years, while infrastructure facilities and hydraulic structures do not always manage to increase the capacity for transshipment of weight. Constraining factor for intensive development is the conservatism of education, because in the existing format students do not acquire the necessary skills and new professions. The solution of this problem is the transition to forms of polytechnic education, which is carried out at the Institute of Water Transport. The complexity of constructing a new model of education for the development of polytechnic competences is a shortage of study time, which is supposed to be compensated by using the modern teaching technologies. In the future, taking into account competition in the labor market, we see the main directions for improving the quality of polytechnic education in the use of information technology, virtual simulators, introduction in BIM-technologies and the life cycle of marine transport infrastructure.

Keywords— *Polytechnic Education, Water Transport, Professional Skills, Engineering.*

1. INTRODUCTION

The basic principles and approaches for the development of polytechnic education are constantly developing all over the world and combine the wide integration of natural and applied sciences. The next distinctive feature in polytechnic education is the use of most amount of practical exercises throughout the education period, which takes place directly in the profile enterprises of industry. The historical aspects of the polytechnic education development in Europe, as a set of professional engineering skills with entrepreneurial and managerial knowledge have proved itself over the past 150

years [1]. The history of Russian engineering education is over 300 years old and in the 20th century was based on the transfer of knowledge to future generations [2]. The engineering profession has always been considered prestigious, training was carried out on a competitive basis. At various times, there was a network of educational institutions that were tutoring and improving the engineers skills for the operation of water transport on the various engineering specialties.

At present, the Admiral Makarov State University of Maritime and Inland Shipping has managed to preserve the most rational form of early professional orientation of schoolchildren for further education in the system of the College of Water Transport in four directions - navigation, operation of ship power plants, operation of ship electrical equipment and automation equipment, construction and operation of engineering structures. The tuition in the college is accompanied by the practice in several stages, at which students receive primary and then professional skills, which corresponds to the international practice.

The classical concept of polytechnic education is given in the UNESCO materials [3]. Recently, some transformation of the traditional view of the goals and methods of polytechnic education has been occurring, a new trend is the transition to modern industrial technologies [4]. Herewith it is assumed that the engineer's field of knowledge may be narrower or briefer

The aim of the paper is to study the adaptation of polytechnic education for water transport engineers to the modern conditions. The issues of organization and management of the educational process, the distribution of educational levels of bachelor-master-engineer specialist, scientific activity and practice for students are considered.

2. METHODS AND MATERIALS

The study of changes in the polytechnic education was being carried out on the example of the Admiral Makarov State University of Maritime and Inland Shipping, where the tuition is based on the skills formation in the field of design, technological and scientific and research activities. We compared the following key indicators:

- the amount of fundamental disciplines teaching;
- the amount of special disciplines teaching;

the amount of industrial practice;
training period;
the number of innovative methods in the educational process.

At the specialized engineers tuition the traditional task is to respond to the needs of society requests and the needs of the water transport economy for 15-20 years ahead. The amount of special disciplines teaching depends on the level of students initial training and is determined by the need of the practical knowledge obtaining, so this indicator has a value of up to 30% for bachelors and 50% for master's degree from the total number of disciplines. Tuition times on the complicated technical specialties, for example, the construction of unique hydraulic structures, tend to increase in comparison with civil engineering.

Historically, the Institute of Water Transport has a high level of fundamental training [5] in basic disciplines. Presently the subjects according to the direction, such as information technology are added to the list.

The water transport complex is experiencing economic difficulties all over the world; the main reason is high costs in the absence of the necessary number of vessels, port reloading systems, terrestrial logistic complexes, hydraulic facilities corresponding to the ports capacity. This has an impact on the change of the education concept at the Institute of Water Transport. We include the development of polytechnic training of the specialists, as an extension of future competencies that will be more competitive in the labor market.

The complexity of construction of education new model for the development of polytechnic competences is a deficit of educational time, which is supposed to be compensated by using the following modern teaching technologies:

- the development of computer simulators and interactive models of water transport facilities;
- the visualization of work processes, emergencies and their consequences at the hydraulic facilities of water transport.

The practice of internships at the existing facilities and at the specialized enterprises is applied for the successful mastering of special educational subjects.

At the junior courses, students receive the first skills in working with the basic set of professional software (architectural and designing, cost booking, organizational and planning, etc.). The coursework's on the composition and requirements for the sections formalization are as close as possible to the requirements of employers for design documentation. Further the complex project is repeated with the complexity increasing.

At the senior courses the applied approach consists in complex designing. It is implementation of course projects (coursework's), including all sections of building designing. It is important here to consolidate the knowledge acquired under the discipline "Project Management". Information support for the scientific and educational activities of the Institute of Water Transport is provided by the united university library complex. The library's funds include the literature on the

construction of river and marine infrastructure, port carrying and lifting equipment, shipbuilding and ship's repair, water resources protection, waterways and water surveys, navigation and communications.

In the future, the improvement of the educational process quality and achievement of the requirements for the industry development is expected to be carried out on the basis of building information modelling (BIM) technologies - a unified information system for the water transport that allows to design efficiently and management of the facility at all stages of the life cycle. The BIM technologies implementation should radically improve and connect all the directions of design, construction and operation of such unique facilities of water transport infrastructure.

3. DISCUSSION

The data on the rating change of the industry transport universities in the international aspect are given in work [7]; the introduction of polytechnic education, in our opinion, will allow to succeed in the conditions of global competition.

In work [8] the authors consider the current changes in Russian universities, especially in the direction of a more external and international approach, in particular caused by the Bologna process.

We pay special attention to the international accreditation of training programs. In 2017 the Institute of Marine Engineering, Science and Technology (IMarEST) was delighted to confirm accreditation of four Bachelor courses at the Admiral Makarov State University of Maritime and Inland Shipping. Following a visit in October 2017 [9], a report prepared by the visiting accreditation panel was approved at the December meeting of the Institute's Professional Affairs and Education Committee (PAEC). All four Bachelor courses that were reviewed have been accredited as meeting the academic requirements for registration as an Incorporated Engineer and Incorporated Marine Engineer (IEng/IMarEng) in full.

Our practical developments [10] being implemented in to marine ports for operational monitoring of the technical condition of the quay walls. One of the basic approaches to assessing the cost of testing and confirming the compliance of port hydraulic structures was developed by us in [11], where economic costs are justified, including for the life cycle of maritime building structures.

4. CONCLUSION

The main goal of the development of polytechnic education in the Institute of Water Transport as part of the Admiral Makarov State University of Maritime and Inland Shipping is the development of complex education of specialists in the field of water transport. In the future, taking into account competition in the labor market, we see the main directions for improving the quality of polytechnic education in the use of information technologies, virtual simulators and the introduction of BIM technologies of the life cycle, cost booking and project operation management.

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