

BACHELOR DEGREE PROGRAMS IN BUILDING MATERIALS TECHNOLOGY

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Abstract. Modern construction production requires constant improvement of the processes of training specialists in the field of construction production technologies. The object of research presented in this article are educational programs for a bachelor degree in construction materials technology in Ukraine and Uzbekistan. The purpose of this article is to compare the educational programs of Uzbek and Ukrainian higher educational institutions for training bachelor students in the field of construction materials technology
Keywords: comparative analysis, bachelor degree preparation, construction materials technology

Introduction. The modern construction industry is in need of highly qualified specialists. The training of such specialists requires continuous improvement. Modern training of specialists in the field of construction production technology necessitates changes in approaches to the content of training. The availability of high-quality training programs will help to improve the quality of training, develop the processes of internationalization of the national educational system, expand and strengthen international educational and scientific ties, bringing professional training in line with the requirements and needs of the construction industry. The study of foreign experience with the training for a degree of bachelor is relevant. When defining our object of study we adopted the position of the program document of the UNESCO "Reform and development of higher education" (1995). The assessment of the quality of education includes three aspects: the quality of staff and programs, the quality of education, and the quality of infrastructure and learning environment [1]. Our study focuses on the characteristics of bachelor degree programs in the field of building materials technology.

The comparison of training programs in different countries was carried out by the following scientists:

- 1) features of training specialists in different countries in the following areas:
 - architecture (Kuznetsova N. G., Rakhimova T. A. [2]);
 - civil engineering (Startseva L. V., Zhdanova E. R., Stroeva T. A. [3]; Baklushina I. V., Zorya I. V. [4]);
 - engineering technology. A comparative analysis of engineering training programs of higher educational institutions in Ukraine, Sweden, Great Britain, and Italy was carried out [5].

A number of scientists from different countries have already paid great attention to various aspects of bachelor degree courses in the field of construction. Among the most informative works on the analysis of training specialists for construction should be named the work of Mike Murray & Stuart Tennant (2015) [6]; Graham, R. (2012) [7]. The authors draw reasonable conclusions: "Undergraduate (UG) civil engineering students should graduate from university with knowledge that links their computational competence in structural engineering

and mechanics to construction technology principles, processes and practice". A series of reports from The Royal Academy of Engineering has demonstrated that change in undergraduate engineering education is urgently needed to ensure graduates remain equipped for the new and complex challenges of the XXI-century Graham, R. (2012) [7].

Many domestic and foreign researchers identify problems in the modern training of construction engineers. An article by Alan Mark Forster, Nick Pilcher, Stuart Tennant, Mike Murray, Nigel Craig & Alex Copping (2017) [8] notes: "From the mid of the XX-th century, construction and engineering pedagogy and curriculum have moved from long-held traditional experimental apprenticeship approaches to one ostensibly decoupling practice and theory."

The authors of this article fully agree with the provisions of the Engineering Council (2014, p. 3) that "all students deserve an engineering education that is world-class and that develops industry-relevant skills" [9]. Wankel, L. A. and Wankel, C. (2016) suggest as one of the ways to improve the quality of students' education in the specialty of building materials, the study of training programs for future specialists [10; 11].

This study is a continuation of the authors' research in the field of improving higher education, Eshniyazov R. N. [18-22].

The **object** of the research are educational programs for obtaining the degree of bachelor in construction materials technology. The purpose of this article is to compare the educational programs of Uzbek and Ukrainian higher educational institutions for training bachelor students in the field of construction materials technologies. The main objectives of the article are: to characterise the main approaches to the preparation of a bachelor degree programs; to compare degree programs in the field of construction technology; to develop recommendations for improving training programs.

Methods. The main research methods were methods of comparison, analysis, synthesis and logical generalization – to determine the features of training systems, substantiate recommendations for their further improvement. The information base of the study was the materials of the curricula and programs of two institutes that train specialists of the same profile [23], departmental materials of the institutes. It should be noted that when comparing the curricula of the two institutes, the following problems were encountered:

- 1) the presence of different names for disciplines with the same content;
- 2) there are small differences in the content of disciplines with the same name. Some disciplines are divided into several subjects;
- 3) the curriculum also included a number of subjects that have no equivalent in the compared programs.

4) in the Ukrainian educational programs, both ECTS credits and hours are used as a measurement of academic load. ECTS (The European credit transfer and accumulation system) is a system that allows you to quantify (in credits) the curriculum, disciplines and loads of a student, etc. A credit transfer and credit accumulation system is a unit used to measure a student's academic load. According to the Ukrainian law "on higher education" [24], the amount of one load is 30 hours. This system provides a single inter-state and inter-University assessment procedure for learning. It allows you to measure and compare student-learning-outcome, and helps academic recognition and enrollment of learning outcomes in various educational institutions. The maximum annual load of a student cannot exceed 60 credits per year (i.e. 30 credits per semester) [25]. The number of credits has been transferred to contact hours.

It should also be noted that at this stage of the study, only quantitative indicators of programs (the amount of training load) have been studied. In the future, it is planned to carry out a qualitative comparison of the content of educational programs of academic disciplines. For the convenience of studying all subjects were divided into two different categories: :

- 1) disciplines: the “content-humanities” and socio-economic disciplines;
- 2) disciplines of choice: the possibility of choice for students-mandatory and subjects of choice for students.

Results and Discussion. Currently, there are two approaches to the preparation of training programs:

- 1) uniqueness, when educational institutions create completely unique educational programs that are a kind of brand of these institutions;
- 2) universalism, which is characterized by complete unification of training programs. Gradually, the acquisition and usage of ready-made educational and methodological complexes prepared by private commercially orientated consulting companies such as Pearson Education and Cengage Learning is becoming widespread .

According to the authors of this article, a mixed method of preparing training programs is more acceptable and competitive. It involves both developing the respective national experience “based on the professional knowledge that is required of future specialists, and at the same time analyzing the world's best practices in the field of training in order to constantly improve the quality of education.

Entry into the world education system requires monitoring and, if necessary, revision, modification and correction of national educational programs and standards. At the same time, the model of education being practiced in the respective country should be taken into account: English-American, French or German. These models of education differ in the degree of state management (regulation) of the educational process, academic freedom of educational institutions, students' independence in the educational process, the obligation to comply with existing educational standards, the degree to which innovative scientific research is used in the educational process, and other indicators. Currently, in many countries of the world, a mixed model of education prevails, which combines various elements of these models.

The results of comparing the curricula (construction materials technologies) of the DonNACA and KKSU are presented in table 1.

Table 1-Training plan: bachelor's degree in Technology of building constructions, products and materials of civil engineering (Ukraine), 5340500-Production of building materials, products and constructions (Uzbekistan)

Name of academic disciplines	Ukraine, Donbass National Academy of Construction and Architecture (DonNACA)	Uzbekistan, Karakalpak State University named after Berdakh
1. Humanities and socio-economic disciplines		
National history and culture	150	78
National language	90	150
Foreign language (for professional purpose)	180	256
Philosophy	90	128

Political science	60	-
Development strategy of Uzbekistan.		78
Physical exercises and sports	136	128
1. Basic training courses		
Higher mathematics	420	369
Physics	180	210
Chemistry (construction chemistry)	90	119
Theoretical mechanics	180	-
Informatics (information technologies in construction)	120	383
Descriptive geometry, engineering and computer graphics	180	279
Strength of materials	240	600
Structural mechanics	90	
3. Disciplines of professional training in the specialty		
Engineering geodesy	180	-
Building materials science (building materials and products)	90	264
Engineering Geology (fundamentals of Geology, Mineralogy and petrography)	90	139
Urban planning and improvement	90	-
Fundamentals of safe life and environmental protection	240	156
Construction Economics (Economics of construction materials enterprises)	90	232
Механика грунтов. Основы и фундаменты	150	-
Architecture of buildings and structures	90	269
engineering networks (heat and gas supply, water supply and sanitation, ventilation,)	120	-
Electrical engineering and automation in construction	270	-
Construction production technology (construction production technology, construction equipment and transport)	90	206
Building construction	60	-

The distribution of disciplines in basic and professional training is shown in table 2.

Table 2 - Curricula: bachelor degree in specialization (educational and professional program) "Technology of building structures, products and materials of civil engineering" (Ukraine) and 5340500-Production of building materials, products and structures (Uzbekistan).

Name of academic disciplines	Ukraine, Donbass National Academy of Construction and Architecture (DonNACA)	Uzbekistan, Karakalpak State University named after Berdakh
1. Discipline basic training (mandatory)		
Higher mathematics	420	369
Physics	180	210
Chemistry (construction chemistry)	90	119
Theoretical mechanics	180	-
Informatics (information technologies in construction)	120	383
Descriptive geometry, engineering and computer graphics	180	279
Strength of materials	240	600
Structural mechanics	90	
2. Discipline training in the specialty (required)		
Engineering geodesy	180	-
Building materials science (building materials and products)	90	264
Engineering Geology (fundamentals of Geology, Mineralogy and petrography)	90	139
Urban planning and improvement	90	-
Fundamentals of safe life and environmental protection	240	156
Construction Economics (Economics of construction materials enterprises)	90	232
Soil mechanics. Basics and foundations	150	-
Architecture of buildings and structures	90	269
Engineering networks (heat and gas supply, water supply, , and ventilation)	120	-
Electrical engineering and automation in construction	120	-
Construction production technology (construction production technology, construction equipment and transport)	270	-
Building construction	90	206
Technical mechanics of liquids and gases	60	-
Innovative technologies in the production of building materials		156
Design basics		96
Thermal insulation and finishing materials		206
Technologies of concrete fillers		232

Binder		206
Metrology and standardization 1		96
Processes, apparatuses and mechanical equipment in construction materials technology. Special course (technological installations of the construction industry) ¹		96
Innovative technologies in the production of building materials		156
Design basics		96
Thermal insulation and finishing materials		206
Technologies of concrete fillers		232
Binder		206
3. Disciplines of professional training in the specialty (elective courses)		
Unit 1. Technology of building materials		
Technology of concrete and reinforced concrete products (special course)	120	
Physical and chemical methods of research of building materials	90	
technology of construction materials from industrial waste	120	
Construction economics, special course	90	
Metrology and standardization	90	
Organization of construction	210	
Production base of construction	60	
Manufacturing practices	120	
Qualification workshop	300	
Total	1200	
Block 2. Equipment in construction materials technology		
Processes, apparatuses and mechanical equipment in construction materials technology. Special course (technological installations of the construction industry)	120	
Engineering survey	90	
Heat engineering and heat engineering equipment. Special course	120	
Construction economics, Special course	90	
Metrology and standardization	90	
Organization of construction	210	
Production base of construction	60	
Manufacturing practices	120	
Qualification workshop	300	

Elective courses		306
Additional subjects (Subject of military training. In case if there is no military department in the institution subjects are set at the option of the graduating department)		288

Source: compiled by the authors based on the materials of DonNACA, Karakalpak State University.

As a result of the analysis of programs, the following features in the preparation processes are highlighted:

1. A larger volume of theoretical training of students in Ukraine. In Uzbekistan, a larger amount of time is spent on obtaining practical skills during all types of practices;

2. In Ukraine, there is a great opportunity to independently choose subjects for study; a higher level of independence of students in the organization of the educational process. A student can have an individual curriculum, which is compiled at the beginning of the semester, and contains information about the list of courses, the student's workload (all types of educational activities) and the sequence of study of academic disciplines (courses)

3. In the Ukrainian Academy much time is devoted to conducting control activities for state certification.

4. The volume of the block of Humanities at the Ukrainian University is 24% more than at the University of Uzbekistan due to the introduction of blocks of selective disciplines. However, the University of Karakalpakstan gives more importance to the study of a foreign language, which reflects the general trend of internationalization of higher education.

Conclusions.

1. This article describes approaches to the drawing up of programs of bachelors training in the field of technology of construction materials.

2. The programs for the training of bachelor students of the technology of construction materials at DonNACA (Ukraine) and at Karakalpak State University named after Berdakh (Uzbekistan) are compared; features in the training programs are highlighted.

3. Recommendations for improving training programs have been developed.

4. The basic requirements for modern programs for the preparation of students for a bachelor degree:

- the program should be aimed at achieving the country's strategic development goals, comply with international and national projects and development programs;

- the content of the program should:

a) be developed with the participation of employers, take into account the needs of the labor market, modern achievements of science and practice, international experience in the training of students for the degree of bachelor. ;

b) ideally combine the theoretical and practical parts in the course of the training, i.e. aspects of social sciences and the humanities, fundamental and professional disciplines.

The main recommendations for improving the processes of preparation of students for the degree of bachelor in construction materials technology are the following:

1. the development of a concept to improve education based on a bachelor's competence model.

2. the development of training process for the degree of bachelor : resources (material and financial, personnel), informational, methodological (development of educational technologies), scientific, organizational (improvement of the processes of monitoring and quality of training)

3. the introduction of a flexible part of the training programs, which provides for the creation of special courses, the introduction of subjects in innovative areas of development of

building materials technologies [26]. Among the possible subjects of choice, we propose the introduction of resource conservation and ecology of building materials, products and structures. The transition to resource-saving and waste-free technologies will lead to an improvement in the environmental situation in industrial regions.

4. The curriculum should provide a certain number of hours for the development of students' research, preparation of articles and reports for participation in conferences on various levels.

5. The development of blended learning based on the use of traditional teaching methods (lectures and practical classes) and distance learning technologies.

6. the implementation of problem-based learning (PBL), interactive learning, project technologies, case study. Project technology is an individual or collective activity that selects, distributes, and systematizes material on a specific topic, resulting in a project. Analysis of specific situations (case study) involves evaluating real problem situations, searching for the best solutions. The advantages of such training methods are the stimulation of students' creativity and encouraging their independence during the educational process.

7. It is advisable to:

- continuously monitor the content of the program, and to adjust programs if necessary;
- take part in joint developments of educational programs in the course of international research.

This article is of methodological and practical significance. The recommendations of the study will contribute to the integration of national education systems into the world educational system, improving the quality of training students for the degree of bachelor in the field of construction materials technology.

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