

# Prospects for Polytechnic Education in the Implementation of Applied Educational Programs

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**Abstract.** Based on the analysis of existing regulatory documents in the field of higher education, the possibility of using an interdisciplinary approach in the educational process as part of the development of polytechnic education, which is aimed at achieving results in priority areas of development of science, engineering and technology, is considered. It has been established that scientific and technological progress is achieved mainly by studies of objects and related tasks in the interdisciplinary field of knowledge. The concept of interdisciplinarity is formulated. It is revealed that the formation of professional competencies related to the implementation of interdisciplinary studies can be implemented in the higher education system on the basis of interdisciplinary applied educational programs aimed at a wide profile of student training. A model for developing an interdisciplinary applied educational program is considered. It was revealed that a team of scientific and pedagogical workers involved in the studies in the interdisciplinary field of knowledge should participate in the development of interdisciplinary applied educational programs, and also students interested in participating in scientific projects, who have mastered the main professional educational programs in one of the interdisciplinary fields of knowledge. It has been established that after mastering interdisciplinary applied educational programs, graduates of higher education institutions become universal specialists who are able to think creatively, apply methods of research and production activity at a professional level, and be in demand in the labor market.

## 1. Introduction

One of the main tasks of the development of education in the Russian Federation is related to the coordination of educational programs implemented in educational institutions of higher education with professional standards used in the practical activities of graduates and employees of enterprises. By means of partnerships between educational organizations and companies (enterprises), applied educational programs that ensure the acquisition of knowledge and skills by students are being developed taking into account the current level of science and technology development, as well as taking into account the development and implementation of innovative projects [1-4].

To increase the competitiveness of graduates of educational institutions of higher education in the labor market, students are offered to join in the implementation of tasks aimed at developing scientific potential within the educational institution and the country as a whole at the stage of developing educational programs with the direct participation of the faculty. To achieve the objectives in higher education institutions, it is necessary to introduce innovative educational technologies aimed at developing students' teamwork skills, developing competencies in the field of modern information and

communication technologies, involving them in Russian and international scientific projects and conferences [5- 11].

The development of the scientific potential of students involves the development of interdisciplinary applied educational programs that will provide an integrated approach to the formation of engineering competencies aimed at the development of innovations and update the main provisions of the classical concept of engineering education [9,12].

One of the requirements for employment in leading companies in the Russian and international markets is knowledge of foreign languages. In this regard, the obligatory element of the educational program is the discipline “Foreign Language”, aimed at obtaining the student’s competencies in the relevant field of knowledge and at improving the acquired skills in professional activity by studying foreign specialized literature, participating in international conferences and symposia [13-14]. Also, in a number of educational institutions of higher education, educational programs taught in foreign languages are already provided for or are being implemented, internships are conducted to exchange international experience both between students and teachers in the framework of international cooperation programs [14]. The aim of educational institutions to carry out international activities contributes to international recognition in the field of education in the form of international accreditation of educational programs and in relation to engineering education - international certification of engineers [15].

To improve the educational process and the student’s effective integration in the field of professional activity, various educational platforms based on remote learning are provided [16-17]. The authors of [16] provide a structural and functional model of the double education system, which allows students to obtain high qualifications and practical skills that are in demand in the labor market through remote technologies with remote partner enterprises participating in the “Educational Consortium”. The paper [17] considered the possibility of virtually gaining real work experience in the company, in addition to developing existing professional skills, on the basis of the Work Based Learning (WBL) platform, which allows the student to prepare for the start of building his own career.

Currently, re-evaluation of students’ training is underway not only in undergraduate and graduate programs, but also in training programs for highly qualified personnel, in which the educational component consists of preparation for research and teaching activities [19-20]. The processes of designing and implementing the educational component by highly qualified personnel training programs entail the use of a systematic approach in which the designed objects (preparation for research and preparation for educational activities) are considered as separate pedagogical systems [19], while the developed programs should be research ones, including an educational component, and not vice versa [20].

From the above it follows that the development of modern polytechnic education in educational institutions of higher education requires a comprehensive approach to the implementation of educational programs aimed at interacting with companies (enterprises), using remote technologies, participating in scientific activities at the Russian and international levels, internships, and gaining professional competencies in the framework of international cooperation programs.

## **2. Materials and methods**

The work is based on the analysis of regulatory documents in the field of education and the organization of the educational process according to the main professional educational programs of higher education.

## **3. Results and discussion**

For the development of polytechnic education in educational institutions of higher education at the modern level, it is necessary to introduce an interdisciplinary approach into the educational process of students, aimed at achieving results in priority areas of science, engineering and technology.

Scientific and technological progress is achieved mainly by studying objects and related tasks at the intersection of sciences, i.e. in the interdisciplinary field of knowledge.

Interdisciplinarity is aimed at organizing scientific knowledge based on certain relationships between scientific disciplines, methods and technologies capable of solving complex scientific and technical problems by transferring research methods from one discipline to another [21].

The formation of professional competencies related to the implementation of interdisciplinary research can be implemented in the higher education system on the basis of interdisciplinary applied educational programs. The main sign of the interdisciplinarity of applied educational programs is wide-profile training, which can increase the range of competencies in the scientific and innovative activities of students. After mastering interdisciplinary applied educational programs, graduates of educational institutions of higher education become universal specialists who are able to think creatively, apply methods of research and production activity at a professional level. An interdisciplinary approach to training helps students, even in the process of mastering applied educational programs, acquire skills of presenting acquired competencies through participation in various scientific symposia and conferences, which will subsequently allow them to more successfully present themselves in the labor market.

The design of interdisciplinary applied educational programs should be based on the integration of educational content in various subject areas, profiles, areas of training through the development of integrated curricula. The interdisciplinary applied educational programs can be mastered by students in parallel with the main professional educational program, starting with junior courses.

The development of interdisciplinary applied educational programs is carried out individually for each specific case.

For example, one can propose the following model for the implementation of a certain interdisciplinary applied educational program, in the development of which both teachers and students participate. In the framework of scientific research in the field of geotechnics, building materials science and landscape design, conducted by a team of scientific and pedagogical workers, students who are interested not only in mastering the main professional educational program, but also in acquiring skills in scientific research are involved. Due to the fact that scientific research is aimed at developing compositions for fixing soil in landscape design, students who have mastered educational programs in the training area 08.03.01 "Construction" by profiles "Production and use of building materials, products and structures", "Construction of engineering, energy, hydrotechnical and environmental structures", in the training areas 07.03.01 "Architecture", 07.03.02 "Reconstruction and restoration of architectural heritage", 07.03.04 "Town planning", in the specialty 08.05.01 "Construction of unique buildings and structures" with specialization "Construction of underground structures" implemented by the Moscow State (National Research) University of Civil Engineering (MGSU) can be involved in scientific research in this field of knowledge.

As part of the work, students should have a set of competencies that form the basis of educational programs in the above areas (specialties), including profiles (specialization). To achieve this goal, a concept of an interdisciplinary educational program should be formed, an analysis of educational and professional standards should be carried out, appropriate competencies should be selected, on the basis of which a draft integrated curriculum was subsequently developed, in a particular case, including the following sample list of disciplines: business foreign language, basics of rhetoric, copyright, chemistry (inorganic, organic, physical, colloidal), binders and composite materials, resource saving and low-waste technologies of building materials, durability and operational reliability of building materials, architectural materials science, architectural ecology, environmental factors in architecture, urban landscape, landscape gardening, landscape and visual analysis, engineering geology, bases and foundations, theoretical basics of soil mechanics, foundations in special conditions, seismic stability of structures and geomechanics, underground and drilling operations. Along with mastering the disciplines, it is mandatory for students to undergo educational and industrial work placement, including research work, the main condition for which is to take part in Russian and international symposia and conferences. It becomes possible for students not only to develop an additional educational program, participate in scientific research, but also to gain experience in processing

research results, writing papers, presenting a scientific report, which will make it possible to be in demand in the labor market after graduation.

Thus, the considered model includes the following stages of the development of an interdisciplinary applied educational program:

- conducting research by a team of scientific and pedagogical workers in the interdisciplinary field of knowledge;
- attracting students interested in participating in scientific activities and mastering the main professional educational programs in areas (specialties), including profiles (specializations), implemented in the educational institution of higher education and included in the interdisciplinary field of knowledge;
- forming the concept of an interdisciplinary applied educational program on the basis of educational and professional standards, the selection of competencies with the subsequent development of an integrated curriculum;
- development of elements of an interdisciplinary applied educational program (work programs for disciplines, programs of internships, state final certification program);
- implementation of an interdisciplinary applied educational program with the mandatory participation of students in research and innovation activities, including the subsequent presentation of research results at Russian and international symposia and conferences.

#### **4. Conclusions**

As part of the development of polytechnic education in the higher education system, the possibility of introducing an interdisciplinary approach to the educational process of students, aimed at achieving results in the priority areas of development of science, engineering and technology, is being considered.

It has been established that the formation of professional competencies related to the implementation of interdisciplinary research can be implemented in the higher education system on the basis of interdisciplinary applied educational programs aimed at a wide profile of student training.

A model for the development of an interdisciplinary applied educational program is considered, which consists of several stages:

- conducting research by a team of scientific and pedagogical workers in the interdisciplinary field of knowledge;
- attracting students interested in participating in scientific activities and mastering the main professional educational programs in areas (specialties), including profiles (specializations), implemented in the educational institution of higher education and included in the interdisciplinary field of knowledge;
- forming the concept of an interdisciplinary applied educational program on the basis of educational and professional standards, the selection of competencies with the subsequent development of an integrated curriculum;
- development of elements of an interdisciplinary applied educational program (work programs for disciplines, programs of internships, state final certification program);
- implementation of an interdisciplinary applied educational program with the mandatory participation of students in research and innovation activities, including the subsequent presentation of research results at Russian and international symposia and conferences.

It has been established that after mastering interdisciplinary applied educational programs, graduates of educational institutions of higher education become universal specialists who are able to think creatively, apply methods of research and production activity at a professional level, and be in demand in the labor market.

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