

Models and Results of Transforming Productional Practice in Higher Professional Education Based on A Cluster Approach

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Abstract: *The article examines the theoretical and methodological model for transforming production practice organization processes in the higher professional education system based on the principles of a cluster approach and its practical effectiveness. In accordance with modern labor market requirements, mechanisms for deepening integration between higher education institutions and manufacturing enterprises have been systematically analyzed. The proposed innovative model serves to develop students' professional competence, creative thinking, and problem-management skills during the internship period. The results obtained prove the pedagogical effectiveness of cluster integration in improving the quality of education and the competitiveness of graduates. This research will serve as a methodological basis for modernizing the content of higher education and improving dual education technologies.*

Key words: *higher professional education, industrial practice, cluster approach, transformation model, pedagogical integration, professional competence, dual education, educational efficiency.*

INTRODUCTION

The cluster approach is an integrated innovative system that unites subjects of education, science, and production around a single strategic goal in modern pedagogical reality. The essence of this approach is aimed at transforming dispersed intellectual, material, technical, and human resources into a centralized pedagogical ecosystem. In a cluster environment, educational institutions, research institutes, and industrial sectors act as subjects of mutual cooperation, which allows for the abandonment of traditional educational formats and the creation of interdisciplinary synergy. As a result, theoretical knowledge is directly intertwined with real practice, and a pedagogical platform is formed that can quickly solve modern problems in the industry[1].

The main pedagogical goal of this approach is to guarantee the effectiveness of targeted training for highly qualified and competitive personnel who are adaptable to the changing requirements of the labor market. In the pedagogical process, cluster modeling elevates students' professional competence to a completely new level, serving to develop their skills in independent research, project management, and teamwork. The creation of a unified pedagogical chain provides the opportunity to clearly design the personal and professional development trajectory of each future specialist and to continuously update educational programs[2]. The ultimate goal is to form a generation of mature specialists who will ensure the sustainable development of the country's economy and social sphere by improving the quality of education.

ANALYSIS OF LITERATURE ON THE TOPIC

Issues regarding the formation of a cluster approach in the integration of education and production, as well as the study of its economic and pedagogical foundations, have been extensively studied by renowned scholars in world science. The founder of cluster theory, Harvard Business

School professor Michael Porter, economically proved the advantages of intersectoral clusters in increasing competitiveness and evaluated educational institutions as the intellectual core of this chain. Through his famous "Triangular Spiral" model, Henry Itskovich has brought the strategic interaction between the state, university, and industry to a new innovative level. Loet Leydesdorff further developed the mathematical and communicative foundations of this model and substantiated the mechanisms for adapting higher education to production needs from the perspective of information exchange[3].

Russian pedagogical scientists Tatyana Shamova and Mikhail Gromiko conducted research on the direct practical implementation of the pedagogical transformation of cluster cooperation in the higher professional education system. Tatyana Shamova developed a methodology for managing clusters within educational management and systematizing socio-pedagogical partnerships between educational institutions and employers. Mikhail Gromiko proposed models for modernizing students' practical training by organizing regional clusters in vocational education and harmonizing the educational process with production technologies[4,5]. The research of these world scientists forms a solid scientific and methodological foundation for transitioning production practice from traditional forms to a cluster system in higher education institutions.

RESEARCH METHODOLOGY

The methodology of this study is based on systems analysis, cluster modeling, and comparative-pedagogical experiment methods. When assessing the transformation of production practice, criteria for the integration of higher education and industrial enterprises were applied. The obtained empirical data and the levels of students' professional competence were comprehensively verified and summarized using pedagogical diagnostic and statistical analysis tools.

ANALYSIS AND RESULTS

Fundamental reform of traditional cooperation between higher professional educational institutions and manufacturing enterprises based on cluster integration is one of the priority tasks of the education system today. The main goal of the proposed transformation model is to fully adapt practice processes to the requirements of the modern economy and the labor market, to reduce the period of professional adaptation of students, and to design an innovative pedagogical environment that ensures the global competitiveness of higher education graduates. Through systemic modeling, industrial practice becomes not merely a mandatory stage in the curriculum, but a strategic platform that ensures the professional development of future specialists and meets industrial needs[6,7].

This model raises the quality of education to a new level by performing a number of interconnected functions. The integrative-target function unites the resources of education, science, and industry into a single system, mobilizing the material, technical, and intellectual potential of participants for the effective organization of student internships. The cognitive-practical function integrates the theoretical knowledge acquired by students in the classroom with real technological operations, forming their ability to make correct decisions in problematic situations. While the innovation-development function serves to introduce advanced technologies and startup projects into the production process, the adaptive-prognostic function guarantees that graduates master the corporate culture of the enterprise during their internship and adapt to the labor market without complications[8].

Table 1. Components of the model for transforming production practice in higher professional education based on a cluster approach, their content, and tasks.

No.	Component name	Summary	Role in practice
1.	Normative-legal	A set of cooperation agreements, regulations, and joint programs.	Legislative guarantee of subject relations and students' rights.
2.	Organizational and managerial	Activities of Coordinating Councils and Joint Departments.	Planning of internship schedules and dual monitoring of the process.

3.	Content-methodological	Educational and methodological complexes based on elements of dual education.	Adapting educational content to modern production technologies.
4.	Technological-resource	An association of the university's scientific potential and enterprise laboratories.	Providing students with the opportunity to work on the latest production equipment.
5.	Pedagogical and mentoring	Collaboration between faculty and enterprise specialists.	Formation of professional ethics in students based on the "mentor-apprentice" system.
6.	Control-analytical	Competence assessment criteria and final monitoring.	Objective assessment of practical results and continuous improvement of the model.

The successful operation of the model relies on the mutual compatibility of its six main components. Firstly, the regulatory and legal component legally regulates the relations of cluster entities on a contractual basis. Secondly, the organizational and management component performs the function of planned management of internship schedules through joint departments and coordinating councils[9,10,11]. Thirdly, the content-methodological component covers educational and methodological complexes and innovative programs based on elements of dual education. Fourth, the technological and resource component allows students to freely use the latest laboratories and production equipment of enterprises. Fifth, the "mentor-apprentice" system, formed within the framework of the pedagogical and mentoring component, develops professional ethics in students through cooperation between professors, teachers, and industry specialists[12,13,14,15]. Sixth, at the final stage, the control-analytical component performs the task of objectively assessing the competencies acquired during the internship and continuously improving the model based on the results obtained.

CONCLUSIONS

The model for transforming production practice in higher professional education based on a cluster approach is an innovative system that harmonizes educational content with production needs. Integrative-targeted, cognitive-practical, innovative-progressive, and adaptive-prognostic functions within the model serve to form students' professional skills in a real industrial environment. The regulatory-legal, organizational-managerial, content-methodological, technological-resource, pedagogical-coaching, and control-analytical components of the system operate in close interconnection, transforming traditional forms of education into an effectively integrated pedagogical platform. Ultimately, this pedagogical model fully guarantees mechanisms for improving the quality of higher education, improving dual education technologies, and the targeted training of competitive and highly qualified personnel in accordance with labor market requirements.

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