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Економіка та управління

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## SCIENTIFIC AND EDUCATIONAL CONSORTIUM AS INSTITUTIONAL PROJECTION OF THE INNOVATIVE PROFESSIONAL TRAINING

**Purpose.** To determine the essence, main possibilities and demonstrate the main capabilities of the educational, research and production complex as a way of modernizing the market of educational services in accordance with the innovative model of development. To describe organizational and pedagogical conditions for coordination of the scientific, educational, innovative and technological potential of the All-Ukrainian Scientific and Educational Consortium (USEC) founding members.

**Methodology.** A systematic analysis of literature and normative documents has been carried out. Various practices of cooperation between educational establishments and enterprises, scientific institutions and production facilities in the world have been investigated. The data were collected during the internship at the All-Ukrainian Scientific and Educational Consortium with the use of individual and group interviews, surveys and teaching and administrative activities experience.

**Findings.** Transformation of educational systems, aimed at meeting the present-day needs of stakeholders and personal needs of future professionals, is achieved by using, along with theoretical training, the resources of the research farms and enterprises integrating their benefits in the system of professional development of young people. The technology effectiveness is achieved through creation of the innovative structure of educational programs of all levels and the research and teaching staff professional development system in the Consortium. Organizational and pedagogical conditions for coordination of the scientific, educational, innovative and technological potential of the USEC founding members are suggested.

**Originality.** Cooperation between labor market and professional education caused by the need to modernize and optimize higher education institutions in Ukraine is expected to be effective in the environment of educational-research-industrial complexes subject to the defined organizational and pedagogical conditions.

**Practical value.** Prospects for the implementation of educational programs within the research and educational consortia are outlined. The described organizational and pedagogical conditions contribute to the integration of educational programs, professional standards and professional formation of students.

**Keywords:** *professional education, scientific-educational-industrial complex, dual education*

**Introduction.** Innovative development of the educational environment in higher education institutions, due to the knowledge-intensive technologies, requires the availability of appropriate staffing. There is a societal demand for the focus of the training process on productive educational and cognitive activities, specialization and universalization, a balanced ratio of the latest advances in theory and practice. National models of the relationship of university systems in labor markets remain topical aimed at formation of skilled workers for the needs of the post-industrial economy [1].

Interpersonal, intellectual, entrepreneurial, practical skills, ethical values, ability to constantly improve their professional level, teamwork skills, and reflection are extremely demanded for the successful employment of graduates. In order to participate in sustainable economic development, universities are required to develop interdisciplinary knowledge that takes into account all aspects of human life and experience and is produced in other institutions (industrial companies, research institutions and laboratories, non-profit organizations) [2].

Currently, a problem has arisen of the effective interaction of higher education institutions and involvement of the employers in professional training program development and, in the long run, employment of the future specialists [3].

Today, the COVID-19 pandemic has become a major challenge for the education sector. Due to the forced transition to distance forms of training, traditional forms of professional education have undergone changes, that make resumption of the previous state of affairs complicated and long standing. In addition, according to the UNESCO, a fall in gross domestic product could lead to reduced spending on education [4].

Limited funding for educational institutions, degradation of material and technical infrastructure over the past decades has led to the need for modern sites of machinery, equipment,

laboratories, and so on needed to train highly qualified specialists.

Limited access of rural school graduates to quality educational services, especially on-line, and their low level of basic training should also be taken into account.

The results of general academic performance rating indicate a significant impact of forms and methods of teaching and learning on the graduate competencies formation.

Thus, a mismatch between learning outcomes and needs of labor market is being observed today.

Therefore, arguments and suggestions to improve educational and professional programs through cooperation between business and higher education aimed at gaining both sound theoretical knowledge and practical skills at the university seem to be relevant [5].

This necessitates modernization and optimization of the educational system of Ukraine through introduction of innovative programs and technologies.

That is why, the issues of interaction of scientific, educational, industrial institutions, dual education, distance learning, personalization of learning within specific educational systems require thorough search.

**Literature review.** Studying the problems of education, scientists confirm that global imperatives lead to the increase in the integrity of higher education, which is associated with its diverse functions: professional, socio-political, social and systemic ones, aimed at comprehensive and harmonious development of personality.

In a number of works it is substantiated that the barrier factors of innovation and professional-qualification potential can be overcome by tuning the mechanism of interaction of the labor market, the market of educational services and innovative university complexes [6].

It is emphasized that the effectiveness of interaction of the labor market and specialist training system will be increased

under the creative interpenetration of professional and educational standards, professional identity of students, their involvement in research and production projects, gradual formation of professional competencies [7].

In particular, the example of most Dutch and individual US universities shows that innovative university research can be seen as an effective mechanism of transfer of technology for commercialization [8].

Based on a systematic review of current best practices of European universities, it can be concluded that in order to maintain the sustainability of changes, inter-organizational processes should be based on equal partnership between educational systems and the production site. Under this approach all stakeholders (employers, students, scientists, universities) get mutual benefit [9].

In particular, in the context of our study, the work "Using Higher Education Consortia for Institutional Promotion" is of great significance. In it, the authors conclude that consortia have a wide range of benefits due to the innovative structures, operations and service delivery methods, creating huge potential for higher education establishments to become more effective educational institutions [10].

**Purpose.** To substantiate the fact that transformation of the educational process towards modern practical requirements and personal needs of future specialists can be achieved by using both the potential of research farms, production facilities and theoretical study in the training system that integrates the best scientific, industrial and subject systems; to demonstrate that the idea of professional training of young human resources within the educational-scientific-industrial complex may serve a convincing example of the mechanism of transition of production to the innovative model of development; to describe organizational and pedagogical conditions for the implementation of links between the structural units of the "All-Ukrainian Scientific and Educational Consortium" (hereinafter – the Consortium).

**Methods.** A systematic analysis of literature and normative documents were carried out. Examples of different types of interaction between educational institutions, research institutions and production facilities in the world are considered.

The data were collected during the internship at the USEC on the base of the regulations study, individual and group interviews, surveys and direct participation in the educational process. The participatory approach allowed demonstrating practical significance of scientific search due to involving all participants in the process of training specialists (students, employers, research and teaching staff, administration, representatives of research institutions).

**Results.** A significant role in the formation of personality is played by an educational institution, namely the interaction of all its components with the person, since transition to the formation of a professional takes place right here. The quality of higher education is manifested in the competence acquired during training, i.e. "a dynamic combination of knowledge and practical skills, ways of thinking, professional, ideological and civic qualities, moral and ethical values, which determines a person's ability to successfully pursue professional and further educational activities and is a result of training at a certain level of higher education" [11].

Under such an approach, the main goal of the higher education institution is to create a professional and pedagogical infrastructure that would contribute to the formation of a highly qualified specialist. The expected learning outcome is a person who has a number of competencies that are a synthesis of professional and universal knowledge, skills, abilities and personal qualities that ensure the efficiency and productivity of their assignment within the framework of their professional activity.

We make accent at the spiritual competence, which is manifested in the self-awareness of an individual as the exponent of the values of national and universal cultures. This is a

person who is aware of his/her personal responsibility for their future, for the destiny of his/her nation and humanity in general. They are characterized by social competence, formed under conditions of civic maturity and social capacity. They have acquired moral and ethical competence – the focus of the future specialist on the conscientious and quality performance of their official duties, based on the perceived need for work, which is the highest form of self-realization. A successful graduate must have psychophysiological competence, which allows a professional to form a personal scenario of behavior in extraordinary situations while performing their professional duties.

The specialist in demand in the labor market owns individual competence – a set of qualities that underlie the individual style and way of activity. It harmoniously combines functional competence, which is expressed in application of the acquired knowledge for implementation of standard tasks of professional nature and dynamic competence – the ability to adequately respond to rapidly changing situations in the professional sphere.

Thus, the emphasis is shifted from the traditional attributes of the future specialist to generating their special characteristics. Therefore, the goal of professional education should be the ultimate disclosure of the spiritual, moral and ethical, intellectual and psychomotor potential of the person during his/her professional development.

In our opinion, in order for the process of practical and theoretical training to "work for the individual", it is necessary to join together all the means of production, science and education. Accordingly, integration of science and industry will be reflected in the updated education system. Therefore, innovative educational technologies, adequate to modern production technologies, acquire special value.

The categorical framework of professional education is a heterogeneous, polystructural system. It consists of the versatile concepts. The processes of convergence, connection, interaction, and complementarity are constantly taking place between them. Prominent place among them is occupied by the connection between science, education and industry, which, in turn, leads to their integration.

The main trends in the development of modern science are somehow related to the implementation of integration processes in it and have a strong influence on transformations that occur as part of the corresponding knowledge. As a result, new disciplines come into existence, old ones disappear, students master disciplines from the related fields (minors), and educational trajectories are changed. These phenomena correlate with the needs of production, thus initiating, in accordance with the principle "from the opposite", the strengthening of scientific and educational ties.

Basic research reveals the laws of the process of professional training, develops general theoretical concepts of science, its methodology and history. In general, it is aimed at expanding scientific knowledge, indicates ways for scientific search, creates the basis for applied research and development. Education is an intermediate link between science and practice, fundamental research and development aimed at obtaining practical results.

Computerization and, as a result, automation of its components, plays a significant role in this interaction, which leads to the fact that they begin to coexist at the level of ideological synthesis of ideas, which permeates the substantive and procedural aspects of the relationship between theory and practice.

However, science created solely for the applied purposes is impossible; truths are fruitful when there is internal connection between them. If you look only for those conclusions from which you can expect immediate practical results, the related links disappear and the chain is destroyed.

In this sense, the idea of changing innovation systems, based on the embodiment of the idea of a triple spiral, is relevant. Interaction between the spirals is seen as production of

knowledge at the academic level, product creation (production) and regulatory control (management), which results in the model of institutional conditions and includes organized production of knowledge and innovation as a mechanism of social coordination [12].

By analogy, we describe the institutional relationships between educational establishments, research institutions and production facilities in the form of Euler-Venn circles, which demonstrate common and distinct institutional areas.

Variations in the dimensions of SCIENCE, EDUCATION and PRODUCTION are analytically independent. Therefore, coordination of activities in these areas can be represented in the Cartesian coordinate system. These components are the coordinate axes. In this space, you can depict an object or relationship in an innovation system.

Basic research often has an indirect impact on the economy and the “delayed” character of usefulness and relevance. In this regard, there arises a problem of determining the degree of influence of various types of research on professional education.

Elimination of contradictions is achieved by using production facilities along with the system of training specialists, which integrates the advantages of production and subject systems. Pedagogical and technical-industrial components find an invariant basis for their existence within this approach.

A convincing example of the abovementioned is the idea of professional training within the scientific-educational-industrial complex, the “All-Ukrainian scientific and educational consortium”, as a conceptual mechanism of transition of agro-industrial production to an innovative model of development. It includes Vinnytsia National Agrarian University and the Institute of Bioenergy Crops and Sugar Beets of the National Academy of Agrarian Sciences of Ukraine with their research facilities, breeding farms and structural departments. The innovative idea of the complex provides training for the future agriculturalists, where modern theoretical knowledge as a didactic equivalent of the relevant science, is intertwined in the outline of professional one and at the same time is implemented in practice, using a decent material base of the breeding stations and research farms, thereby flexibly responding to the needs of the modern labor market. This approach coordinates the mechanisms of partnership for the maximum realization of the creative potential of all members, exchange of scientific information, inclusion of basic and applied science into the educational process [13].

The philosophical (general methodological) approach ensures unification of the components of this training. The ideas of the leading role of cooperation in the evolutionary formation of mankind occupy a prominent place among the general scientific foundations. An important role among the partially scientific foundations is played by the natural science concept of “science of the unity”, modern ideas of scientists about the self-regulatory system of the Earth, which assumes the existence of opposite and mutually exclusive forms of existence. The core of the concrete-scientific approach is the idea of harmonious human development, a holistic approach to its formation.

However, when introducing new approaches, it is important to remember that education is an equal partner but not an appendage of production. On the one hand, the laws of production and technological processes should not prevail in the professional development of a specialist without their pedagogization, since there is a danger for education to be deprived of its own scientific and disciplinary independence and turning into eclectic conglomerate of diverse knowledge, which lacks a system-creating factor. And vice versa, the laws of pedagogy alone should not dominate. After all, this causes a contradiction between production and pedagogical essence of the educational-industrial process and the subject method, which limits composition of educational components purely by production and technical facilities.

Today, the idea of innovative projects that unite scientific institutions and production facilities around educational establishments is relevant. International relationships are based on integration – interpenetration of structural elements of educational institutions (consortia) [10, 14], transformation of the learning environment based on cooperation, which is focused on solving a specific problem [15], providing the student problem-oriented research for the needs of production [16], formation of the cross-border research and educational services aimed at shaping the global market of educational platforms are accepted [17].

A number of authors prove the prospects of dualistic unity between theoretical and industrial training [18]. The principle of dual education is already used in Germany, Denmark, Austria, Switzerland, the Netherlands and Norway to provide the labor market with a highly skilled mobile workforce capable of adapting to new and changing conditions. Taking into account the specific needs of universities and students, based on the German experience, the dual education programs successfully work in Brazil, France, Qatar, Mexico and the United States. These projects take into account not only the interests of stakeholders in production, but also universities, research institutions, foreign partners and other parties involved [19].

Dual forms of education based on the European experience are being introduced in Ukraine. In autumn 2020, the first year of the pilot project of introduction of dual education in partnership with small, medium and large businesses ended. The level of the employers’ concernment in involving applicants at the stage of their training indicates the potential for the dual form of education [20].

The Consortium creates such organizational and pedagogical conditions under which the above mentioned training systems are implemented through introducing elements of training content into the process of professional education of future specialists, i.e. creation of a certain educational composition of the real production situation, which still does not fully disclose it.

Integration of professional-pedagogical and technical-industrial components allows for the implementation of innovative training. Production features are accompanied by pedagogical ones, for example, division of the production process into elements in accordance with pedagogically justified requirements thus covering both production and training aspects, promoting early professional adaptation of the future professionals.

In our opinion, the process of the specialist professional competence formation requires compliance with the following pedagogical conditions: integration of theoretical and practical training; development of information and communication competence as a component of professional one.

Consolidation and interaction of different levels is a powerful tool for eliminating contradictions between the purely theoretical education of future professionals and the practical needs of production. Integrative processes take place at the vertical and horizontal levels. At the vertical level, they are manifested in the hierarchical relationship and continuity between the elements of the Consortium (theoretical studies in classrooms and learning laboratories, practical training in problem research laboratories, professional and industrial internships at foreign universities and agricultural partner companies, research and breeding stations and farms, certification and business-project development). The Figure below demonstrates the structure of educational programs for training specialists in such an integrative system.

Horizontal integration implies consistency not only in content (interdisciplinary links), but also in the procedural component of training (forms, methods, tools): teachers in the classroom and mentors in the workplace; teaching and learning, mentoring and acquisition of skills by future specialists; introduction of innovative forms for organizing young scientists’ work, international scientific and discussion platforms,

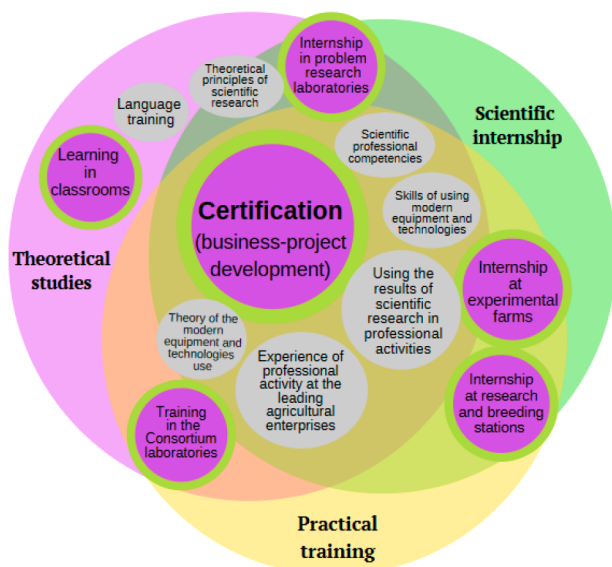


Fig. The structure of educational programs for training specialists at the "All-Ukrainian Scientific and Educational Consortium"

thematic moderations, round tables, master classes; creation of personal and instructional farms as real agribusiness formations.

Collectively, the acquired professional training will be that part of the competence of the specialist which reflects his/her personal and ideological qualities. Accordingly, integration of training which reflects all aspects contributes to the formation of a holistic person ready to perform professional tasks already in the process of learning at the higher education institution.

We consider integration as a purposeful way of establishing and implementing organic connections of structural elements of the pedagogical system around professional orientation of the student, which ensure effective functioning of the system.

In the context of the Consortium, integration is manifested in the development of a system of goals that determine the place of theoretical and practical training (disciplines, practices, projects) in professional education, concentration and coherence of activities related to professional orientation. Great importance is attached to the harmonious combination of theoretical-cognitive and practical-cognitive components of professional orientation, development of organizational components of the training process and interaction of the main components of training.

Investigation of the educational process in the outlined conditions has resulted in establishing links and developing algorithm of actions in the theoretical and practical training of future agriculturalists on the basis of integrative approach: setting goals, determining the basics of integration, selection of forms and ways for implementation of interconnections.

The role of the general basis is played by the professional orientation of training the agricultural specialists. However, depending on the direction of training, in each case it is necessary to determine individual characteristics of this orientation.

In addition, the model of relations of structural units of the Consortium allows using various forms and methods of cooperation of theorists and practitioners: scientific discussion platforms, conferences, seminars, round tables, forums, student scientific groups, practical training of students, joint research projects, teacher internship, and others.

Due to such cooperation, students have the opportunity to be advised from various sources, both from scientists and practitioners, to test theoretical developments in practice, to share their own experiences.

Effectiveness of the technology is achieved through the innovative structure of educational programs to train specialists in

the Consortium. Under this approach, theoretical studies in classrooms and laboratories take only 30 % of the training period.

In the educational process and in the production environment various information technologies are used. They differ in the number of functions, convenience and quality of the user interface, graphics capabilities, applications, ability to share data with other systems. The main task in the process of forming professional competencies is consistency in the choice of technologies for the theoretical studies and the practical needs of production.

In order to harmonize the educational and practical components, joint creative teams of teachers and practitioners are built in the process of forming regulatory documents, which guide formation of training content (curricula, discipline programs, scientific and methodological materials).

An effective means of cohesion is formation of a single information system and databases, on the ground of which teachers form the content of relevant disciplines, choose information technologies that best meet the logic of the discipline and demands of production.

As has been demonstrated by the experience of training future agricultural specialists in Vinnytsia National Agrarian University (VNAU) in recent years, in the process of implementing the student-centered approach, blended learning technology based on integration of traditional classroom and distance forms, with the use of the best features of each one, proved its pedagogical effectiveness.

In our opinion, a rotational model of blended learning is methodologically justified; it features a nonlinear transition between different locations: lectures, practical classes, tutorials, communication with the research farms practitioners. Based on personal needs and abilities, a flexible form of combination of on- and off-line learning is implemented. A good didactic technique in this situation is the creation of distance learning courses that have been successfully tested during quarantine period caused by the coronavirus epidemic.

This approach forms a peculiar educational trajectory – a personal way of realizing the individual potential of each student in education.

Important here is the cognitive-psychological aspect, according to which new knowledge is always associated with the existing knowledge. Thereby, not only an associative series is formed, but knowledge is transformed on the basis of that from other fields. It depends on their objective content, as well as on the activities in which they are gained or used, on the content provided to them by a particular specialist. In the outlined conditions, the content of academic disciplines should be focused on specific learning outcomes and promote formation of productive professional thinking.

Transformation of professional education requires serious reorientation of all components of the pedagogical process. This includes research and teaching staff. Acquisition of new competencies is facilitated by modern forms of activity of the teaching staff, in particular, internships at foreign universities and research and production units of the Consortium. An important role is played by participation of teachers in grant programs, scientific developments and their implementation in production, funded both by legal entities and the government, participation in conferences of various levels, scientific and educational exhibitions. In educational activities the emphasis has shifted to writing science-intensive lecture courses, transformation of training technologies with a focus on mixed forms and coaching, preparation of distance learning courses.

Thus, our studies and practice of training future agriculturalists at VNAU allow us to conclude that innovative training will be effective subject to the availability of integration of scientific, industrial and educational resources in compliance with the following organizational and pedagogical conditions:

- formation of a single information environment of the Consortium in order to ensure coherence and effective interaction of all its structural units;

- creation of analytical information and methodological center aimed at coordination of educational, research and practical training;
- creation of an organizational structure to support educational and professional programs that meet the demands of stakeholders, personal goals of the future specialist and modern requests of practical activity;
- development and revision of normative documents, educational-methodical and informational support for the mixed forms of training implementation on the basis of student-centered approach;
- staffing support for training the specialists and creating conditions for continuous updating of professional competencies for the teaching staff and mentors at the production site;
- creation of the modern platforms on the basis of scientific, educational, innovative and technological potential of the founding members of the Consortium.

**Conclusions.** Thus, the All-Ukrainian Scientific and Educational Consortium has become a place where implementing their own initiative project, one can test their knowledge and skills, apply abilities and experience, learn to work in a team. Here you can get not only opinion from teachers, researchers and practitioners, but also financial support. Within the limits of the specified approach, situations for the developing teamwork skills are purposefully created.

The central organizational principle of this approach is the principle of flexible response to changing labor market requirements, the needs of the population in obtaining this or that profession. Such a strategy should be combined with the important, generally accepted fact that not only demand generates supply, but supply also generates demand. These circumstances necessitate the implementation of promotional work in conditions of the USEC, which will also contribute to the actualization of a propaedeutic function of education.

The training system described above is a multi-purpose one. It is designed to perform a diagnostic function aimed primarily at determining professional orientation of students, the study of the levels of their cognitive abilities. This function is combined with the motivational one, associated with the preparation of future professionals for labor activity, which is based on the psychological theses that a person is able to get into particular activity only if he/she is ready for it. The information and educational function turns the process of professional training into a source of the latest information and is transformed into the prognostic educational and developmental one, which necessitates direct participation of students in research and experimental work, organization and implementation of professional activities at the place of production.

At the same time, expansion of the social functions of education means increasing the impact on all spheres of social reality: education, along with its specific purpose, begins to solve problems that go beyond it. For example, direct appropriation of agricultural education is the economic function of food security. Changing the role of education leads to a change in priorities of traditional situation in which it expresses certain demands of socio-economic development. In general, without losing these positions, education is increasingly beginning to play the role of an equal partner in relation to other components of the society. In particular, this is the case of production: education ceases to be a functional appendage of the latter, whose development is increasingly determined not by market demand but by the level of educational services offered.

Thus, integration of science, education and industry not only creates contradictions that arise in the practice of training specialists, but serves a means of resolving them, while being the foundation in formation and development of professional education.

The approach described above settles some other contradictions of professional education: compression, consolidation of information and time; elimination of duplication and establishment of continuity in the development of knowledge

and skills; dissolution and interpenetration of knowledge and skills of some disciplines; systematization of concepts, facts, skills and abilities, denial of some of the acquired knowledge, skills in formation of the generalized integration properties, establishment of subordination and coordination.

Under this approach, the content of professional education is broader than its traditional interpretation: it combines the whole set of diverse competencies necessary for the vital function of the holistic personality of the future professional implementation.

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## Науково-навчальний консорціум як інституційна проєкція інноваційної підготовки фахівців

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**Мета.** Визначити сутність, основні можливості та продемонструвати резерви навчально-науково-виробничого комплексу як способу модернізації ринку освітніх послуг в інноваційній моделі розвитку. Описати організаційно-педагогічні умови координації наукового, навчального, інноваційного й технологічного потенціалу колективів-засновників ННВК «Всеукраїнський науково-навчальний консорціум» (ННВК).

**Методика.** Здійснено системний аналіз літератури, нормативних документів. Розглянуті різні практики співпраці навчальних закладів і підприємств, наукових інституцій і виробничих об'єктів у світі. Дані були зібрані під час стажування у ННВК «Всеукраїнський науково-навчальний консорціум» на підґрунті індивідуальних і групових інтерв'ю, опитувань і досвіду викладацької та адміністративної діяльності.

**Результати.** Трансформація освітніх систем задля відповідності сучасним запитам стейкхолдерів та особистісним потребам майбутнього професіонала досягається шляхом використання в системі професійного становлення молоді ресурсів науково-дослідних господарств, підприємств, одночасно із теоретичним навчанням, інтегруючи в собі їхні переваги. Результативність технології досягається за допомогою створення інноваційної структури освітніх програм усіх рівнів і системи підвищення кваліфікації науково-педагогічних працівників у Консорціумі. Запропоновані організаційно-педагогічні умови координації наукового, навчального, інноваційного й технологічного потенціалу колективів-засновників ННВК.

**Наукова новизна.** Спричинене необхідністю модернізації та оптимізації закладів вищої освіти України, співробітництво ринку праці та професійної освіти буде ефективним в умовах навчально-науково-виробничих комплексів за дотримання окреслених організаційно-педагогічних умов.

**Практична значимість.** Окреслені перспективи реалізації освітніх програм у межах науково-навчальних консорціумів. Описані організаційно-педагогічні умови сприяють інтеграції освітніх програм, професійних стандартів і становленню студентів як професіоналів.

**Ключові слова:** професійна освіта, науково-навчально-виробничий комплекс, дуальна освіта

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