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Designing a Scientific and Educational Professional Environment of a Higher Educational Institution for the Training of Future Engineers of an Agrarian Profile

Abstract. Introduction*. The article considers and analyzes the structure of the project of scientific and educational professional environment as a design result can be presented in the form of an existing model of educational environment of professional training of future agricultural engineers and improvement of its conditions and resources.*

Purpose. *It is revealed that in the scientific-educational professional environment of the higher educational institution cross environments are configured - the educational environment of the higher educational institution, the scientific environment, the information-communication pedagogical environment, the professional environment.*

Results. *It is established that the functioning of scientific and educational professional environment is provided by the following important components: technical resources (computer and multimedia database, software, channels and equipment for data transmission at a distance), human resources (teachers, heads of educational institutions, top managers), educational and methodical resources (methodical recommendations for the implementation of research works and projects, didactic system of research training of future agricultural engineers). The design of the scientific and educational professional environment contributed to the creation of a project to modify the existing educational environment and enrich its resources and opportunities to improve the conditions of professional and personal development of the future agricultural engineer. In order to ensure the implementation of the educational project on the basis of the predicted logical and structural matrix of the educational process, the content, methods, forms and means of forming research competence of students were designed, which reproduces updating the content-procedural block of structural-functional model of formation profile.*

Conclusions. *As a result of modeling the character of interdependence between structural elements, features of formation of research competence of future engineers of an agricultural profile, realization of communications between functional and structural elements, sequence of passing of stages of functioning, quantitative and qualitative characteristics of shifts in the personal characteristic which is research is revealed competence.*

Keywords: *designing; scientific and educational professional environment; resource; engineer.*

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Проєктування науково-освітнього професійного середовища вищого навчального закладу щодо підготовки майбутніх інженерів аграрного профілю

У статті розглянуто та проаналізовано структуру проєкту науково-освітнього професійного середовища як результат проєктування може бути представлений у вигляді наявної моделі освітнього середовища професійної підготовки майбутніх інженерів аграрного профілю та удосконалення його умов і ресурсів. Виявлено, що у науково-освітньому професійному середовищі вищого навчального закладу конфігуруються перехресні середовища – освітнє середовище вищого навчального закладу, наукове середовище, інформаційно-комунікаційне педагогічне середовище, професійне середовище. Встановлено, що функціонування науково-освітнього професійного середовища забезпечують такі важливі складові: технічні ресурси (комп'ютерна та мультимедійна база, програмне забезпечення, канали й устаткування передачі даних на відстань), кадрові ресурси (викладачі, керівники освітніх установ, керівники вищого рівня), навчально-методичні ресурси (методичні рекомендації до виконання науково-дослідних робіт та проєктів, дидактична система науково-дослідної підготовки майбутніх інженерів аграрного профілю). Проєктування науково-освітнього професійного середовища сприяло створенню проєкту видозміни наявного освітнього середовища та збагачення його ресурсів і можливостей для удосконалення умов професійного й особистісного розвитку майбутнього інженера аграрного профілю. З метою забезпечення реалізації освітнього проєкту на основі прогнозованої логіко-структурної матриці освітнього процесу проведено проєктування змісту, методів, форм та засобів формування науково-дослідної компетенції студентів, що відтворює оновлення змістово-процесуального блоку структурно-функціональної моделі формування науково-дослідницької компетенції майбутніх інженерів аграрного профілю. У результаті моделювання виявлено характер взаємозалежності між структурними елементами, особливості формування науково-дослідницької компетенції майбутніх інженерів аграрного профілю, реалізацію зв'язків між функціональними й структурними елементами, послідовність проходження етапів функціонування, кількісні та якісні характеристики зрушень в особистісній характеристиці, якою є науково-дослідницька компетентність.

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Formulation of the problem. In the conditions of rapid development of the information society, in which the main products of production are information and knowledge, it is not enough for a future specialist to possess only information, it is necessary to be able to operate it correctly and obtain objective knowledge about reality. In this regard, the need for the formation of research competence of the future specialist as a willingness and ability to research. This fully applies to engineers, their fundamental theoretical training and high level of practical skills must be complemented by the ability to work in a developed information society, to adapt quickly to the situation in the field of information technology.

In the professional training of engineers under any conditions, the leading trend is modernization, which provides the need for compliance with the quality of training of engineering personnel to the rapid improvement of science, technology and production.

At the same time, due to the rapid development of information technology as a field of scientific, technical and professional knowledge and the constant growth of educational material, it becomes virtually impossible to cover in a limited course all important disciplines in the required amount. There is a need to intensify the process of professional training of future engineers, which provides such a level of mastery of professional competencies that meet modern requirements of the information society, allow to be realized in professional activities, are the basis for solving research and creative tasks.

The above actualizes the search for ways to form the research competence of future engineers in a specially organized educational environment of higher education.

Analysis of recent research and publications. Pedagogical design of higher education and preparation of teachers for pedagogical planning is studied by scientists: S. Denysenko [1], I. Zyazyun [2], T. Korshun [3], T. Podobedova [4], V. Strelnikov [5], J. Fruktova [6].

In the scientific literature there are different approaches to understanding the phenomenon of design. The breadth of scientific interpretation of the content of the phenomenon "pedagogical design" is reflected in the recognition of its new field of knowledge, scientific direction of pedagogy, organized practical activities, the process of creating and implementing a pedagogical project, method of system or technology development [7, p. 95].

The problem of designing the educational environment of the university attracts the attention of scientists. Thus, Yu. Manuilov calls environmental design modeling of the environment and the environment of the educational process, which is necessary to determine the goals, methods, means of achieving them and obtaining appropriate results [6, p. 40].

G. Sazonenko believes that the design of the educational environment is aimed at solving three strategic tasks: the organization of conditions and opportunities for effective development and self-development of the individual; creation of conditions and definition of priorities for educational, self-educational activity of the student, realization of an individual educational trajectory; organization of conditions and opportunities for the formation of key competencies of the graduate [8, p. 232–233].

Thus, the design of scientific and educational professional environment for the training of future agricultural engineers is a specific type of pedagogical activity to create a project to change the educational environment and enrich its resources and opportunities to improve the conditions of research competence of future agricultural engineers.

Formulation of research goals. The purpose of the article is to design a scientific and educational professional environment of a higher education institution for the training of future agricultural engineers.

Outline of the main research material. The result of pedagogical design is an educational project, the functional specificity of which depends on certain conditions: the state of the environment, the characteristics of the subjects involved in a particular project, functional relationships between project elements, its application, expected results [7, p. 99]. The educational project is the basis for the development of a system of measures and actions for its implementation.

Consider the algorithm for designing the educational environment for the formation of research competence of future agricultural engineers, represented by a logical-structural matrix. Numbering 1-14 reproduces the sequence of filling the corresponding elements of the logical-structural matrix.

First, we formulate the goals / objectives of the educational project: 1) long-term goal - a system of professional training of future agricultural engineers; 2) specific goal - the formation of research competence of future agricultural engineers; 3) results - to substantiate and experimentally test the structural and functional model of formation of research competence of future agricultural engineers and organizational and pedagogical conditions of its implementation in the educational environment of higher education; 4) measures: to analyze the state of the researched problem in the theory and practice of higher school activity, to specify the essence of basic concepts and categories; determine the components, criteria, indicators and levels of research competence of future agricultural engineers; substantiate the structural and functional model of the formation of research competence and create organizational and pedagogical conditions for its implementation in the educational environment of higher education; experimentally test the effectiveness of the structural and functional model of the formation of research competence of future agricultural engineers in the educational environment of higher education.

We determine the necessary resources for the implementation of measures: additional time to work on the submission, design, development, implementation and monitoring of the implementation of research projects; learning English; cooperation with agricultural holdings; costs of publication and registration of intellectual property; business trips to conferences, seminars, trainings.

We formulate assumptions about external factors and conditions, risks and threats of implementation of measures, achievement of results, goals of the project: 5) activities: the availability of real research projects at the departments; conducting research by teachers of the department; close cooperation with agricultural holdings and departments; teachers and administrative staff of the university will refuse additional workload; 6) results: the administrative staff of the university will not accept innovations; additional load will lead to a negative perception; additional competition will lead to a negative perception; 7) specific goal: close cooperation with scientific institutions and companies; involvement of students in real research works; due to significant bureaucracy in universities, cooperation will not be effective.

Define objectively verifiable indicators of achievement and sources and means of verification, moving from a long-term goal to a specific goal and results: 8) indicators of long-term goal achievement: close cooperation between the department and companies; increasing the number of research projects of the department; number of own research of the graduating department; 9) sources for the above indicators: employers; labor market; professional, scientific and methodological sources; OKH; OPP; work programs; 10) indicators of achieving a specific goal: the number of students participating in scientific conferences; number of publications and copyright certificates co-authored by students; the number of students involved in research projects of the department; 11) sources for certain indicators: students of specialties "Agroengineering", employers, graduates, teachers; 12) indicators of achievement of results: increase of efficiency of preparation of highly professional engineers of an agricultural profile who have experience of work on production and real projects; involvement of students in scientific activities; scientific and methodological support, implementation of experience in other universities, experimentally tested results; 13) sources for the above indicators: questionnaires, surveys, interviews, labor market, experimental results, statistical information, analysis; 14) sources of information on project implementation: analysis of philosophical and psychological-pedagogical literature on the research topic; comparison, classification and systematization of theoretical and experimental data, theoretical modeling and generalization of data; method of theoretical analysis and synthesis at the stages of determining the purpose, subject, hypothesis and objectives of the study; study of normative documents, curricula and programs, other educational and methodical documentation for systematization of data, development and substantiation of conceptual bases of structural-functional model of formation of research competence of future specialists; empirical methods: diagnostic (interview, questionnaire, testing), observational (direct and indirect observation), prognostic (expert assessments), pedagogical experiment, methods of statistical processing of research results.

Thus, the project of scientific and educational professional environment as a result of design can be presented in the form of an existing model of educational environment of professional training of future software engineers and improvement of its conditions and resources. Accordingly, the design of scientific and educational professional environment for the formation of research competence of future software engineers requires purposeful improvement of the content, methods, forms and means of research activities first through the predicted logical and structural matrix of the educational process and then through its implementation.

In the scientific and educational professional environment of the higher educational institution cross environments are configured - the educational environment of the higher educational institution, the scientific environment, the information and communication pedagogical environment, the professional environment (Figure 1).

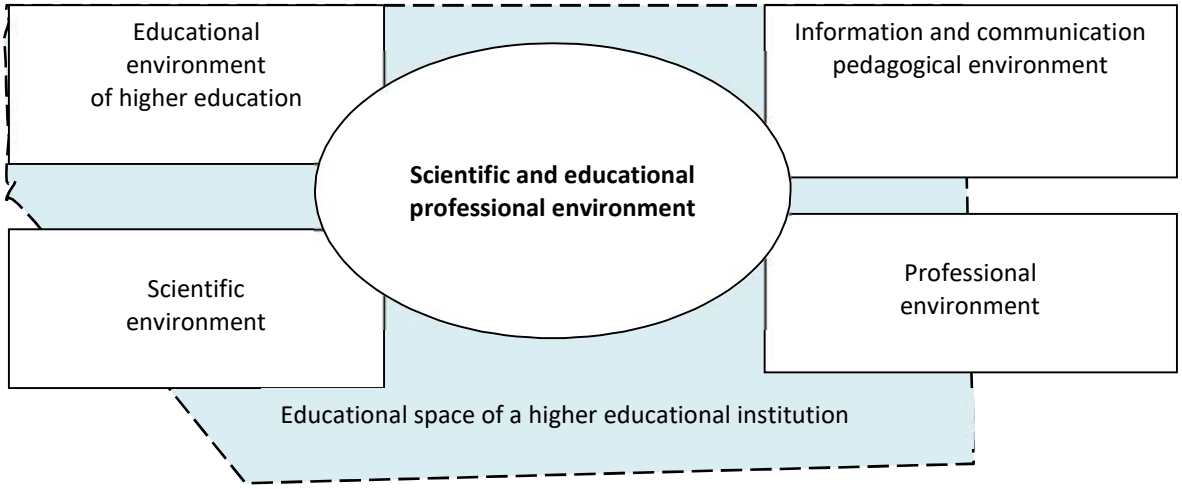

Figure 1 – **Scientific and educational professional environment of a higher educational institution**

Source: generated by the author

Given the above, the functioning of the scientific and educational professional environment is ensured by the following important components: technical resources (computer and multimedia database, software, channels

and equipment for remote data transmission), human resources (teachers, heads of educational institutions, top managers), educational and methodical resources (methodical recommendations for the implementation of research works and projects, didactic system of research training of future agricultural engineers). As a result, psychological mechanisms are activated, forcing subjects to engage in research work.

The scientific environment is an association of scientists, research and support staff and other categories of workers who are directly involved in research or perform engineering, administrative and other functions of scientific organizations [9]. This is a fundamental component of the scientific and educational professional environment, focused on attracting students to research activities from the level of faculty or department to the level of the university, national and international levels. Accordingly, students in the process of "immersion" in the scientific environment gain knowledge, skills, abilities of the future specialist of agricultural profile and competence of legal protection of intellectual activity, technological audit, marketing, product sales in the innovation market [10]. The participation of students in scientific and practical conferences, competitions and contests in programming has a positive effect on their training. In the process of preparing students it is necessary to focus not only on direct participation in such activities, but also in volunteer work. The results of such work must be formalized in the form of professional articles and copyright certificates.

Of particular importance in the training of future agricultural engineers is the information and communication pedagogical environment, which is directly related to the specifics of training. According to the topic of our research in the structure of the scientific and educational professional environment of information and communication pedagogical environment we will consider in more detail than other components.

The analysis of various definitions of information and communication environment led to the following generalization: information and communication environment is a systemically organized set of information, organizational, methodological, technical and software that promotes the emergence and development of information and educational interaction between the subjects of the environment for professional purposes. -personal development of the future software engineer.

According to L. Petukhova, the information and communication pedagogical environment has the following advantages [11, p. 134]: contributes to the formation of motivation of the individual to consume the content circulating in it; provides access to resources at any time convenient for the person; has a convenient, flexible, friendly, intelligent service that helps a person find the necessary information resources, data or knowledge; functions in accordance with the needs of man as much as he needs; ensures the availability of a significant amount of rapidly increasing information; allows you to organize virtually free, convenient in time contacts between any number of people, to provide a convenient and flexible exchange of information (and in any form) between them; standardizes and integrates all previous traditional means of obtaining, storing, processing and presenting the necessary information, data and knowledge to mankind; takes on more and more routine operations related to human operations; gains more and more control over the data and operational activities of mankind.

In terms of content, the resources of the information and communication environment should: ensure the availability of obtaining and exchanging knowledge and information; implement comprehensive support for the process of training, research, innovation, information protection; create a distributed database that includes multimedia and distance learning technologies and provides open access to educational resources of regional information centers and information technology centers; to ensure the development of geographic information systems in education.

In structural terms, the development of information and communication environment resources includes the creation of a developed unified telecommunications network of education, science and innovation organizations; development of a segment of the national computer communications network for science and higher education; organization of access to high-performance data banks, computing power, network technologies of the new generation [12, p. 82].

Significant for the formation of the material and technical base of the information and communication pedagogical environment are distance learning systems and electronic teaching aids. For example, a teacher, having access to the resource he uses, can create their own e-courses, fill them with the necessary methodological support, use the necessary electronic teaching aids to improve visibility. Students, having access to the resources offered by the teacher, get more opportunities for data perception (using multimedia), independent processing of tasks; materials, online discussions.

Particular attention should be paid to the unique capabilities of online educational tools. Thus, the use of specialized educational software resources allows you to: 1) computer visualization of educational material; 2) instant feedback between students and the teacher; 3) storage of significant amounts of information with the possibility of its transmission; 4) fast access of students to the central data bank; 5) automation of information retrieval processes; 6) processing the results of the educational experiment with the possibility of multiple reproduction of its fragment, or the experiment itself in general.

An example of such an online tool is the Web-site of a separate course, which provides for the need for students

to conduct their own research, and therefore provides the following opportunities:

- access to lectures and other theoretical materials (textbooks, scientific articles, etc.);
- presentation and editing of research materials directly on the resource used;
- the opportunity to discuss and evaluate the study by the teacher and other students;
- storage of research materials of each group of students in the form of an open archive, etc. [13].

Thus, for the scientific and educational professional environment of information and communication pedagogical environment implements the following important components: information and educational resources (electronic libraries, educational systems and programs), software and hardware and telecommunications tools, rules for their support, administration and use that provide common technological means of information, information support and organization of the educational process, in particular scientific research, professional counseling [14, p. 91].

Professional environment – the surrounding social, material and spiritual conditions of his professional activity. It is characterized by: the processes of interaction, ways of organizing and implementing interaction, the content of interaction, the specific situation (develops, degrades), willingness to interact, the results of interaction, information saturation, environ Professional environment - the surrounding social, material and spiritual conditions of his professional activity. It is characterized by: the processes of interaction, ways of organizing and implementing interaction, the content of interaction, the specific situation (develops, degrades), willingness to interact, the results of interaction, information saturation, environmental friendliness.

To ensure the interaction of higher education institutions with enterprises and business, research centers are created on the basis of higher education institutions, which play the role of a kind of mediator that provides solutions to problems of "maladaptation" of students to the real professional environment. processes, lack of equipment needed for research, development and design work at a high competitive level [15].

Increasingly, the employer is willing to work with students who are just beginning their careers, as the professional potential of the future specialist is still being formed and the student is focused on the tasks he has to do after graduation. To ensure research work in the higher education institution, research laboratories, centers, parks are created, which provide students with the necessary material base. The main task of such structural units is the maximum development of all components of the potential of research and development, as well as the creation of modern educational and technological support of higher education and the development of information and communication pedagogical environment [16].

Thus, for the scientific and educational professional environment, the professional environment creates favorable conditions for involving students in real professional interaction in the workplace through such forms of organization as internships and internships in the best companies, introductory practices and open lectures with invited leading world agricultural experts. work in national and international projects, internships abroad.mental friendliness.

Scientific and educational professional environment is a modification of the existing model of educational environment of professional training of future agricultural engineers, which is aimed at improving its conditions and resources by synchronizing scientific, professional, information and communication pedagogical environments to ensure the formation of research competence.

The method of designing a scientific and educational professional environment for the formation of research competence of future agricultural engineers involves designing a system of tools, including the formation of research competence along with traditional (verbal, textbooks, manuals, visual aids, models) we consider the most effective means of information. communication technologies (computers, networks, electronic resources, information systems, information and communication pedagogical environment yet). It should be noted that during the formation of research competence of future agricultural engineers it is important to properly organize the use of information and communication technologies as:

- a means of learning that provides the process of cognition, the formation of an individual style of professional activity;
- subject of study - acquaintance with modern methods of data processing, taking into account the specifics of the organization of information processes inprofessional environment;
- a tool for solving professional problems that provide the formation of decision-making skills in the modern information environment [17, p. 370].

A special role in the functioning of the modern educational environment is played by Internet tools, which V. Osadchy classifies by functional purpose: 1) to search for information, literature, multimedia data (search engines, special purpose searches, library catalogs); 2) for the transfer, storage and dissemination of information (e-mail, file storage, file sharing services); 3) for communication (chats, forums, messengers, social networks, virtual environments); 4) to work with text, presentation, tabular, graphic and video information (office online packages, web-oriented graphic editors, online video editors); 5) for automatic translation of text (for example, Google translator, etc.); 6) for aggregation of information flows (aggregators of RSS news); 8) to create information resources (blog platforms, online site designers; content management systems, training, educational content; software for generating electronic

textbooks and for creating tests); 9) for teamwork (mind maps, online boards, schedule management tools, teamwork tools); 10) to create and work with databases (cloud services) [18, p. 32].

Thus, the rational use of information and communication technologies of the environment involves the organization of research activities of students, in which information and communication technologies are a means of learning, a subject of study and a tool for forming research competence of students. In the system of existing means of organization of research activities of students for future agricultural engineers we single out means of information and communication technologies (computers, networks, electronic resources, information systems, information and communication pedagogical environment).

The implementation of the project of scientific and educational professional environment in the training of future software engineers required the following tasks: 1) identify ways to carry out information and research activities of students, 2) create educational and methodological and resource support for the formation of research competence of future agricultural engineers.

There are several ways to carry out information retrieval activities of students in the implementation of the planned types and forms of research activities:

- using various search engines and target search engines such as Yandex.ua, Google.com, Search.com, Yahoo.com, etc. Among the national Ukrainian-speaking search engines Meta-Ukraine (http://www.meta-ukraine.com) and TopPing (http://www.topping.com.ua), which search within Ukrainian servers, as well as servers with Ukrainian themes all over the world;
- using thematic catalogs, such as, for example, UAport (http://www.uaport.net/UAcatalog/) - the general thematic catalog contains about 20 directions;
- using a system of bookmarks by tags collected by the online community, for example, through social services Web 2.0 BeaverGood, Delicious;
- through specialized forums on the sites of individual scientists, specialists, or thematic sites. Specialized sites of educational, scientific and research organizations, as well as scientific networks deserve special attention. Such a network in Ukraine is first of all the Ukrainian scientific and educational telecommunication network URAN (http://www.uran.net.ua/~ukr/frames.htm), the main purpose of which is to provide institutions, organizations and individuals in the fields of education, science and culture of Ukraine with information services based on Internet technologies for the implementation of professional needs and development of these industries. Such services include, in particular, prompt access to information, exchange, dissemination, accumulation and processing for research, distance learning, use of telematics, electronic libraries, virtual laboratories, teleconferencing, implementation of remote monitoring methods and more.
- through the review of databases of abstracts, dissertations, term papers and research papers, encyclopedias, electronic dictionaries, virtual textbooks in some disciplines [19, p. 34-35].

Thus, based on the constructed structural and functional matrix of the formation of research competence of future software engineers, the content, forms, methods and means of designing a scientific and educational professional environment are specified. The project of scientific and educational professional environment involves improving the conditions and resources of the educational process, by establishing certain links and relationships between faculty, students, leading specialists of enterprises and information and communication pedagogical environment, the main tasks of which are to form a future engineer. programmer needs professional competencies, including research, to develop the graduate's exploratory and creative potential, the desire to create in the future tnomu new objects of scientific and intellectual property, the ability to achieve good results in agricultural research profile.

Conclusions. Designing a scientific and educational professional environment contributed to the creation of a project to modify the existing educational environment and enrich its resources and opportunities to improve the conditions of professional and personal development of the future agricultural engineer. In order to ensure the implementation of the educational project on the basis of the predicted logical and structural matrix of the educational process, the content, methods, forms and means of forming research competence of students were designed, which reproduces updating the content-procedural block of structural-functional model of formation profile.

As a result of modeling the character of interdependence between structural elements, features of formation of research competence of future engineers of an agricultural profile, realization of communications between functional and structural elements, sequence of passing of stages of functioning, quantitative and qualitative characteristics of shifts in the personal characteristic which is research is revealed competence.

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