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Development trends of interdisciplinary integration in the educational process of the university at the level of technological sciences and technologies

Abstract. Interdisciplinary integration as a process of mutual coordination of the educational disciplines from the point of view of unified, continuous and integral development of professional activity is considered. From the positions of competences of the interdisciplinary integration is becoming the logical basis for the self-development of the future expert. The main features of interdisciplinary interaction in educational process, conditions of successful implementation of interdisciplinary integration in educational practice of high school are dwelled on.

Keywords: interdisciplinary integration, content of higher education, subject structure of scientific knowledge, logic and structure of formation of personality, complex training, training situations, network educational and methodical complexes.

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One of the most important methodological foundations of the modern educational process is interdisciplinary integration. The development of modern scientific knowledge, which leads to the emergence of new scientific disciplines, must inevitably take into account the processes of its interdisciplinary integration. From the perspective of the formation of competences, interdisciplinary integration becomes the logical basis for the self-development of the future specialist. Interdisciplinary links lead to the integration of subject areas in the learning system, which are based on the assimilation of disparate knowledge by students in the study of a large number of academic disciplines. The need for the synthesis of knowledge, their integrated assimilation and application in practical professional activities and human life becomes the basis for the development of interdisciplinary integration at all levels. From the standpoint of modern requirements for the content of higher professional education, the future specialist should not only possess knowledge, skills and skills, but also interdisciplinary professional mobility. This is determined, among other things, by the need to react promptly to constantly emerging changes in professional scientific theoretical and practical activities.

Interdisciplinary integration is based on the idea of comprehensive education, which has been thoroughly studied in pedagogy and pedagogical psychology. The complex system of instruction (from Latin - “communication”, “association”, “combination”) is based on the need to combine educational material in a certain semantic space.

The idea of integrated learning, which is the forerunner of the idea of interdisciplinary integration, was developed in the last century. At the beginning of the twentieth century, complex methods were considered promising and effective in the education of Germany, Austria, Belgium, Russia and other countries. Soviet pedagogy actively experimented with the complex system of teaching. The studied material in educational institutions was formally organized on the principle of multilateral inclusion of different academic disciplines on the basis of building links between individual subjects. The shortcomings of the system of integrated training were reduced to building formal links between the academic disciplines without regard for their substantive identity. The complex system of education could not create conditions for studying the content aspect of the fundamental sciences, so students and students could not gain in-depth knowledge of individual academic disciplines. From the standpoint of an integrated approach, in particular, the need for structuring the educational material was criticized, and some basic academic disciplines, such as the Russian language or mathematics, were complexly modified to the detriment of content. The idea of comprehensive education in the Soviet education system was that it was based on a general systematization of content that determined the processes of education and was based on attributes that were not basic for the overall subject systematization of scientific knowledge. Mainly, this was undermined both by the idea of structuring the system of received knowledge, and the principles of the student’s personality development. The positive aspects of this process can be attributed to the fact that the true complexity of training takes into account a number of

important components that are combined by the principles of structuring and the logic of the student's personal development. They include: the subject structure of scientific knowledge, the structure of activity, the structure of the personality, the logic of personality formation [4, 482].

In modern pedagogy, the need for interpenetration of the content of educational disciplines, as a rule, is beyond doubt. The methodological basis of interdisciplinary integration is an integrative approach, which is well established in vocational education. However, interdisciplinary integration is an extremely multifaceted phenomenon. Therefore, up to now, among researchers of the phenomenon of integration, representatives of academic pedagogical science and practice, there has not been a single understanding of such concepts as "interdisciplinarity"; "Interdisciplinarity", "interdisciplinary approach", "interdisciplinary integration". Also, there is no single methodology and holistic approach to the methodology, embodying the idea of interdisciplinary integration in the modern educational process.

In interdisciplinary integration processes of association of educational disciplines for the decision of epistemological, methodical, technological and practical problems are reflected. In turn, integration is interpreted by researchers as ensuring the integrity of the learning process. Pedagogical integration becomes the highest form of unity of goals, objectives, methods of presentation of the content of disciplines and is interpreted as the basis for the creation of new pedagogical units of education on the basis of the internal interrelation of educational disciplines and the corresponding didactic justification [1].

Interdisciplinary integration in modern Russian education includes two basic problems, characteristic not only for Russian, but also for foreign pedagogical schools.

The first problem is the development of the student's competence as a process of forming and developing his professionalism and practical application of knowledge. The second problem is personal development, personal self-realization and the practical application of competencies in a particular field of activity, which inevitably and everywhere includes the whole qualitative complex of human culture. Without him, a modern specialist in economics, management, law, pedagogy, psychology, ecology, etc. does not exist. The personal development of the student today in education is realized through interdisciplinary integration [3, 234]. The model of a graduate of a modern university includes a set of general and professional competences that are designed not only to form a high level of his professionalism, but also become the basis for his self-realization. So, interdisciplinary integration in education today becomes the basis of personal self-realization and development of the future specialist.

The main features of interdisciplinary interaction in the educational process can be formulated as follows:

- the structure of modern scientific knowledge is formed in four areas: natural science (knowledge of the natural world and the natural environment of man), techno-knowledge (knowledge of the artificial world and the artificial environment of man), sociology (knowledge of society), humanitarian knowledge (knowledge about a human);
- in the structure of modern scientific knowledge there is a constant and dynamic interaction between all four spheres of modern knowledge. The most interesting happens when different sciences interact;
- knowledge of the humanities penetrates into all spheres of scientific knowledge today. This is manifested in particular in the presence of features of various scientific schools and scientific authorities, in the style and methods of thinking of different researchers, in the presence of heuristic and intuitive methods of work in different areas of scientific knowledge, in the use of the method of associations, etc.

The most significant, in our opinion, is the third position, since it is connected with the general modern tendency of humanization of knowledge. The personal development of the student makes him more receptive and successful in all fields of knowledge and all forms of academic work.

The principle of interdisciplinary integration is also embedded in the notion of "competence". Competence is treated as an integral characteristic of a student. Competence as the development of professionalism in the practical sphere of application is a dynamic set of knowledge, skills, abilities, and personal qualities that a student is required to demonstrate after completing part or all of the educational program using the principles of interdisciplinary interaction.

Interdisciplinary integration is based on the interpenetration of the content of different academic disciplines and the creation of a unified educational space that has a holistic development potential through the use of innovative pedagogical and didactic methods and organizational forms of teaching and the formation of competencies.

One of the most common forms of interdisciplinary integration is traditional integrated training sessions - lectures, seminars, practical work. Dynamic elements of integration can be used in them, which, using certain methods and technologies, make it possible to obtain qualitative pedagogical results. In the process of integration pedagogical principles development, a new type of cognition - cognition of the integral type - is being formed. Applying integration pedagogical principles in the existing subject-modular system of education, the teacher can create his own author's integrated courses. Their development and construction depend on the process of forming specific competencies, as well as on the goals, objectives, the degree of the inclusion of disciplines in the common space of interdisciplinary integration. An integrated problem space, reflecting the degree and nature of interdisciplinary connections, reveals not only the degree of the teacher's professionalism, but also outlines the ways of its further authorial professional growth. In the integration processes, thus, the author's individuality of the teacher is revealed, which will inevitably influence the creative growth and professional training of the student. The goal of creating a modular integrated course is the formation, with the help of integrated means of content, of studying a holistic complex of disciplines. Interdisciplinary integration allows to form the basic complexes of knowledge, skills and skills that include epistemological, axiological, cognitive, communicative, managerial and activity aspects of academic work.

At the same time, taking into account the competence approach and using the knowledge gained in the process of studying the humanities disciplines, philosophy, sociology, history, pedagogy, psychology, the fundamentals of economics and ecology, it is necessary to take into account the competence approach and create a number of mandatory requirements for the teacher.

These requirements can be formulated as follows:

- the availability of consistency in the study of individual academic disciplines in terms of temporal and spatial characteristics (any changes to this requirement must be methodologically substantiated);
- the study of each subsequent discipline must be based on the conceptual basis of the previous discipline, which creates the basis for successful mastering of concepts on an interdisciplinary basis (forms of intermediate control must be subject to this requirement);
- the basic concepts of discipline should have such qualities as continuity and continuity of development;
- in the process of continuous development of the basic concepts of discipline, they are filled with new content, as well as their enrichment with new interdisciplinary connections;
- from the standpoint of the interdisciplinary approach, unity in the interpretation of general scientific concepts in different disciplines is necessary;
- from the standpoint of an interdisciplinary approach, a unified approach to the organization of the learning process is necessary;
- the learning space in all components of the training module should be integrated based on the content of the discipline.

These requirements allow us to formulate the principles for constructing holistic sets of educational disciplines that correspond to the principle of interdisciplinary integration. Interdisciplinary integration, corresponding to the original objectives of the course, assumes a clear structure of the material, the dynamism of the presentation, the relevance of the knowledge obtained. Didactic material at the same time has constantly updated capabilities for the application of a variety of forms and methods of teaching. Working on the basis of the principles of interdisciplinary integration, the teacher performs the following functions: informational, methodical, organizational, consultative, coordinating, controlling. Interdisciplinary integration in modern higher education is impossible without the use of technical means of education and general informatization of education. One of its directions is the creation of interdisciplinary network of teaching and methodical complexes [2].

Interdisciplinary network training and methodological complexes include the following materials: a work program of discipline; methodical recommendations for the implementation of practical and laboratory work; tasks for independent work of students; tests for control and self-control; sample questions for preparation for the exam or offset; methodical instructions for the implementation of the course work (if it is included in the curriculum); bibliographic list and Internet resources; e-course of lectures; materials for further in-depth study of the discipline; criteria for evaluating learning outcomes.

Integration of the network interdisciplinary educational and methodological complex is also provided by the definition of interdisciplinary goals and objectives of training; carrying out hor-

izontal and vertical integration of disciplines; the identification of interdisciplinary links within individual blocks and between the main blocks of disciplines; the allocation of courses that form the basic fundamental concepts; structuring and compiling a network of disciplines and semantic concepts; the definition of the sequence of training at different levels of training [2].

The problem of the formation of evaluation tools in the system of interdisciplinary integration of a modern university has two main aspects in its development. The first aspect is the formation of a fund of evaluation tools from the standpoint of interdisciplinary integration. The second aspect is the ratio of professional and general cultural competences of students, which is the basis for interdisciplinary integration.

The main qualities of evaluation tools, taking into account interdisciplinary interaction, are based on quality control of competence formation. Projected evaluation tools should not only meet the requirement of the structuredness of the educational material included in them, but also its coherence, integrativity, which is important for the process of interdisciplinary interaction.

When assessing the quality of a coherent or parallel study of the disciplines that underlie those or other competences, all types of links between the knowledge, skills and skills included in them should be taken into account. It is these integral assessments, formed in the process of interdisciplinary interaction, that make it possible to establish the quality of competencies formed by the student in terms of activities and the degree of general readiness of the graduate to work. Competencies are formed and developed not only through the assimilation of the content of educational programs, but, to a large extent, the educational environment of the university, the personal impact of teachers, used by author educational technologies and the process of interdisciplinary interaction. Particularly effective in this process are forms of evaluation control, such as colloquiums, debates, business games, pedagogical case studies, forms of remote and interactive networking between students and teachers, etc.

Thus, for the successful implementation of interdisciplinary integration, it is necessary:

- creatively rethink traditional procedures and forms of educational work;
- develop the competence of the teacher and student, on the basis of which new forms of interdisciplinary integration are formed;
- choose from the list of traditional forms of reporting those aimed at a comprehensive identification of competencies (term papers and final qualifying works, practices, NIRS) to pay special attention to them, focusing on the procedural, substantive and formal aspects of reporting from the perspective of interdisciplinary integration;
- create a specific methodological development of innovative forms of interdisciplinary education and control over the formation of competencies (scenarios of business games, various forms of debate, samples and templates to implement projects);
- introduce a variety of forms of ongoing monitoring, allowing continuous monitoring of the formation of competencies;
- combining existing methods of assessment of professional knowledge and skills to identify innovative models to assess the socio-personal and system competence from the perspective of interdisciplinary integration;
- to use integrative technologies taking into account the processes of interdisciplinary interaction.

Interdisciplinary integration is a necessary process of modern education. In the training of specialists of the XXI century for the teacher, it is important, along with the orientation of learning for specific activities, the ability to apply knowledge in a complex manner, to synthesize knowledge, transfer ideas and methods from one science to another. These principles are the basis of creative development as requirements to any human activity in modern conditions. The current social task of the higher school is due today to the trends of integration in science and is successfully solved through interdisciplinary connections.

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ЖОО-дағы білім беру үдерісінде пәнаралық интеграциялауды технологиялық ғылым мен технологиялар деңгейінде дамытудың тенденциялары

Аннотация. Пәнаралық интеграция кәсіптік қызметтің біртұтас, үздіксіз және интегралды даму тұрғысынан оқу пәндерін өзара үйлестіру үдерісі ретінде қарастырылады. Құзыреттілік туралы ұстанымнан бастап, пәнаралық интеграция болашақ сарапшының өзін-өзі дамытудың логикалық негізі болып табылады. Оқу үрдісінде пәнаралық өзара іс-қимылдың негізгі ерекшеліктері, орта мектептің білім беру практикасына пәнаралық интеграцияны сәтті енгізу шарттары қарастырылады.

Түйін сөздер: пәнаралық интеграция, жоғары білім мазмұны, ғылыми білімдердің тақырыптық құрылымы, жеке тұлғаны қалыптастырудың логикасы мен құрылымы, оқытудың кешенді жағдайлары, желілік оқу-әдістемелік кешендер.

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Тенденции развития междисциплинарной интеграции в образовательном процессе вуза на уровне технологических наук и технологий

Аннотация. Междисциплинарная интеграция рассматривается как процесс взаимного согласования учебных дисциплин с точки зрения единого, непрерывного и целостного развития профессиональной деятельности. С позиций формирования компетенций междисциплинарная интеграция становится логическим основанием саморазвития будущего специалиста. Раскрываются основные особенности междисциплинарного взаимодействия в учебном процессе, условия успешного осуществления междисциплинарной интеграции в образовательной практике вузов.

Ключевые слова: междисциплинарная интеграция, содержание высшего профессионального образования, предметная структура научного знания, логика и структура формирования личности, комплексное обучение, обучающие ситуации, сетевые учебно-методические комплексы.

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