

## INTERDISCIPLINARY LINKS AS A DIDACTIC BASIS OF THE FUTURE TEACHER'S PROFESSIONAL TRAINING

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**Abstract.** In the article, the authors consider interdisciplinary links as an important factor in training students of higher pedagogical educational establishments for their future professional activities. As a result of the study and analysis of pedagogical experience, the researchers found that interdisciplinary links are the didactic principle and the basis for the formation of methodological knowledge. These connections are also considered as conditions for the formation of the outlook and the improvement of professional training of future specialists; they are means of increasing the efficiency of knowledge acquisition, activating cognitive activity, forming cognitive needs and developing a system type of thinking, etc. The attention is paid to the technology of implementation of interdisciplinary links in higher pedagogical education, which makes it possible to make the learning process of future teachers efficient. In the pedagogical practice, it became clear that the systematic nature of vocational and pedagogical knowledge involves an interdisciplinary synthesis of these knowledge. Students need to master the concepts, necessary skills and abilities within this knowledge system (system of philosophical knowledge, system of psychological knowledge, system of pedagogical knowledge, system of historical knowledge, system of knowledge in subjects that are profiling in the department, etc.). An analysis of the content of curricula, textbooks, manuals on a number of subjects enabled the authors to find out that interdisciplinary orientation in teaching philosophy, political science, sociology, economic theories, psychology, pedagogy and teaching methods of a particular discipline in the context of interdisciplinarity offers some extra opportunities for the formation of the system of professional and pedagogical knowledge of the future teachers, provides opportunities for mastering the methods of cognition, which prompts for a scientific understanding of the tasks of pedagogy, the issue of education and upbringing of the younger generation, understanding the state policy in the education area. As a result of the analysis and comparison of the contents of the curriculum, the sections, the topics and the separate questions that were adjacent to the indicated disciplines were identified. It allowed determining the content of interdisciplinary knowledge. Implementation of multifunctional interdisciplinary connections in the educational process affects the ideological orientation of a future teacher, the mastery of the dialectical method of cognition, the formation of a professional type of thinking and methodological culture.

**Keywords:** higher pedagogical education; system of knowledge; interdisciplinary links; interdisciplinary integration; training a future teacher.

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## Introduction

In an age of globalization, any social and professional activity becomes intermediate. Under this circumstance, every person may find himself/herself in unpredictable communicative, professional and social situations. Modern education is guided by broad interdisciplinary training of specialists based on effective mechanisms of dynamic communicative and intercultural interaction. Acquiring a certain amount of knowledge remains an important function of the modern educational process. In the process of implementing this function, there are issues related to the assimilation of the future teachers' knowledge; mechanical memorization of basic knowledge sometimes prevails, which does not always have a positive influence on its comprehension and understanding of the level of their value both for the future specialist and in the process of professional educational activity. It is difficult to ignore the subtle understanding of basic knowledge if the scope of this knowledge is critically large. Therefore, the student must master this knowledge at the level of stereotypes, patterns, samples, and this is the reason why the value of such knowledge is reduced, the phenomena of pedagogical activity are ignored, the subject-subject relations acquire signs of a command-administrative system of governance that has already exhausted itself. Basic knowledge that is overloaded with unnecessary information becomes minor; it is leveled, loses value-sense content, and this issue negatively affects the cognitive activity and the development of a personality of a future teacher. Information overloads are also caused by rapid socio-cultural changes that are peculiar not only for education, but also for other branches of social development. Studying educational transformations contemporary didactics considers the fundamentalization of the content of education, which involves the study of the most important basic humanities and natural sciences, the mastering of interdisciplinary (and, consequently, inter-scientific) connections, the focus on ensuring the formation of a coherent picture of the world, the knowledge of its fundamental laws. Nowadays fundamentalization of the education content is an urgent problem. In the system of higher education, this subject is being discussed. However, it mainly concerns natural sciences and mathematics.

It is the interdisciplinary links that should be the foundation of the fundamentalization of the education content. The urgency of the problem of interdisciplinary connections in the educational process of higher education institutions is caused, firstly, by the peculiarities of the modern development of sciences, that is, their differentiation and integration; secondly, by the conceptual unity of scientific knowledge, which manifests itself, in particular, in the conceptual unity of professional knowledge; thirdly, the requirements that are currently put forward to the quality of training future specialists, as well as the necessary changes in the educational process.

## Aims

The aim of the article is to characterize interdisciplinary links as a didactic basis for training a future teacher for effective professional activity, to consider the concept of "interdisciplinary links" and their role in this process.

## Discussion

The problem of the relationship between educational disciplines and their consideration in the educational process has been realized by teachers for a long time, practically since there was a distinction in the process of teaching certain subjects. The problem of the implementation of interdisciplinary links was studied by J. Komensky, D. Locke, I. G. Pestalocci, K. Ushynskiy and others.

J. Komensky, unsurpassed specialist in didactics argued: "Everything that is in a mutual connection should be taught in the same connection" (*Komensky, 1955, p. 287*). Developing J. Komensky's insight, I. G. Pestalocci acknowledged that it is significant to "interconnect the objects in one's consciousness in the same connection in which they are indeed in nature" (*Pestalocci, 1963, p. 175*). The idea of generalized knowledge as a method of finding truth was put forward by D. Locke, who considered it necessary to fill one subject with the elements and facts of another, and to combine general education with the applied one. He advanced the idea of elemental knowledge and their relationship. The need to establish interdisciplinary links is mentioned in the papers of such German scholars as J. F. Herbart and A. Diesterweg.

K. D. Ushynskiy found interdisciplinary links fairly important and was the first scholar in pedagogy who expressed his opinion about their system-forming function. In his papers, an outstanding teacher developed an idea of forming a system of knowledge and the obligatory presence of links between its constituents, indicating the impossibility of the existence of such without interdisciplinary connections. His recommendations should be taken on the essence of the concept of "knowledge system" and filling it with certain content. It is no accident that K. D. Ushynskiy, who considered the mind as an organized system of knowledge, argued that "only a system, of course, intelligent one, which proceeds from the very nature of objects, gives us full control over our knowledge. A head filled with fragmentary, unconnected knowledge, resembles a barn where everything is in a mess and where the owner himself can find nothing; a head where there is only a system without any knowledge resembles a store where all the boxes have inscriptions, but there is nothing on the shelves" (*Ushynskiy, 1949, vol. 5, p. 355*).

In science, the term *discipline* means the historically formed branch of knowledge, which is characterized by the unity of a fixed subject of research, methods and language in each particular period of its existence. In universities there are disciplines in certain branches of scientific knowledge that are considerably different from school subjects, especially in structural terms. So, if it comes to the implementation of the links between disciplines that are taught at universities, it makes sense to use the term *interdisciplinary links*, thus emphasizing the difference between higher education and school.

The problem of links between school subjects and academic disciplines at the universities has attracted the attention of many researchers, as it is evidenced by a significant number of publications, in which the authors cover a particular way of solving it. In particular, the researchers point out that "the use of interdisciplinary links at the lessons makes it possible to understand and master the material better due to the timely restoration of knowledge in related disciplines, promotes the development of active mental activity of students to

restore previous knowledge and assimilate new material, affect their self-study, contribute to a comprehensive study of a subject (*Spivakovskiy, Petukhova, Kravcov, Voropay, Kotkova, 2016, p. 48*).

The results of researches were generalized, and it was found out that interdisciplinary links are considered as a didactic principle and basis for the formation of methodological knowledge, the condition for the formation of the worldview and improving professional training of future specialists, a means to increase the efficiency of knowledge acquisition, activating cognitive activity and the formation of cognitive needs, as well as the development of systemic thinking, one of the areas of developmental training and one of the criteria for the degree of readiness of graduates of higher educational institutions for professional activities, a way to implement the principles of learning with promoting their interaction, a factor in the formation of the content and structure of the discipline and the factor in the organization of cognitive activity by general scientific methods. However, the concept of *interdisciplinary links* is multifaceted. Therefore, it is quite clear that the essence of interdisciplinary connections can not be determined precisely. These relationships permeate the content, organizational forms of training, methods, educational and cognitive activities, promote the development of abilities and cognitive needs, provide effective formation of scientific concepts, in-depth learning of theories under investigation, etc. Modern Ukrainian scholars refer to the main types of innovative educational technologies as “interdisciplinary learning is the use of knowledge from different fields, their grouping and concentration in the context of the task being solved” (*Spivakovskiy, Petukhova, Kravcov, Voropay, Kotkova, 2016, p. 110*). Researchers from other countries interpret interdisciplinary learning as learning that combines teaching tasks and methods contained in more than one discipline and focuses on a central topic, section, problem, or work. Interdisciplinary learning is a teaching approach that combines curricular goals and methods from more than one discipline focusing on a central theme, issue, problem or work (*Interdisciplinary Learning, 2005*). According to the results of the analysis of dozens of sources, Ronald A. Styron, Jr., concludes that since knowledge is not acquired in isolation, interdisciplinarity is an important tool in creating new ways of thinking; it facilitates the integration of fragmented knowledge into a coherent whole, interdisciplinary learning contributes to critical thinking, creativity, skills of collaboration and communication (*Styron, 2013*).

Can we consider that interdisciplinary links are characterized by poly-functionality, dynamism, synergy, and so on? Probably that is right, because having a thorough impact on the learning process and the educational process as a whole these links directly affect the mastery of students’ professional and pedagogical knowledge. V. Kremen highlights that the stronger the interdisciplinary links are, the more effective is the process of forming the personality of a future teacher, who is ready to work under conditions when “the paradigm of education is changing, when there is a transition from the reproductive, authoritarian education to the formation of an innovative personally oriented type, the special structure of psycho-pedagogical, methodological and informational-technical preparation should be a subject to transformation” (*Kremen, 2009, p. 413*). The technology of implementing interdisciplinary links in higher pedagogical education enables the process of teaching future teachers to be effective.

The efficiency of this educational process lies in the fact that interdisciplinary links make it possible to identify relevant theoretical information in the area of pedagogical knowledge, and unnecessary information remains beyond the educational process. That is, the resources of a teacher and students are not allocated on the analysis and study of superfluous (obsolete, secondary) information, and the subject-subject interaction in general obeys the predicted educational outcome. The technology of the implementation of interdisciplinary links in higher pedagogical education makes it possible to work with key phenomena and laws, progressive forms and means of learning. In this way, the theory, which, according to I. Rau, "does not directly teach," but its knowledge should be used for the knowledge of reality (Rau, 1985, p. 119).

We find that in this context, the materials provided in the publication *Interdisciplinary Learning, 2012* are important; they analyze Scottish education that is undergoing significant and important changes: in the process of interdisciplinary education, links are used between different themes and / or disciplines to improve the education level, interdisciplinary training is the key to the effectiveness of education that meets the needs of students / pupils, effective interdisciplinary learning is always based on several general ideas concerning the multidisciplinary elements of curricula in several disciplines (knowledge sectors). Interdisciplinary training provides a stimulating and self-motivating context for learning and improves the integrity of understanding important educational (pedagogical) ideas, enhances competence in applying knowledge and skills of transferring knowledge from teacher to students; interdisciplinary training is effective when it is supported by an adequate self-assessment of the subjects of the educational process, and their cooperation forms teamwork where this very style leads to an effective dialogue that is the basis of development for all spheres of human activity.

Psychologists *theoretically proved and experimentally confirmed* that thinking is systemic by its nature and develops if system-forming links are present. The principle of systemicity in the work of the brain is common to the physiological and psychological processes; all mental functions are based on associative bonds and, in fact, the system of knowledge is formed on this basis.

At the level of intra-system associations, mental activity covers a range of knowledge of the subject and form internal subject links that combine the content of the course into the system. Activity at the level of inter-system associations is the highest degree of association. On the basis of the achievements of psychology, we note that inter-system associations become of paramount importance in the formation of the human mind. The associative nature of thinking defines (determines) the understanding of the process of learning knowledge only in close connection with their application, resulting in the formation of a complex system of associations that reflect the connection between objects and phenomena of reality. The formation of systemic knowledge affects the worldview, promotes the transformation of knowledge into beliefs.

System knowledge gained in the process of implementing interdisciplinary links not only encourages subjects to go beyond the typical content but also develops their critical thinking, creativity, communication skills; however, it is much more important that in the implementation of interdisciplinary links, learning satisfaction is ensured (*Benefits of Interdisciplinary Teaching and Learning*).

Hence, the methodology of teaching at a higher school should answer a series of interrelated questions: “How to form knowledge on the basis of various information in a rigorous and harmonious scientific system?”, “How to teach quick and creative use of knowledge to expand, deepen and acquire new knowledge and solve various applied problems?”, “How and in what way to solve the exact tasks, to establish the relations of the subject under study with other subjects and types of study?”, “In what way is it the most efficient to apply knowledge from different x objects (subjects) in professional activity?” and so on.

Even in the content of these formulated questions, there is a definite (albeit curtailed) program of studying the knowledge system. On the other hand, we can admit the didactic approach to the fact that the problem of interdisciplinary connections is associated with a wide range of issues of gaining the new knowledge necessary for creative solution of various applied professional tasks. The current development of science is featured by a significant and rapid accumulation of information, and therefore, the higher school has to fulfill a very difficult task of selecting the most essential (basic) sciences, those very issues which constitute a system of orderly fundamental knowledge. Though the tendency for fundamentalization of knowledge in higher education arose long ago, it has not acquired a sufficient theoretical substantiation. Therefore, it is noteworthy to discuss the need to study the outlined problem.

In each particular branch and system of knowledge, in general, *a system of scientific knowledge* is characterized by a sufficient logical rigor, the mutual ordering of components. However, in the process of development of scientific knowledge, a number of theoretical positions, concepts, methods began to be operated by the relatively independent branches of science that were “adapting” these provisions, concepts, methods, etc for themselves. The further synthesis of these achievements should not be perceived as an artificial phenomenon; this is a result of a logical one, because in such a way, they are perfected; general principles, rules, methods are crystallized; common concepts are developed, which helps to systematize scientific knowledge, to deepen comprehension of the essence of various processes and phenomena, to find the best ways to use scientific knowledge in a practical plane.

The systemic nature of vocational and pedagogical knowledge also points to the need for interdisciplinary synthesis of knowledge. On the other hand, every academic discipline studied at an higher educational establishment has its own special subject of study and presents a special system of knowledge with a specific system of concepts, around which the facts are grouped. Students need to master the concepts, necessary skills and abilities within this knowledge system (system of philosophical knowledge, system of psychological knowledge, system of pedagogical knowledge, system of historical knowledge, system of knowledge on the subjects that are profiling in the department, etc.). Thus, for the fundamentalization of the content of vocational and pedagogical knowledge, a consistent reflection of the interpenetration of philosophical, historical, economic, psychological, pedagogical, methodological disciplines, subjects that are profiling in the department, etc. ensuring a broad outlook of a specialist, their professional competence are necessary. It is noteworthy to establish connections between the sciences of the same industry, different branches of knowledge.

In this regard, particular attention should be paid to interdisciplinary connections and the definition of their functions in the process of fundamentalizing the content of education.

At the same time, among the main areas of international education quality monitoring (*Spear, Mocker, 1984*) *problem solving competence* is characterized as an ability to apply cognitive skills that positively affects the identification, analysis, optimization of the processes of occurrence and implementation of interdisciplinary problems.

*An analysis of the content* of curricula, textbooks, and manuals on a number of disciplines made it possible to find out that the study of philosophy, political science, sociology, economic theories, psychology, pedagogy and teaching methods of a particular discipline provides constructive opportunities for the formation of the future professional system of vocational and pedagogical knowledge, opportunities for mastering the methods of cognition, which prompts for a scientific understanding of the tasks of pedagogy, problems of education and upbringing of the younger generation, understanding the state education policy.

As a result of the analysis and comparison of the contents of the curriculum, sections, topics and separate questions that were adjacent to the indicated disciplines were identified. It allowed determining the content of interdisciplinary knowledge. Under such we consider knowledge; prior to the process of interdisciplinary synthesis (integration of the constituent elements (components), it belongs to different educational disciplines, and as a result of this synthesis (through the implementation of interpersonal relations) acquire in the minds of students integral integrative reflection. We adhere to this very point of view.

For example, for a number of subjects, the topic "Personality and processes of its formation" is contiguous. It is clear that in each discipline, the topic is revealed from certain positions, but knowledge of a future teacher must be integrated.

In pedagogy, the main factors influencing human development are considered. In philosophy, the following ones are given: "The concept of development, its relationship with the concepts of motion and change. Features of development in nature and society. Natural environment as a constant and necessary condition for the existence and development of society, etc."

In the course of psychology, they comprise "...Man as a natural and social being. The concept of an individual... The concept of a personality", etc.

In the courses of political science, sociology and other social sciences, one way or another, issues that relate to this topic are raised.

In the course of pedagogy, consideration of such an important factor in the formation of personality as a social environment requires a philosophical reflection and understanding of the relationship between personality, social environment and the dialectics of the processes of their development. The depth of knowledge on this topic is also dependent on the quality of knowledge in psychology, which addresses the issues of the structure of an individual and the psychological mechanisms affecting it. At the same time, even more systematization and deepening of knowledge contributes to the consideration of the issues of the relationship between individuals and society, the role of education in pedagogy and sociology. Data obtained by the analysis of curricula and

manuals on specified disciplines allows to establish interdisciplinary knowledge, namely: “The natural and the social in human development. Personality. Individual. Personality as a product of socio-historical development. The social essence of a man. Ratio of parenting and development”.

When studying the topic “The essence of the learning process”, future teachers require knowledge of philosophy and psychology. In philosophy, the question of teaching as a process of cognition is considered. In psychology, the cognitive processes of a personality are revealed: perception, memory, thinking, imagination. The needs of pedagogical practice require students to comprehend and learn the following concepts: education, educational activity, content of discipline, thinking and knowledge, types of thinking, mental operations, techniques of mental activity, peculiarities of thinking of children of different age groups, and that learning achieves the developmental effect under the purposeful management of cognitive activity of students only. Development is closely linked to qualitative changes in mental activity, which is expressed not only in the accumulation of knowledge, skills, in the formation of skills, but also in the change and the emergence of new psychological properties (for example, in the formation of cognitive interests, in the activation of mental processes, etc.) In many cases, by the way, it is difficult to identify interdisciplinary knowledge, or it is even impossible, because there is a mismatch between the curriculum itself.

*Analysis of training manuals for these disciplines provided similar results.* It is evident that the content of manuals on various disciplines reflects the logic of a particular science. Being the specialists in a certain area, the authors sought to make them suitable for a wide range of professionals, which is fully justified. However, the analysis of textbooks on pedagogy, some textbooks and teaching aids on the methodology of teaching certain disciplines showed that in their content there is a problem of interdisciplinary connections, which has not received a sufficiently complete reflection yet so that these links are revealed at the level of individual examples illustrating those or other theoretical positions from other sciences. In fact, the artificial reduction of pedagogical knowledge to certain positions of other sciences is ensured. At the same time, it would be totally unfair to assert that there are no preconditions for the implementation of interdisciplinary links in the educational process in the curricula, manuals and textbooks. The task is to ensure that these objective prerequisites are most reflected in the content and methodology of studying at universities.

Analysis of curricula, manuals, and textbooks allowed revealing a number of concepts and a range of issues that are interdisciplinary in their essence. Thus, in the section “General Fundamentals of Pedagogy” they include: the subject and methodology of science, methods of research (theoretical analysis and synthesis, content, formalized research methods), laws, regularities, principles, process, development, formation, education, purpose, personality, individual, society, social relations, social environment, natural and social in the development of a personality, driving forces of education and upbringing, conditions, factors, education, self-education, outlook, career guidance, diagnosis, correction, forecasting, etc. In the section “Didactics”, such concepts include a system, structure, element, form and content, age and individual characteristics of a person, knowledge, teaching as a process of cognition, psycholo-

gical properties of a person, sensation, perception, memory, attention, thinking, cognitive activity, mental ability, knowledge, skills, abilities, motivation of training, receptions of mental activity, management of cognitive activity, enhancing of cognitive activity, assimilation, educational problems, problem situation, direct and reverse interoperability, algorithm, test, information, dose of information, etc.

In the section "Theory of education", these notions are mental, labor, aesthetic, ethical, physical education, objective and subjective factors of education, form and content, the system of education, the group of people, development of an individual in a team, team structure, team activity, self-government, public body, public association, social movement, etc.

It cannot be argued that the abovementioned issues encompass all the content of interdisciplinary knowledge in the course of pedagogy. It should be notified that the development of sciences, the change in their content inevitably leads to a change in the interconnections between them, their mutual enrichment takes place, the tendency to increase knowledge and, consequently, to increase the volume of interdisciplinary knowledge. According to O. Abdullina, the content of training the students of a higher educational establishment should interconnect, coordinate, and balance the general (the core), the special (specificity of the faculty) and the individual (the differentiation and individualization of education and upbringing). The structure of the general nucleus is to a greater extent an invariant component such as knowledge of the laws, principles, methods of teaching and education, ways of organizing the educational process, as well as knowledge of a child as an object and subject of this process. The second (variational) component of the content of pedagogical training is optional courses, special courses, which take into account the peculiarities of future professional activities. The third component of the training of future teachers is self-study in the area the students are interested in; it is aimed at the development of individual cognitive and creative abilities that forms an individual style and approach to future professional activities (*Abdullina, OA (1990, p. 28)*).

Taking into consideration the above-mentioned issues, it should be stated that the availability of educational disciplines in related subjects, issues, general concepts involves the need to identify objective prerequisites for the use of interdisciplinary links in the learning process, which will enable them to solve a number of urgent issues, which are related to the formation of the system of students' professional knowledge, namely:

- enhancing the professionalization of academic disciplines by selecting the content of educational material that is the basis for the acquisition of professional knowledge;
- eliminating unnecessary duplication of material, which may reduce the amount of time allocated to studying a particular section, and increase of the amount of information on a certain discipline;
- specification of tasks for students' self-study; since it is possible to determine the amount of information on a particular related discipline, there is an opportunity to establish in which scientific discipline it is more expedient to cover the issue more in depth, and in which it is possible to limit references to the previously studied material or to consider it from certain positions;

- students' awareness of the links between disciplines and facilitating the process of generalizing knowledge and expanding the scope of their application on this basis.

In the content of the educational material there are objective prerequisites for the development of cognitive interests; the full right to them can be attributed to the professionalization of disciplines, taught in universities.

From our point of view, first of all, professionalization of educational disciplines lies in defining subjects and selecting the content of lectures, workshops and practical classes. Following many researchers we take an orientation towards the formation of the following students' knowledge as a main criterion:

- 1) knowledge that constitutes theoretical basis for students to comprehend the ideas, concepts and theories of pedagogy;
- 2) knowledge that is directly applicable in the educational process;
- 3) knowledge and skills contributing to improving the methodological training of teachers.

This will be only possible by the implementation of interdisciplinary links. Thus, during the compilation and updating of curriculum for the subjects that are profiling in the department, we should take into account the content of the school subjects (direct connection with the teaching method of the subject). When students master the methods of scientific research, it is necessary to reveal the possibilities of their application in school practice, and so on. Establishment of interdisciplinary links will allow considering various pedagogical processes and phenomena in the interconnection and interdependence, unity and contradictory factors influencing them, as well as to differentiate and synthesize knowledge.

To a certain extent, a variety of forms, methods and means of learning intensifies students' cognitive activity and promotes increased interest in learning. An effective means of activation, which is very important in learning, are questions and tasks that can be informational and problematic. Even the most difficult issue is not always an active mental activity. To a large extent, this is facilitated by problem issues and challenges. Problem solving, creating problematic situations that cause intellectual difficulties to the student, stimulate their cognitive interest and create internal psychological conditions for the active learning of new knowledge, has its own peculiarities in a particular case. The problematic issue, the challenging task includes a problem that remains to be uncovered by a student, the area of the unknown, new knowledge, which requires a certain intellectual action, which is a deliberate intellectual process associated with the establishment of new relationships. The issue goes into the category of problems under the following conditions:

- A) it must be complicated in such a way as to cause difficulties for students, and at the same time suitable for finding an answer on their own;
- B) there should be a logical connection with already acquired knowledge;
- C) it should contain a cognitive difficulty and visible limits of the known and the unknown;
- D) a challenging issue should cause a sense of surprise when comparing new issues with the already known ones, dissatisfaction with the available storage of knowledge.

In our opinion, the materials of the Conference “Insights on Interdisciplinary Teaching and Learning” (Michigan State University, May 2012) are interesting and useful (*Augsburg, Bekken, Hovland, Klein, Luckie, Madison, Martin, et Al, 2013*). Based on the published results of the attendees of this conference, we formulated the main statements related to our problem: a) the specific disciplines are not ideally suited for interdisciplinary purposes, and interdisciplinary connections should be considered from the point of view of potential synergy and feedback between disciplinary and interdisciplinary training (*by Barbara Bekken and Marci Sortor*); interdisciplinarity manifests itself in a wide range of contexts, leads to radical transformations and changes in strategies, starting with improving comprehensive education; an educational mission should be considered through the prism of the interdisciplinary core of educational programs, and the solution to interdisciplinary problems will increase interdisciplinary capabilities (*by Julie T. Klein and Paula J. S. Martin*); education should aim at developing a habit of developing interpersonal skills on a multidisciplinary basis that promotes knowledge integrity (*by William H. Newell and Douglas B. Luckie*); The distinction between interdisciplinarity and integration must be clearly distinguished; the concept of integrated learning is a wider and more general term used for structures, strategies and activities characteristic of secondary schools, colleges, comprehensive education; integrated learning contributes to discipline and interdisciplinary communication (*by Bernard Madison and Tanya Augsburg*); the practice of learning should go beyond the disciplinary boundaries, which will enable a new and a creative approach to solving complex interdisciplinary problems (*by Aaron M. McCright*); the implementation of interdisciplinarity facilitates the application of knowledge in the context of real-world problems (*by Kevin Hovland and Richard Vaz*).

*Another didactic aspect of the implementation of interdisciplinary links is the use of problem situations.* Together with students, a teacher considers different pedagogical situations, mostly real-life ones. Modeling a challenging situation, students apply the knowledge acquired in general pedagogy, psychology, sociology, physiology and, of course, didactics. The most unexpected pedagogical situations will occur in the path of a teacher's set. The pedagogical skills and skillful use of the acquired interdisciplinary knowledge will help to solve them.

Creating problem situations and attracting students to active cognitive activity enable to reflect such a characteristic feature of modern scientific knowledge as the process of integration of different sciences and to promote the research aspects of various disciplines in the learning process, model their future professional activity. Such tasks require applying knowledge from different subjects, while the activity is directed at finding new unknown relationships, or the formation of generalized concepts based on specific interdisciplinary connections that determine the need for a broad transfer of knowledge. Transfer actions are transformed into interdisciplinary cognitive skills.

In the educational process, implementation of interdisciplinary connections (polyfunctionality) affects ideological orientation, mastering the methods of cognition, the formation of a professional type of thinking and its methodological culture. Students' awareness of the links between scientific disciplines,

their understanding of practical significance contributes to the activation of mental activity, the formation of cognitive needs and leads to the need for the further deepening of knowledge.

Based on this discussion, we can state that the solution of problem situations in the process of students' learning, involving students in active cognitive activity reveals relevant interdisciplinary links that enable to reflect such a characteristic feature of modern scientific knowledge as the integration process in learning different sciences and to promote the research aspect in the study of certain subjects, to model their future professional activities. Such tasks require applying knowledge from different disciplines, while the activity is directed at finding new unknown relationships, or the formation of generalized concepts based on specific interdisciplinary links that determine the need for a broad transfer of knowledge. Transfer actions are transformed into interdisciplinary cognitive skills. The students' ability to interdisciplinary generalizations characterizes the productivity of their cognitive activity, which ultimately leads to the formation of a knowledge system.

The analysis of scientific publications and practice of teaching subjects in the pedagogical university shows that it is possible to highlight the technology of Portfolio among the training technologies for the implementation of interdisciplinary links. In accordance with the tasks of a teacher, a student selects the works created at various lessons. Selection is carried out from several disciplines (for example, psychology, didactics, and methodology of educational work). Under these conditions, opportunities are created for the implementation of interdisciplinary connections, the use of knowledge of related disciplines. Portfolio may include all completed work for a certain period, namely, a term or an academic year. Portfolio can be presented at the final lesson, when passing the attestation modular control in order to demonstrate the ability to apply new knowledge of the subject in applied areas of activity.

Problem situations technologies and Portfolio can be effectively used in selective academic disciplines, which are usually taught in the form of special training courses in order to enhance general, fundamental and professional (theoretical and practical) training. One of such courses may be the interdisciplinary course "Humanities". Pedagogy is a science that studies human being. Consequently, it is necessary that the future teacher mastered the universal knowledge, because active creative pedagogical practice requires the teacher to apply knowledge in various branches of science.

## Conclusions

Implementation of multifunctional interdisciplinary connections in the educational process affects ideological orientation, mastery of the dialectical method of cognition, the formation of a professional type of thinking and its methodological culture. Students' awareness of the links between scientific disciplines, their understanding of practical significance contributes to the activation of mental activity, the formation of cognitive needs and leads to the need for further deepening of knowledge.

Interdisciplinary links provide for the enhancement of the professionalization of educational disciplines through the selection of content (material), the

mastery of the dialectical method of cognition, generalized methods of cognitive activity, the formation of the ability to transfer knowledge in new situations, thus acting as a condition for the reader's readiness for the creative application of knowledge.

As it was discussed above, establishing links between subjects is the most important condition for the formation of systemic knowledge, as in the process of their study, inter-system associations are created, and even individual concepts can serve as their source. Inclusion in the content of lectures, workshops and other forms of academic lessons of the material, revealing the links between disciplines, becomes an urgent necessity. However, we should not include separate facts for illustrating certain provisions, but information in their interrelations. Effectively, those relationships will be established between phenomena, facts, concepts, and theories that are common to these disciplines.

The similarities between pedagogy and methodology of teaching a subject are well-known. We are going to consider this provision more specifically.

Methodology of teaching a subject is a pedagogical science, and its fruitful development is possible on the general pedagogical and especially on the didactic basis. The lack of a close relationship between methodology and didactics depletes in general both the one and another science. Scientific disciplines, relations between which are considered, have their own subjects and investigate certain areas of reality. If in general, a subject of didactics is the content and organization of the learning process leading to the mastery of this content, the subject of the method is the social process of teaching the younger generation the basics of science. In general, didactics reveals the patterns of education and training, the method reveals the peculiarity of teaching a particular subject. Consequently, the commonality of these disciplines lies primarily in the fact that they have the same object of research. At the same time, in contrast to the methodology, specifics of didactics is the fact that it takes into account the logic of the science itself, develops the optimal directions of teaching the fundamentals of this science.

At the present stage of development of higher pedagogical education, implementation of interdisciplinary relations is one of the most important problems. It is possible to solve this problem comprehensively, provided modernization and upgrading of the education system, updating of educational standards and curricula, the creation of interdisciplinary training plans and the corresponding variational content, etc. In such circumstances, the personality of a teacher will play a very important role, since it is entrusted with responsible tasks for improving the educational process, increasing its efficiency and quality. A modern teacher of a higher educational institution should ensure the most efficient use of academic time, scientific and consistent presentation of the content of discipline so that students can not only perceive, comprehend and analyze pedagogical phenomena and facts, but could make pedagogically appropriate conclusions and act in any situation adequately.

## References

- [1] Abdullina, O. A. (1990). *Obshchepedagogicheskaiia podgotovka uchitelia v sisteme vysshego pedagogicheskogo obrazovaniia* [General Pedagogical Education of a Teacher in the System of Higher Pedagogical Training]. Moscow: Prosvieshcheniie.
- [2] Augsburg, T., Bekken, B. M., Hovland, K., Klein, J. T., Luckie D. B., Madison B. L., Martin P. J. S. *et al.* (2013). *Insights on Interdisciplinary Teaching and Learning. White Paper. Edited by Aaron M. McCright and Weston Eaton.* Available at [lbc.msu.edu/CITL/whitepaper.cfm](http://lbc.msu.edu/CITL/whitepaper.cfm). East Lansing, MI: Michigan State University. Retrieved from [http://lbc.msu.edu/faculty\\_staff/CITL/%20White%20Paper.pdf](http://lbc.msu.edu/faculty_staff/CITL/%20White%20Paper.pdf)
- [3] Benefits of Interdisciplinary Teaching and Learning. “Toolkit” for Interdisciplinary Learning, Teaching, Assessment. Retrieved from <http://apcentral.collegeboard.com/apc/public/repository/AP-Interdisciplinary-Teaching-and-Learning-Toolkit.pdf>
- [4] Interdisciplinary Learning (2005). *Elements of Effective Teaching Practice. Knowledge and Employability Studio.* Alberta Education, Alberta, Canada. Retrieved from [http://www.learnalberta.ca/content/kes/pdf/or\\_ws\\_tea\\_elem\\_05\\_interdis.pdf](http://www.learnalberta.ca/content/kes/pdf/or_ws_tea_elem_05_interdis.pdf)
- [5] Interdisciplinary Learning (2012). CfE Briefing. 2012, September. Retrieved from <https://education.gov.scot/Documents/cfe-briefing-4.pdf>
- [6] Komenskiy, Ya. A. (1955). *Izbrannye pedagogicheskie sochinenia* [Selected Pedagogical Papers]. Moscow: Uchpedgiz.
- [7] Kremen, V. H. (2009). *Filosofia liudynocentryzmu v stratehiiah osvitiioho prostoru* [Philosophy of Human-Centeredness in the Strategies of Educational Space]. Kyiv: Pedahohichna dumka.
- [8] Pestalocci, I. G. (1963). *Izbrannye pedagogicheskie proizvedenia* [Selected Pedagogical Papers]. Moscow: Izd-vo APN RSFSR.
- [9] Rau, I. A. (1985). Hegel’s Views on the Correlation between Theoretical and Practical Cognition of Reality. *Voprosy filosofii.* 2, 114–123.
- [10] Spear, G. E., Mocker, D. W. (1984). The organizing circumstance: Environmental determinants in self-directed learning. *Adult Education Quarterly,* 35.
- [11] Spivakovskiy, A. V., Petukhova, L. Ye., Kravcov, G. M., Voropay, N. A., Kotkova, V. V. (2016). *Novaia didaktika: ot subiekt-subiektnykh — k tri-subiektnym otnosheniam* [New Didactics: from Subject-Subject to Three-Subject Reactions] (ed. A. V. Spivakovskiy). Kherson, Ukraine.
- [12] Styron, Ronald A., Jr. (2013). *Interdisciplinary Education: A Reflection of the Real World.* Systemics, cybernetics and informatics. Vol. 11, No. 9, 47–52. Retrieved from [http://www.iiisci.org/journal/CV\\$/sci/pdfs/iSA312DD.pdf](http://www.iiisci.org/journal/CV$/sci/pdfs/iSA312DD.pdf)
- [13] Ushinskiy, K. D. (1949). *O pervonachalnom prepodavanii russkogo yazyka* [On the Original Teaching of the Russian Language]. (11 vols, vol. 5). Moscow–Leningrad. Russia: Izd-vo APN RSFSR.