THEORY AND METHODOLOGY OF INNOVATIVE EDUCATION DEVELOPMENT IN THE NATIONAL, EUROPEAN AND GLOBAL CONTEXTS

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PREFACE

The monograph is devoted to the theoretical and methodological foundations of innovative education development in the national, European, and global contexts. It is the result of the team research of the members of the Doctoral House in Educational, Pedagogical Sciences in Sumy State Pedagogical University named after A.S. Makarenko, covering a wide range of current issues of innovative education development in the field of school, out-of-school, pre-higher, higher, and postgraduate education.

The first chapter reveals the issue of professional creativity of the future teacher, which is manifested in his professional activities and has a productive impact on students' learning. The study assumes that changes taking place in all spheres of the modern society form an educational situation in which every specialist should be prepared for creative solutions to social and personal problems. The teacher's creativity is formed in various types of pedagogical interaction, solving creative problems at the methodological, pedagogical, educational, and innovative levels.

In the second chapter the theoretical substantiation of the model of formation of information and communication competence of the future teacher in the context of realization of the concept "New Ukrainian School" in the process of training bachelors is offered. The structural-functional model aims at formation of the structural components of information and communication competence of the future teacher (motivational-value, cognitive, operational-activity, reflexive) based on creating appropriate pedagogical conditions in the process of bachelors training.

The third chapter highlights the results of the comparative analysis of the structural and content characteristics of the future musical art teachers' professional training in the context of the innovative transformations in the field of music-pedagogical education in such European Union countries as Denmark, Finland, Latvia, Poland, Austria, Germany, Sweden and so on. Considering a number of criteria (description of the curriculum, structure of the curriculum, structure of the educational program) the characteristics of the future musical art teachers' professional training of two types – music teacher (Type A) and instrumental/vocal teacher in music schools, private practices (Type B) are revealed. The peculiarities of the future musical art teachers' training in the conservatories, music schools (colleges), academies and universities of the specified EU countries are determined.

The problem of the international cooperation in the field of vocational education and training in the European Union countries is considered in the fourth chapter through the prism of innovative processes. The study reveals the main areas of international cooperation in the field of VET, in particular: development, coordination and/or implementation of international VET policy; increase in the institutional capacity of public authorities/technical assistance, including development of VET standards and qualification systems; development and management of international networks of VET institutions, including information exchange and joint projects; certification and quality assurance of VET educational services abroad; marketing of VET providers and business development; development of mobility programs; development of research, information exchange and networking; development of training systems, curriculum and training equipment.

The fifth chapter is devoted to the modern personality-centered concepts and learning technologies as a factor of optimal formation and development of professional competences of the future teachers. The author identifies the most appropriate personality-centered methods for the formation of the future teachers' professional competences in the framework of the innovative heuristic-modular learning technology, namely: educational design, which involves solving student problems of professional activity, practical application of acquired knowledge, creating their own educational creative products; research work, which provides the formation of professional and

creative research competences, promotes interest in cognitive and creative activities, the formation of an active, competent, creative personality; solving heuristic professional problems.

It is indisputable that one of the most important innovations in training competent specialists able to meet the requirements of the global labour market is dual education, which has become the object of research in the sixth chapter. The study characterizes the state of dual education development in Ukraine in the system of vocational and higher education. Special attention is paid to the results of the first and second years of implementing the pilot project in vocational and higher education institutions for training specialists in the dual form of education and study of the cases of implementing the dual form of education in Ukrainian pre-higher and higher education institutions.

The seventh chapter covers the innovation scientific activity of medical colleges at U.S. Universities as studying the foreign experience is a powerful means of rethinking of current state of medical education in Ukraine and finding the ways to its modernization. The innovation scientific activity of medical colleges at U.S. Universities is revealed in the aspects of engineering, design, and transfer of innovation products. The study characterizes peculiarities of applying engineering principles and design concepts in the medical or biological field in the health care system for diagnostic, therapeutic, rehabilitation, and other purposes. It also raises the problem of increasing the efficiency of transfer of the products of innovation activity by developing innovative methods of assessing their commercial success.

The innovations at the third level of education are highlighted in the eighth chapter. The study reveals the goals, factors, and organizational approaches to the renewal of the European Research Area and development of global cooperation of the European Union in research and innovation, which became the basis for developing European Union strategies in the context of implementation of the Horizon Europe program. It identifies the current geopolitical, geoeconomic and geotechnological factors that influenced formation of the new European strategies in the field of R&I and international cooperation.

The ninth chapter reveals the features of the regulatory framework for the education of sports-gifted schoolchildren in Ukraine and Poland. Sports education is an important part of life of the younger generation, because it is responsible for a significant part of health education. The adoption of laws, projects, and programs for the education of gifted youth gives a new course in education and upbringing as healthy gifted youth are the driving force for the development of any nation.

The authors hope that the monograph contains useful research results that are relevant for education policymakers and theorists, teachers-practitioners of the education institutions of different types and levels, researchers, students, and all those who are interested in innovative education development.

Maryna Boichenko,
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PROFESSIONAL CREATIVITY OF FUTURE TEACHERS AS A CONDITION FOR INNOVATIVE EDUCATION

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Abstract. The paper reveals the main approaches to the problem of professional creativity as one of the characteristics of the teacher's personality qualities. It is emphasized that creativity of the teacher is manifested in his professional activities and has a productive impact on students' education and training. The teacher's creativity is manifested in professional activity based on various types of pedagogical interaction, solving creative problems at the methodological, pedagogical, educational, and innovative levels. The paper reflects the results of the theoretical analysis of existing approaches to the study of the problem of creativity and professional creativity. The requirements for the level of professional creativity of future teachers have been substantiated. Approaches to future teachers training, which contribute to the development of their professional creativity, are proposed.

Key words: creativity, pedagogical creativity, professional creativity of the future teacher, creative abilities, creative potential, creative education, creative style of activity.

Introduction

The current socio-economic level of society development indicates the need to reform the existing concept of reproductive pedagogical education into the concept of a creative approach to the preparation of a future teacher capable of creative self-development. Active processes of social transformations currently taking place in our country require an initiative, free-thinking, creative specialist capable of perceiving new ideas and making non-standard decisions. The changes taking place in all spheres of modern society form an educational situation in which every specialist should be prepared for creative solutions to social and personal problems. Proceeding from this, today a creative, intellectually developed person is in demand, able to learn, flexibly adapt to constantly changing life situations, able to apply the knowledge gained in practice, to look for ways to rationally and non-standardly solve emerging problems.

The situation in the educational system dictates new requirements for the training of future teachers, consisting in the fact that special knowledge acquired by them is not enough to be competitive specialists in the labor market, and therefore it is necessary to develop the individuality of each person, his internal potential, and creative abilities. In this regard, the need of the future teacher in the conscious development of his professionally significant qualities to achieve career, professional and personal-professional goals is actualized. The desire for constant self-development and self-improvement of the teacher determines his success and competitiveness in the market of educational services. A modern teacher needs to quickly adapt to new conditions, and this requires from him, among other things, such a quality as creativity.

A teacher at a modern school should be able to make a transition to a new educational paradigm that reflects the need to improve the creative potential of the student, in which he will be ready to solve new educational problems with the help of non-standard creative techniques and methods. The priority direction is creative education, which creates conditions for identifying mechanisms and ways to develop the potential of the future teacher.

Since the modern system of pedagogical training is at the stage of transition to the subject-creative concept, in this regard, a contradiction arises between the need of the educational system for qualified teachers with a high level of creativity and insufficient development of methodological

material for the professional training of future teachers, considering development of such a quality as creativity.

For the future teacher, creativity will allow him to model possible changes in the structure, content, and organization of the educational process, to form the goals of education and upbringing, to make timely adjustments for the introduction of innovations and the use of pedagogical technologies, to implement a personality-oriented approach to students based on their potential creative abilities, to plan their further professional activities. This requires not only the transfer of ready-made knowledge and value-normative ideas in the learning process by means of reproductive pedagogy, but also the mandatory development of innovative creative pedagogical technologies for teaching and upbringing, since only a creative teacher can educate a creative student. This involves the search for new content and organizational forms of education and upbringing. This envisages the search for new content and organizational forms of education and upbringing of the future teacher, while particular importance gains the methodological component, which includes creativity and the ability to self-development.

Currently, there is an intensive search for the conditions for the development of the future teacher's creativity in the process of his professional training, including pedagogical practice, the analysis of negative factors that inhibit his professional formation and the comprehension of the stages of training in the system of continuous education as an environment for the development of creative potential, professional orientation, innovativeness, and creativity of the student.

Therefore, development of the educational system should follow the path of turning it into a sphere of full-fledged life activity of participants in the educational process, creating conditions for the manifestation and realization of the creative potential of the individual. To do this, it is necessary to activate the creative potential, to develop the creative abilities of future teachers. And higher pedagogical education, therefore, should create conditions for the development of creative potential, creative abilities, professional creativity of future teachers. This becomes one of the main strategic goals. And implementation of these attitudes will be visible in general education institutions, it largely depends on the willingness of the teacher to carry out professional and pedagogical activities focused on the formation of creative potential of the student, his ability to create, maintain development of the flexibility, originality of thinking.

To develop professional creativity of the future teacher in pedagogical education institutions, it is necessary to rethink the tasks, content, and technology of training, revise the forms and methods of organizing the educational process, approaches to conducting pedagogical practice.

The importance of professional creativity development of future specialists is also due to the complication of situations of social interaction, strengthening of requirements for specialists in the framework of professional activities. At the same time, it is obvious that there is the lack of theoretical elaboration of issues related to the concept of professional creativity, its structure and stages of development i.e. the lack of methodological elaboration of this problem. All this determines high social, scientific, and practical relevance of our research.

Creativity in the context of the educational system attracts more and more attention of foreign and domestic scientists. Even though in modern science a fairly large number of researchers are engaged in the study of creativity, there is no single point of view on the concept under consideration, as well as a single concept regarding the categories associated with creativity.

All the above actualizes the need to address the problem of developing professional creativity of the future teacher, allowing him/her to self-actualize and improve herself in new conditions, to be the subject of his/her life, a professional who can reveal the creative potential of students.

The problem of the teacher's creativity formation was studied by D. Bohoiavlenska, C. Borysov, A. Brushlynskyi, N. Vyshniakova, M. Kagan, A. Kovaliov, A. Luk, A. Matiushkin, Y. Ponomariov, V. Ryndak, I. Strelkova and other researchers, as well as foreign authors such as G. Eysenck, T. Amabile, F. Barron, D. Wechsler, M. Wertheimer, J. Gilford, H. Gruber, R. Crachfield, R. May, A. Maslow, S. Mednick, C. Rogers, C. Robinson, R. Stenberg, R. E. Tafel, E. Torrens, M. Wallach, J. Heslrud, E. Schechtel and others.

The creative nature of pedagogical activity was noted by many teachers of the past J. Comenius, I.G. Pestalozzi, K. Ushynsky, A. Makarenko, V. Sukhomlynskyi and others.
The issues of creative nature of pedagogical activity and the ways of forming the creative personality of the teacher are widely studied (V. Bukhvalov, V. Zahviazynskyy, V. Kan-Kalik, Yu. Lvova, N. Nikandrov, M. Potashnyk, V. Slasteninand others) and multifaceted.

Creativity as a professional quality of the teacher was studied by V. Ryndak, L. Puzep. The problems of creative education were considered by V. Ryndak, E. Mikhalev, N. Havryliaka. Issues of professional creativity are revealed by L. Horbaneva. Ways of creativity development during pedagogical practice were studied by L. Vitvytska, A. Miroshnykova, A. Kostriukov.

The purpose of the study is to analyze modern psychological and pedagogical approaches to the problem of personal creativity, to determine the tasks and directions of the future teachers' professional creativity formation.

Research methods: in the process of scientific research, we used a theoretical analysis of scientific sources on the specified problem, and applied the method of systematization, comparison, generalization of special literature.

Research results

Creativity as a professionally significant quality of a modern teacher

Formation of a creative personality is one of the most difficult problems of many sciences: philosophy, psychology, pedagogy, etc. We set the task to analyze the main scientific approaches to the theory of creativity. A significant contribution to the development of the problem of creativity was made by D. Bohoiavlenska, A. Morozov, Y. Ponomarev, V. Ryndak, T. Amabyle, J. Gilford, E. Torrens, S. Mednik, R. May, A. Maslow, C. Rogers, K. Robinson.

Analyzing the philosophical approaches to the study of the problem of creativity and creative personality, it should be noted that a significant contribution to the development of ideas about the creativity of the individual was made by philosophers: Socrates, Plato, I. Kant, N. Berdiaiev, M. Heidegger, F. Bacon, and others.

The creative existence of a person is determined by personal meanings that come only from him. A person must create himself all his life and create his essence, create the surrounding world of his being. According to I. Revich, "what nature or social evolution dictates to him does not depend on man; another thing is the attitude to this diktat. It does not depend on a person that he has natural instincts, but how he disposes of them depends on the person. The need to live in society does not depend on a person, but how to live largely depends on himself" (Revich, 2003).

From a philosophical point of view, human creativity is considered as his essential characteristic, requiring manifestation of the productive activity of human consciousness. To reveal their creative potential, inherent in each person "from God", philosophers determine the need for intellectual and spiritual work on themselves. Analysis of philosophical literature allows us to believe that a person is born with creative potential, and the task of psychologists and teachers is to see and develop it.

Creativity is a relatively new and unsettled concept in psychological and pedagogical research. Depending on the psychological direction, it is understood as either the activity of creating something new, original; or the characterological quality of the personality; or a process or complex of cognitive and personal characteristics of the individual, contributing in a psychological sense to the formation of creativity.

The psychology of creativity explores the psychological mechanisms of the creative process as a subjective act and as a set of creative potential of the individual, which provide productive (creative) effectiveness in implementation from the point of view of the creative paradigm of education.

A great contribution to the study of the phenomenon of "creativity" was made by foreign psychologists M. Wallach, J. S. Williams, J. Guilford, A. Maslow, R. Sternberg, P. Torrance, and

others. Also, in psychology, these studies are associated with the names of B. Ananiev, D. Bohoyavlenska, V. Druzhynin, A. Matiushkin, Y. Ponomariov, S. Rubinstein, B. Teplov, M. Kholodna and others.

In philosophy and psychology, there are three approaches in the study of the category of "creativity":

- creativity as a personal category associated with self-development and self-actualization;
- creativity as a creative process;
- creativity as a result of activities related to the creation of new.

The creator of the theory of creativity was American psychologist J. S. Miller. J. Guilford proposed to define creativity as a universal ability, which can be manifested in psychological processes (perception, thinking), various activities, in behavior and communication. J. Guilford identified 16 factors of hypothetical abilities that characterize creativity: mental mobility, fluency and originality of thinking, sensitivity to a problem, etc. He combined them under the general name "divergent thinking". Compared to convergent thinking, which is focused on a known solution to a problem, divergent thinking manifests itself when an idea is only defined, but not disclosed and there is still no way to solve it.

In the works of C. Rogers, creativity is expressed in the search for tendencies to satisfy needs (Rogers, 1996). R. Stenberg defines creativity as the ability to take reasonable risks, willingness to overcome obstacles, internal motivation, tolerance for uncertainty, willingness to resist the opinion of others (Sternberg, 1998). The logic of development of the ideas about creativity leads from simplifying, purely intellectualistic ideas about its nature to more complex ones, according to which creativity is a complex formation, the mandatory components of which are certain personal parameters.

In psychology, the problem of creativity was also considered in connection with the problem of abilities. The studies clarify the ratio of intellectual abilities, creative qualities and thinking of the individual (V. Andreiev, D. Bohoiavlenska, I. Kohn, T. Kudriavtsev, Y. Ponomariov and others), identify significant signs of creativity as one of the integral, socially significant qualities of the personality (D. Bohoiavlenska, E. Yakovleva, A. Yesaulov, and others), examine the creative abilities and creative thinking of students in the process of learning at school and university (Yu. Kuliutkin, A. Luk, A. Kochetov, and others).

Analysis of the works of D. Bohoiavlenska, E. Yakovleva, Y. Ponomariov and others, made it possible to draw the following conclusion: creativity is understood as an integral quality of the personality, which is manifested in his orientation (predominance of purposefulness, cognitive motivation, cognitive interest, desire for knowledge, curiosity); in abilities (the ability to overcome stereotypes, the ability to feel problems, fluency, flexibility of thinking); is characterized by originality, initiative, non-standard, tolerance for uncertainty, insight.

There are several signs of creativity as a personal category:

- intellectual and creative initiative, that is, going beyond the tasks and requirements;
- latitude of categorization, breadth of associative series, remoteness of associations;
- fluency and flexibility of thinking (the ability to quickly find and combine different ways and methods of solving problems);
- originality of thinking as independence, unusualness, ingenuity of problem solving;
- dynamism as a mechanism of creative development (Vyshniakova, 1995).

Scientists believe that creativity requires experience and previously acquired knowledge (J. Guilford, E. Yakovleva), as well as novelty, originality, and progressiveness of the product of creativity (V. Andrieiev, Z. Kalmykova, S. Goldentricht).

Analysis of the psychological literature allows us to assert that creativity can be developed: "educate" thought (J. Dewey), "know and develop the methods of creativity" (J. I. Nirenberg). The issues of personality development as a conscious, free creative subject of activity were studied by K. Abulkhanova-Slavska, B. Ananiev, L. Vygotsky, S. Rubinstein, and others (V. Polonsky, A. Khutorskoi, V. Andrieiev, M. Lazarev).

Creativity in the context of the educational system attracts more and more attention of foreign

and domestic scientists. Even though in modern science a fairly large number of researchers are engaged in the study of creativity, there is no single point of view on the concept under consideration, as well as a single concept regarding the categories associated with creativity.

Pedagogical theories of creativity are associated with the problem of both development of the teacher's and students' creativity, that is, all subjects of the educational process. The creative nature of pedagogical activity and the ways of formation of the creative personality of the teacher are widely and multifacetedly studied (V. Bukhvalov, V. Zahviazynskyi, V. Kan-Kalik, Yu. Lvova, N. Nikandrov, M. Potashnik, V. Slastenin, I. Ziaziun, M. Lazarev and others). Development of a basic psychological model of the teacher (V. Krutetskyi, V. Kan-Kalik, N. Kuzmina, and others) justifies the relevance of formation of the psychological profile of a specialist capable of approaching the solution of problems of creativity.

The need of modern society for a new teacher, ready to master innovative educational technologies, to constantly search for new forms of education, actualizes the importance of developing creativity as a professionally significant quality of the teacher's personality, which determines his success, relevance, competitiveness, and potential for professional development. It is based on the content of the Professional Standard of the Teacher and the Concept of the New Ukrainian School (NUS), which define the creative activity and indicate creative competences of the modern teacher.

Based on the requirements of the professional standard, from the position of forming readiness for creative activity, such competences include:

- ability to generate new ideas, search and solve problems, initiative and entrepreneurship (entrepreneurial competence);
- competence of pedagogical partnership: ability to subjective interaction (equal and personality-centered) with students in the educational process;
- project competence: ability to set a goal of education, upbringing and development of students;
- innovative competence: ability to apply a variety of approaches to problem solving in pedagogical activities;
- emotional and ethical competence: ability to constructively and safely interact with participants in the educational process (*About the hardened professional standard of the teacher,* 2020).

Also important are the ability to apply knowledge in practice, the ability to organize and plan, research skills, the ability to adapt to new situations, the ability to criticize and self-criticize, interpersonal skills.

Thus, we have proved that the work of a teacher is always creative, and creativity is a professionally significant quality. This is indicated by the works of V. Sukhomlynskyi, Yu. Babanskyi, V. Kraievskyi, M. Potashnyk, M. Skatkin, V. Zahviazynskyi, V. Kan-Kalik, Yu. Kuliutkin, I. Isaiev, I. Ziaziun, M. Lazarev and others. "The discovery made by a scientist, when it comes to life in human relationships, in a living impulse of thoughts and emotions, appears before the teacher as a difficult task that can be solved in many ways, and in choosing a method, in embodying theoretical truths into living human thoughts and emotions, the creative work of the teacher lies precisely" (Sukhomlynskyi, 1981).

In the late 70s of the twentieth century, there was an interest in studying the creative qualities of the teacher's personality. Thus, in the works of Yu. Babansky, V. Kraievsky, M. Potashnyk, M. Skatkin and others, the problem of teachers' readiness to introduce innovations is investigated. V. Kraievskyi notes that the ready-made "scenario" of practical pedagogical activity cannot provide for each of those unique situations that the teacher faces daily. In each new unforeseen situation, the teacher is investigated. He must act independently, solve practical problems. To reproduce an experience or pass it on to others, it must be comprehended. Simply copying a good sample without understanding its essence can lead to failures. According to V. Kraievskyi, it is important to be creative about one's work and have scientific and pedagogical training. To independently "derive thought from experience", it is necessary to be educated (Kraievskyi, 1994).

In pedagogical activity, creativity is determined, firstly, by the high social significance and uniqueness of its product – formation of the student's personality in all the richness of its individual originality. Secondly, the very process of pedagogical activity, based on the interaction of the teacher and students, does not tolerate a standard and a template, although the scale of the creative tasks of the teacher can be, of course, different, ranging from introducing fundamental innovations in the content, forms and methods of the educational process and ending with the solution of various private issues that arise in specific situations of activity and communication with students.

The teacher's art is evident in the way he builds the framework and composition of his lesson; how it organizes the independent work of students, including them in the solution of educational and cognitive tasks; how he finds contacts and the right tone of communication with students in certain situations of school life. Creativity is not some separate aspect of the personality of the future teacher, but his most essential and necessary characteristic.

Creativity reflects both the potential, the internal resource of the future teacher, manifested in the ability to constructive, non-standard thinking, and awareness, development of his experience. This allows us to identify the personal and behavioral parameters of creativity and consider creativity as a resource for personal development, demonstrating positive dynamics in the context of professional activity and professional development of the future teacher. It is creativity that provides a constructive way out for the future teacher from professional crises, a stable transition to professionalism, self-realization in adaptive, reproductive, heuristic and creative forms (V. Slastenin), manifests itself in the design of the student's personality, making independent decisions in unexpected situations, building the educational process in accordance with the characteristics of children (N. Kuzmina), ensures realization of one's own individuality as a creative act that ensures introduction into the world of a new, previously non-existent (E. Yakovleva).

The activity of the teacher is characterized as creative. This is the specificity of pedagogical activity. This feature is pointed out by many authors of pedagogical science, who studied the problems of the essence and specificity of pedagogical creativity (V. Zahviazynskyi, Yu. Azarov, S. Bondarevska, Yu. Lvova, V. Slastenin and others. During such activities, optimal, non-standardized pedagogical solutions are developed and implemented (Slastenin, 1997). That is, exploring pedagogical creativity as a process, scientists analyze the activity of the teacher – "the ability to see, set and solve pedagogical problems in an original way, quickly navigate in the created pedagogical situations, as well as also to foresee the results of their work" (Slastenin, 1997).

From this we can conclude that creativity is a significant condition for pedagogical activity, an objective professional necessity of a teacher's work.

A teacher whose pedagogical activity is distinguished by high social significance and uniqueness of the formation of an individually peculiar personality of the student, the absence of a standard and a template in the interaction of the teacher and the student, the solution of creative problems, in the content, methods and forms of teaching, is a modern teacher. He is capable and ready for different risks, creative and enterprising, knows how to work in a team.

Creativity, as the most essential and necessary characteristic of his activity (V. Zahviazynskyi, V. Ryndak, V. Slastenin and others), is an important factor in professional development, which determines the ability to realize and overcome the barriers of professional development, to find constructive ways out of professional crises, thereby contributing to the transition to higher levels of professionalism.

R. Florida (Florida, 2011) considers creativity to be the main resource of economic and social life. "Knowledge" or "information" is only the working material of creativity, and the product of this process is innovation.

Creativity is also understood as a quality or ability inherent in a person. According to V. Moroz, creativity is the basis for discoveries and innovations, and it is characterized by two qualities: novelty and usefulness (Moroz, 2011). The creativity of the teacher is manifested in professional activity based on various types of interaction (Vitvytska, 2009) and solving creative problems at the methodological, pedagogical, educational and innovative levels. In addition, as noted by N. Kuzmina, creativity of the teacher is manifested in the design of the student's personality,

making independent decisions in unexpected situations, building the educational process in accordance with the characteristics of children (Kuzmina, 2008). A creative teacher is able to develop and maintain the creativity of students.

V. Ryndak and A. Moskvina consider creativity as a dialectical unity of potential and actual, systemic interaction of the author's potential with its execution. Creativity, from the point of view of the authors, is defined as the ability to generate new ideas, deviate in thinking from traditional schemes, quickly solve problem situations (Ryndak, 2012).

According to modern researchers, pedagogical creativity is due to the creative potential of the teacher, it is based on accumulated social experience, and includes psychological and pedagogical skills and subject knowledge, new ideas, skills and abilities that allow finding and applying original solutions, innovative forms and methods, improving the performance of their professional functions (Shcherbakova, 2006).

M. Lazarev proposed a general model of creative abilities and skills of the teacher, which reflects the structural-binary approach to the problem. According to the proposed model, five groups of creative abilities of the teacher (motivational and energy activity, communicative-creative abilities, research abilities (prognostic, constructive and diagnostic), didactic and reflexive abilities) are allocated and intellectual-logical and emotional-heuristic components are characterized (Lazarev, 2016).

Pedagogical creativity is defined as the embodiment by the teacher of non-standard pedagogical solutions in the constantly changing conditions of the educational process.

Basically, differentiation of the concepts of creativity is reduced to the understanding of creativity as a personal characteristic, and creativity as an expression of creativity.

Personal pedagogical creativity is expressed in the professional self-realization of the teacher through pedagogical and creative self-awareness, formation of his own creative and career path of development, a conscious plan for self-realization. The realization of the teacher's creativity is possible only through creative pedagogical activity.

Pedagogical creativity can be considered as an active process of the teacher's work aimed at successfully solving pedagogical problems, increasing the productivity of teaching, and educating schoolchildren.

The educator is a key figure in creating an educational environment conducive to the development of the creative nature of the child. In turn, this places special demands on his professional and personal training.

Personal development implies a strategy of releasing internal resources, including the ability to solve value and moral problems and, if necessary, resist the environment, actively influence the environment, defending its independence from external pressure and the possibility of creative manifestations.

Professional development is inseparable from personal development – the basis of both is the principle of self-development, which determines the ability of the individual to turn his own life activity into an object of practical transformation, which is characteristic of the model of professional development of the teacher.

According to N. Kuzmina, creativity of the teacher is manifested in the design of the student's personality, making independent decisions in unexpected situations, building the educational process in accordance with the characteristics of children (Kuzmina, 1990).

E. Yakovleva defines creativity as a personal characteristic, but not as a particular set of personality traits, but as the realization by a person of his own individuality (Yakovleva, 1996).

Representatives of a different research approach identify a certain set of personality traits inherent in creative people (T. Amabile and M. Collins, R. Kettell, L. Puzep and others). Human individuality is unique, so realization of individuality is a creative act (introduction into the world of the new, which did not exist). The characteristics of creativity, according to E. Yakovleva, are not objective (in the sense of the presence of a product – material or ideal), but procedural, since creativity is considered as a process of identifying one's own individuality:

a. creativity develops in the process of subject-subject interaction;

b. creativity is manifested in a particular human activity.

These characteristics logically follow from the consideration of creativity as realization of one's own individuality, because human individuality manifests itself in the process of interpersonal communication (direct or indirect) and is always in one way or another the presentation of one's individuality to another person.

The foregoing allows us to conclude that a modern teacher is necessarily a creative person, a competent specialist who is able to effectively interact with children, based on the identification and development of their creative and intellectual inclinations, abilities, desire for self-development and improvement. Creativity becomes a specific component of pedagogical activity, without which it is not effective enough. And this requires new approaches to teacher training.

One of the objectives of our study is the need to analyze and concretize the concepts of "creativity" and "professional creativity" of future specialists by means of philosophical, psychological, and pedagogical literature, as well as to determine the effectiveness of the mechanisms for developing professional creativity of future teachers.

Professional creativity L. Horbaneva proposes to consider as an integral characteristic of the personality, indicating its ability to create a new, original, unique (Horbaneva, 2009). The core of creativity is the ability of the individual to create something new, original. At the same time, creativity cannot be reduced only to this ability, the latter does not exist as something separate, isolated from other personality traits. Creativity, along with the named ability, involves formation of a system of other, closely related to it and interpenetrating qualities of the personality. Among them, first of all, is intellect, orientation, etc. Such an approach to the development of professional creativity seems to be a holistic, systematic approach, as opposed to the functional approach, which tears out its individual properties from the holistic personality.

Professional creativity has a peculiar psychological structure depending on the content of professional activity, which constitutes a specific component of professional creativity. The invariant component of professional creativity is the general creative ability or creative potential of the individual as a system of motivational, intellectual, emotional, volitional, and value-semantic properties of the individual, creating the opportunity to find new things, make decisions and act outside the box. Development of professional creativity depends on a few factors and is provided by a combination of conditions and means.

An important characteristic of professional creativity (Horbaneva, 2009) includes the subjective position of the teacher, which contributes to a deeper awareness of the meaning of creativity in his profession; allows him to develop a program of requirements for himself, for the process and results of his activities; contributes to the consistent generalization of his professional experience and skill) and promotes development of professional creativity. We consider the choice of alternative approaches and their assessment to the implementation of their pedagogical activities, the ability to correct and restructure it, the ability to introspection, orientation to self-development as indicators of the professional creativity of the future teacher.

Creativity is the main reserve for improving any activity. A real teacher is in constant creative search: every day he must solve more and more new tasks – educational, upbringing, organizational, communicative.

The study of the problems of the formation of the teacher's personality, his pedagogical skills, often indicates the development of the creative style of the teacher's activity.

Independence, self-activity are the qualities that nourish creativity. For the teacher, it is important not only to realize pedagogical activity as creativity, but also to constant professional and personal self-education.

Creative education as a way to develop the creativity of the future teacher

The full disclosure of the personality properties, the realization of human creativity represents a significant reserve of civilization, a massive means of developing production, science and culture. "Creativity is the highest of human functions, which is based on free will and imagination. It is the

freedom of imagination, if approached with responsibility, that helps a person to be the creator of the future, and not just a product of the past. Creativity is a rebirth, the eternal source of youth; creativity gives freshness, originality, and significance to everything we do, think about, and feel. In creativity we use our unique capabilities and express the uniqueness of our thoughts and feelings.

With each creative manifestation, we develop the Power of the Personality, to which creation is available" (Weinzweig, 1990).

The fullest disclosure of the inclinations and talents of the individual is possible only through the performance of socially significant activities. At the same time, it is important that implementation of such activities is determined not only by external factors (society), but also by the internal needs of the individual. In such conditions, the activity of the individual is transformed into amateur activity, and realization of abilities in the chosen activity acquires the features of self-realization. It follows that creative activity is an amateur activity that encompasses the transformation of reality and personal self-realization in the course of creating material goods and spiritual values. Creative self-realization of the individual allows you to expand the limits of human potential.

Creativity is a permanent attribute of the individual's activity. It implies a historically formed evolutionary form of subjects' activity, which is expressed in different activities and leads to the formation of personality. The basic criterion of a spiritually developed personality is his mastery of the full process of creativity.

Creative self-realization of the individual is the area of application of the individual creative potential of the subject and development of a reflexive attitude to his own personality. Any kind of creativity is a kind of process of formation of a personal worldview. In the process of creative activity, individuals independently acquire new knowledge and methods of activity. As a result of the acquired experience through such activity, the individual forms an emotional and value attitude to his own personality and to the reality around him. The individual achieves a certain degree of creative self-realization, applying the creative potential and expressing his creative essence (*Creative self-realization as a scientific problem*).

Creativity should be an attribute of any profession, and in this sense it is absolute. But creativity is not only for absolutely everyone, it is also relative. It is always relative to the possibilities that a person possesses. If the capabilities and abilities of a person are not realized, if the forms and methods of behavior that satisfy their carrier with the result become stereotypical, there is a stagnation in the development of the personality (Klimov, 1983).

N. F. Vyshniakova argues that the main functions of realization of the creative individuality are:

- enrichment of human culture, determined by the criterion of social significance;
- improvement of the surrounding world, transformation of the psychological and pedagogical process and personality;
- resolution of contradictions according to the criteria of expediency;
- finding new technologies and original technological processes, determined by the criteria of productivity and significance;
- realization of emotional culture, empathy and identification;
- development of the subconscious or unconscious structure of the personality, intuition and imagination;
- self-development on the basis of self-determination, freedom, self-identification of the individual, formation of creativity and individual style of professional activity, determined by the criteria of prospects;
- realization of the ability to encode the system of knowledge and find new productive and significant technologies for their transfer, manifested in professional genius and talent (Vyshniakova, 1995).

The rigorous logic of social development has led us to a point where the very real truth has become the impossibility of being content with the knowledge gained in secondary and higher education institutions for successful professional activity throughout life. A person cannot be taught once for life. However, you need the ability to obtain knowledge in a timely manner and use it effectively.

Researchers agree that in the twenty-first century, it seems that those who can best develop their higher intellectual abilities, ability to analyze, synthesize, evaluate, as well as mental flexibility and creativity will have power and work.

In conditions when education, professionalism, the ability to create become the most significant among all the factors that determine the economic, social, and spiritual progress of society, the need for constant, systematic, continuous education is obvious. It should become a part of everyone's life, regardless of social status and place of work. Any underestimation of this factor, any delay negatively affects not only the professional and spiritual development of the individual, but also the cause to which a person has devoted himself. Comprehensive development of the personality, maximum realization of the abilities of everyone is the main goal of continuing education. The essence of continuity lies in the constant satisfaction of the developing needs of the individual and society in education, comprehensive in completeness, individualized in time, types and direction, i.e., in providing everyone with the opportunity to implement their own system of education. According to N. Vyshniakova, "it is the dominant position of creativity in the education system and development of creative individuality that can change the individual, the professional and society. It is necessary to realize that not only the individual is a product of society, but also society is based on creatively developed individuals. And the faster we will implement the second position, creating productive conditions in education, culture, and science, the more dynamic will be the flowering of self-expression and self-improvement of everyone (given the complexity of this problem), which should be the defining strategy not only of creative pedagogy, but also of society as a whole" (Vyshniakova, 1995).

Signs of a creative direction in education are a change in strategies aimed at the personal and transformative mastery of fundamental knowledge with the help of a teacher, the parallel application and adaptation of them in practice and the creation of maximum conditions for the use of knowledge in unforeseen circumstances based on developed creative abilities. According to such a strategy, applying innovative technologies of training and education, each person will be able to self-actualize, achieving and realizing his giftedness in any type of activity.

Modern conditions for the development of society, culture and education determine the need of society in an innovative and creative teacher who can realize the importance of updating the education system, the theory and practice of organizing the educational process, to create, master and use innovative and creative pedagogical ideas. In addition, the continuous change in the composition of the curriculum requires the teacher to constantly search for new alternative forms and technologies of teaching.

The range of manifestation of creativity in pedagogical activity is expressed in relation to students, pedagogical behavior, methods of teaching the subject, selection of material and choice of means and forms of its presentation, extracurricular educational and upbringing activities. However, in the domestic pedagogy there are unsolved issues of developing the creativity of the future teacher at the stage of his professional training.

Theoretical analysis and analysis of the experience allows us to identify the following structure of the potential of the future teacher: the potential component itself (individually expressed capabilities (mental, creative, social) and abilities (intellectual, divergent, communicative and organizational)); motivational component (need as a socio-psychological attitude to mastering evaluation activity in the context of one's individually expressed abilities and capabilities); cognitive component (acquired knowledge, skills, ways of activity, attitudes and self-expression as a result of creative education and their inclusion in the process of socialization).

It is creative education that is a means of developing the potential aimed at the creative and social interaction of the teacher and students. The pedagogical possibilities of creative education in the development of the potential of future teachers, researchers include the following: meta-individualization (co-creation, cooperation, self-education), self-organization (self-regulation, self-presentation, self-realization), variability (creative technologies, competitions, project activities), enriching personal (personal qualities) and external (joint activity) resources. Thus, creative education will provide a set of opportunities for self-development of all subjects of the educational

process, based on their individual characteristics and requirements of the professional standard (Ryndak & Mikhaleva, 2017).

Consequently, there is an increasing need for professional training of teachers in the system of creative education to develop the potential of the future teacher.

V. Andrieiev identified the following conditions that contribute to the formation of a creative personality within the framework of university education:

- development of creative abilities of the student;
- pedagogical management and self-management of students in the organization of various types of creativity (scientific, educational, technical);
- increasing the number of intensive methods for the development of creative activity (discussions, business games, etc.);
- combination of collective and individual creative activity, encouragement of cooperation, competitiveness, honesty of assessment, etc. (Andrieiev, 2008).

It also requires a sufficient level of formation of the ability to overcome obstacles that may arise in the way of creative thinking. For example, the following:

- conformism – the desire to be like other people; a person is afraid to express unusual ideas for fear of appearing ridiculous or not very smart;
- censorship (especially internal or excessively high self-criticism) – people who are afraid of their own ideas, as a rule, are not innovators; some balance is needed between giftedness and self-criticism, because too picky self-esteem can lead to a creative dead end;
- fear – fear of failure shackles imagination and initiative;
- rigidity – difficulty in changing the ways of activity in non-standard conditions;
- desire to find a solution to a new problem immediately; but excessively high motivation often contributes to making inadequate, false decisions.

The obstacles of critical thinking should also be taken into account:

- fear of being too aggressive; it is known that some of us learn from childhood the idea that to criticize is to be impolite;
- fear of retribution; by criticizing other people's ideas, we can provoke a response to criticism of our ideas;
- such fear gives rise to another obstacle – a reassessment of our own ideas: we are reluctant to share what we like;
- excessive stimulation of creative imagination; it also reduces criticality.

Critical thinking, for which the ultimate goal is constructive, should be distinguished from critical thinking, which is destructive in its very essence. The teacher's desire to criticize solely for the sake of criticism itself is more of a psycho-emotional nature than a cognitive goal itself.

Creative thinking, which generates new knowledge, depends on the level of professionalism of the teacher, his ability to systematically obtain new information, the psychological orientation not to adaptation, but to development, to search for new things.

Increasing the creative culture of the teacher's personality, along with its mandatory moral improvement, contributes to the formation of a truly humane society that opens the way for each person to the free creation of culture. The teacher should be not just knowing, but transforming pedagogical reality, able to see new facets of ordinary phenomena and facts, to push the usual boundaries of human knowledge.

Interactive communication of the subjects of the pedagogical process, manifested in the problem-search character, which determines their inclusion in the independent creative solution of professionally and personally significant situations, self-actualization, and self-completion, is one of the significant mechanisms for the development of the teacher's creativity (Ryndak, 2012).

For our study, the criteria foundations of the typology of teachers proposed by V. Ryndak are of interest – possession of the methodology for developing the creative abilities of the student and the ability to create his portrait. The first group is teachers who do not know the methodology for developing the creative abilities of students and do not know how to create a portrait of a creative

student or find it difficult to create it. They are at the stage of imitation – copying (based on the concept of imitation of V. Prosetskyi). Since teachers of this type have a strong desire to act according to the model, not to go beyond the original way of activity, pedagogical support for them is important in the person of a mentor with developed creative abilities, formed creative competence. This group of teachers was named teachers-reproducers.

A group of teachers of the second type – teachers-explicators (from the word explication – explanation, unfolding). This type of educator is in the transition from imitation-copying to creative imitation. They're building good knowledge, trying to develop the creative abilities of their students, they know how to do it, but they're having trouble creating a portrait of a creative student, describing it. This type of a teacher needs pedagogical support, which can manifest itself in developing their own creativity.

The third type is teachers-improvisers (the transition from creative imitation to imitative creativity). They can create a portrait of a creative student, but they cannot teach children to act creatively, because they do not own the methodology for developing the creative abilities of students. Pedagogical support of this type of teachers is necessary in the person of a professional methodologist who can competently correct the actions of the teacher and give greater weight and significance to his activities.

The next group of teachers (the fourth type) are research teachers who are on a creative level. They can create their own style of creative activity and are able to teach this to their students.

Manifestations of humanity in a creative teacher are fixed by respect for the dignity and rights of the child, his value as a person; focus on strengthening of physical and intellectual health (own and students); creative life activity and self-realization as an ethical norm, spiritual and moral improvement. The creative teacher prefers humanism as the highest universal value.

Thus, the influence of communication with a teacher with creative abilities on the development of the student's creativity is obvious. A creative teacher more successfully develops the creative abilities of the student (Ryndak, 2012).

The ability to consciously manage their actions and effectively use the stages of creativity, to know them, considering their individual characteristics, while developing not the process, but its understanding and work with it, is subject to formation and development. The transition from the study of the theoretical foundations of creativity to their practical implementation includes understanding of the essence of the creative process; knowledge of the stages of the creative process; gathering information about the creative process; teaching the creative process; formation of experience of creative and self-educational activities.

The main goal of the creative system of teacher education is to awaken the creator in the personality, to develop its creative potential, with the aim of further productive and effective work in society.

The future teacher's possession of creative skills will allow him to simulate possible changes in the structure, content, and organization of the educational process, to form the goals of training and upbringing, to make timely adjustments for the introduction of innovations and the use of pedagogical technologies, to implement a person-oriented approach to students based on their potential creative abilities, to plan their further professional activities.

It is necessary not only to transfer ready-made knowledge and value-normative ideas in the learning process by means of reproductive pedagogy, but also the mandatory development of new creative psychological and pedagogical technologies for teaching and upbringing, since only a creative teacher can educate a creative student.

This involves the search for new content and organizational forms of education and upbringing of the future teacher, while the methodological component is of particular importance, the component of which is creativity and the ability to self-development (Havryliaka, 2017).

The range of manifestation of creativity in pedagogical activity is quite wide and can be expressed in relation to students, pedagogical behavior, methods of teaching the subject, selection of material and the choice of means and forms of its presentation, extracurricular educational and upbringing activities. The level of creativity of the teacher in combination with his professional literacy

and the accumulated pedagogical experience determines the effectiveness of the lesson and the assimilation of knowledge and practical skills by students, as well as stimulates cognitive activity and development of students' creativity. However, in modern pedagogy, the issues of developing the creativity of the future teacher at the stage of his professional training, and, in particular, in the process of pedagogical practice, still remain open.

It is generally recognized that pedagogical practice is an integral part of the professional training system of the future teacher. Traditionally, it is believed that pedagogical practice is aimed at creating unity between theoretical training and practical activities of the future teacher.

Based on the data of modern research on the issues of creativity and organization of pedagogical practice, it can be assumed that pedagogical practice as a factor in the development of the creativity of the future teacher is one of the multifaceted phenomena of pedagogical reality and acts in line with the systems, activity, personal, creative, axiological and optimization approaches as one of the components of general pedagogical training, as a type of practical activity of students and as a form of professional training of higher pedagogical education institutions.

As we can see, a comparative analysis of various approaches to determining the essence of creativity reveals the possibility of disclosing one's scientific position and substantiating it based on theoretical and practical material that was formed by previous researchers, while maintaining a certain continuity of their scientific ideas and concepts.

Therefore, it can be considered that creativity is an integral dynamic property of the personality that ensures effectiveness of the creative activity of the future teacher, as a measure and a way of creative self-realization of him in various types of pedagogical activity aimed at mastering, transmitting, creating professional values and pedagogical technologies.

Such an approach to the understanding of creativity in pedagogical practice, from our point of view, makes it possible to present it as a condition and prerequisite for effective pedagogical activity, as an indicator of the competence of the teacher and as a goal of professional self-improvement.

Implementation of the creative approach in the framework of our research is achieved through a comprehensive study of the phenomenon of personality creativity in conjunction with other professionally significant qualities (reflection, innovative potential, motivation, intellectual level), as well as in the selection of methodological material of the program, forms, in the means and methods of its presentation, assessment of the dynamics of the development of the phenomenon under study.

The core of the creative approach of the program for the development of creativity of future teachers is stimulation to creative and cognitive activity, motivation to improve professional skills, as well as formation of professional self-awareness, which directly connects the creative approach with the preferential career approach. "Preferential" means "predominant, preferred", thus, in the preferential-career approach, the pedagogical activity of the future teacher is considered from the point of view of the development of professionally significant qualities of the future specialist, the choice of an individual career path, means, methods, forms of work for the effective achievement of the set career goal, as well as the determination of the individual's factor of success of professional activity and career motivation (Kostriukov & Miroshnykova, 2015).

According to L. Vitvytska and D. Miroshnykova, the process of developing creativity of a future teacher should be effectively implemented in the process of pedagogical practice with due provision of the following components:

- organizational, where a certain once worked educational route of the student allows to rationally distribute his activities to achieve positive results in the acquisition and development of professional skills;
- professional and motivational, which consists in identifying significant motives and emotions for the conscious management of professional reality and designing the future professional path;
- methodological-theoretical, the accumulated basis of theoretical knowledge and general intellectual resources of the student's personality;
- methodological and practical, including the primary skills and abilities of designing a

lesson in compliance with the principles of teaching the subject;

- purposeful interaction, organized by combining individual and group work with the use of methodological means of professional and pedagogical interaction, as a result of which the student forms critical thinking, analytical abilities and the ability to "see from the outside" the process and result of his activities;
- creative, allowing you to comfortably navigate in the variable educational space, make the necessary changes in your professional activities and its content;
- reflexive, determining the introspection of one's own activity, allowing to adjust the direction of pedagogical and methodological work, as well as ways of self-development;
- activity, consisting in an active approach to the development of creativity in the process of pedagogical practice, where students perform three types of activities – investigative (pedagogical diagnostics, psychological diagnostics, research in the field of methods, techniques and means of teaching, research in the field of goals and content of training, research in the field of methods, techniques and means of assessing achievements of students, pedagogical reflection), project (designing lessons with the mandatory use of creative forms, methods and technologies of teaching) and analytical (analysis of their own pedagogical activities, the activities of trainees-classmates, teachers of practice bases; analysis of advanced pedagogical experience) (Vitvytska & Miroshnykova, 2017).

The results of the study of the deep mechanisms of the influence of the level of creativity on the success of overcoming external and internal barriers to the professional development of teachers allow us to note that it is necessary to develop appropriate specialized technologies based on the use of techniques for stimulating creative activity in the context of professional development (Zeer, Popova, 2012) effective adaptation to external and internal changes; active adaptation in solving problems that are beyond the available experience; search activity, which allows, in conditions of uncertainty, to maintain stress resistance and change the situation with the least risk; in everyday creativity ("Everyday creativity") in the creation of original products, ideas, behaviors based on creative activity both in work and in free time. This allows you to adapt to changing conditions and act as a humanistic force, the motive of "continuous growth and personal development" (M. Runco, R. Richards) of the future teacher.

Development of creativity in the future teacher is extremely important both for his effective study and future professional activity. Therefore, in the course of training, it is necessary to orient the student to deep assimilation and reflection of the system of pedagogical knowledge; selection of original creative ideas; development of the ability to detect, set and solve creative problems; generation of ideas; search for original solutions; assessment, synthesis, analysis of facts, phenomena, theory, experience of pedagogical activity, stimulation of their participation in research conducted at the university, region; organization of independent work of students and support of their scientific interests. Noteworthy is the idea when each student from the first year forms a portfolio, which reflects the result of the realization of personal abilities, the manifestation of talents and the original concept of pedagogical experience in solving problems, unforeseen situations. This provides a large degree of "quasi-self-independence with significant market responsibility" (Liakhova, 2012).

Theoretical analysis allows us to note that when studying the topic at lectures, seminars on pedagogical disciplines, during the preparation and conduct of pedagogical practice, it is important to systematically form internal motivation to study pedagogical disciplines; teach how to work with information (find, analyze, structure); to teach to work in the classroom (listen and hear others, ask questions, answer them reasonably); to teach to critically comprehend and demonstrate the results of personal creativity.

It will be relevant to form the creativity of the future teacher by introducing the student to the experience of innovation; tracking the positive and negative effects of innovation; orientation to self-development, self-realization, the formation of the "I" concept; approbation of selected innovations, highlighting the difficulties that the future teacher experiences in their implementation,

transforming existing experience, reflecting on the novelty and originality of solving the most complex and relevant pedagogical problems; correction of innovation evaluation criteria; development of an idea in the applied aspect and its implementation in practice; identify the risks of innovation.

When designing the result of the development of creativity, it is necessary to take into account both the level of development of the intellectual abilities of the future teacher (this allows him to master technical, economic, cultural changes in society in a timely manner), and the degree of initiative, confidence and willingness to work in a modern education institution; the level of development of cognitive competence, including cognitive, motivational-value and emotional-volitional components, which ensures readiness to successfully carry out pedagogical activities.

The results of the experimental work of N. Hnatko and V. Ryndak allow us to assert that students who are inherent in creativity prefer experiment, search for new, conscious problem solving in an original way, assuming the result, try to organize activities according to their capabilities and needs. They are ready to take risks, ready to test the limit of their capabilities. They are characterized by intellectual activity, intellectual initiative of mental activity, independent creative solution of pedagogical problems. And intelligence and creativity are indicators of professional growth, formation, and well-being of the future teacher (Hnatko, 1994, Ryndak, 2012).

The future teacher should be taught to think creatively at the conscious and unconscious levels, considering creativity as a practice-oriented activity, as the generation of new ideas; teach him to make innovative decisions in his daily activities. To this end, it is advisable to use methods of transformation of several well-known methods of activating creative thinking, the ability to create, cognitive attitudes built on the principle of opposites and designed to solve creative problems. Students are invited to find similarities in seemingly heterogeneous subjects, describe the interaction of various systems, know the knowable, etc. The use of heuristics in solving creative problems allows the future teacher to more purposefully, from different angles, consider the available information about the subject of study based on a wide range of social information and individual capabilities of the researcher.

According to the results of the study of A. Derkach, E. Sigida (Derkach, 2000, Sigida, 2000), the environmental direction of research on creativity in the educational process required considering: the need-and-information aspect, which includes an analysis of the nature and content of general educational programs, and interpersonal interaction, that is, a system of emotional relationships that create a creative climate in the educational environment. The study of cognitive creativity in the educational process allowed to expand the idea of the future teacher about the genesis of creative self-expression, the development of a person capable of creative self-realization, to identify the personal features of the learning and development space, to reveal the possibilities of forming his competence as a teacher, to purposefully identify and train creative specialists capable of introducing innovative developments into all spheres of life. The mechanisms for the development of creativity include creative consciousness and creative interaction. Creative consciousness, being the sphere of non-standard, is characterized by a predominance of orientation to innovative activity in comparison with the standard; stable (but not excessive) motivation; creative needs; creative ideas.

Creative interaction, first, provides the effect of “penetration” into the “self” of another, into the value-semantic field, into the “communicative core of the personality”, into the world of feelings and reasons, according to A. Bodalev. Second, it strengthens personal interest in productive learning, the need for self-expression. Third, it presents creative samples, that is, such a level and nature of personal manifestations of the subjects of pedagogical interaction, in which the creative potential of the future teacher is actualized, creative self-manifestation is ensured, the choice of options for the manifestation of one’s “self” in the self-consciousness of another student is grounded.

The basis of the creative interaction of the teacher and the future teacher is the system of his goals and motives, which determines the goals and motives of the teacher in the form of an open

dialogue, direct interaction and feedback. Theoretical analysis of the studies has allowed us to outline the pedagogical conditions that ensure creative interaction:

- activation of the interactive communication function. At the same time, dialogue communication contributes to the solution of problems of mutual understanding, interaction, manifestation of personal characteristics and determines the reflexive and activity nature of interaction;
- orientation of the future teacher to the realization of the need for self-manifestation and self-knowledge in the course of story-roleplaying, spontaneous-imitative games, micro-presentations in the classroom;
- organization of pedagogical design through the "movement" of its subjects in the semantic spaces of self-determination, activation of independent work, comparison of the experience of solving the problem.

Thus, the pedagogical prerequisites for creative interaction are professional competence, erudition, intelligence of the teacher, the trusting attitude of the future teacher to the teacher, the humane relationship of students in the group (Ryndak, 2012).

The result of the professional formation of the future teacher is the ability to go beyond the continuous flow of daily pedagogical practice and see his professional work as a whole. This allows him to purposefully design a program of his self-development.

In the training system, it is important to motivate future teachers to "self-observation' of their own reactions and actions, active personal and creative reflection. Comprehension of the pedagogical problem, as a rule, proceeds from generalized ideas about the ways out of difficulty to specific creative ways of overcoming it (to a successful solution). Reflexive analytical activity is required in modeling the systems of education and upbringing, in the direct implementation of the constructed model and introspection of the results of pedagogical work. Since the procedures of self-analysis are self-observation, self-assessment, self-control, it is they who need to train future teachers, reflection acts as a set of cognitive techniques that contribute to the development of professional creativity.

In order for the implementation of professional requirements for a modern specialist to become possible, students during the period of study at the university need to be helped in the development of their subject-managerial abilities: mastering the technologies of goal-setting, modeling and organization of activities and technologies for managing the development of their intellectual, spiritual and professional potential and readiness to extrapolate the acquired experience into professional activities.

The conducted theoretical research allows us to formulate several provisions that contribute to the development of professional creativity of the future teacher. This is a systemic vision of pedagogical reality; continuity, ensuring the continuity and integrity of the formation of professional creativity of the future teacher, which should be reflected in the content of the educational material, in a set of individually differentiated tasks, forms, methods and means of their implementation; problematic, suggesting the presence of educational and extracurricular situations containing problems, deliberately developed by the teacher and offered to students to realize the goal of developing their creativity; the priority of the spiritual and moral basis in the purposeful formation of motivation for active socially useful activities as a property of the individual; organization of educational activities aimed at identifying the abilities of students and developing them as subjects of creative activity.

According to these provisions, the development of professional creativity of the future teacher occurs not during the study of one or more special courses, but throughout the entire period of study at the university.

One of the priority pedagogical conditions for the development of creativity is the use of programs, methods and techniques of training aimed at the development of creativity. It is necessary to make changes in the organization of the educational process (the use of non-traditional forms of presentation of the material, the formation of problematic issues, the joint search for solutions, the stimulation of cognitive activity and the creative potential of students and the lecturer through the

transformation of their internal and external world).

The main emphasis in the development of professional creativity falls on practical exercises, where such teaching tools as the method of problem pedagogical situations, the method of discussions, the method of professional role-playing games and other active teaching methods prevail.

The effectiveness of active learning methods is because they simulate real school life; contribute to the formation of teamwork skills; form not only professional abilities, but also social, moral, ethical norms of behavior of the future teacher; give a systematic view of the content of professional activity; contribute to self-learning and self-education of the future teacher.

Thus, the development of the subjective position of the teacher, the development of subject-managerial abilities of students, the introduction into pedagogical practice of new, scientifically based and experimentally proven teaching technologies, business, imitation games are an important structural component of the development of professional creativity of the future teacher and serve as a link between pedagogical theory and direct practice at school (Horbaneva, 2009).

Conclusions

Life realities allow us to state the fact that graduates of a pedagogical university still do not have fully developed creative abilities, are not creative enough, and, consequently, professional creativity is not always at a high level. That is, the problem of developing the creativity of the future teacher does not have a definite solution. And it is innovative education that has significant potential to solve this problem.

Probably, precisely because creativity as a criterion for effective learning has not become fundamental in the modern educational environment and we must teach the future teacher to be creative precisely in the sense that he is ready to accept the new, able to improvise. he should not be afraid of changes, be able to remain calm in the turbulent flow of the new and, if possible, meaningfully welcome everything new.

And it is the professional teacher who can create the necessary conditions for the comprehensive development of the student's personality. And the individual, his knowledge, abilities, and competences are the most important intellectual resource, the availability of which will ensure the stable economic development of the country.

In the study of the problem of the creativity development, many unresolved issues remain related to determining the place of creativity in the competence system of the future teacher, the technological aspects of its development, the potential of the educational system for the development of students' creative abilities, the possibilities of creativity in the professional development of the future teacher.

Also, the question of how much the teacher can influence the creativity of the student remains insufficiently studied. Such factors as forced conformism, authoritarian attitudes and authoritarian environment, rigidity of the teacher, manifestation of sarcasm and ridicule, strict assessment, rigid orientation to success, hostility to a person with developed divergent thinking, etc. How to avoid a negative impact on the student's creativity have a negative impact on the creativity of the student. This issue requires special attention and scientific substantiation.

The creative personality of the future teacher is successfully realized and reproduced if: to give a decent assessment of his/her activities; encourage him/her to be creative; provide mechanisms for mobilizing resources around his/her ideas; to be equally receptive to minor changes and new ideas on a large scale.

References

Авакянц, С. Ю. (2010). Фрактальный подход к процессу развития творческого потенциала будущих педагогов (на примере специальности «профессиональное обучение (дизайн)». *Педагогическое образование и наука, 10,* 101-104 (Avakiants, S. Yu. (2010).

A fractal approach to the process of developing the creative potential of future teachers (on the example of the specialty “vocational training (design)”. *Pedagogical education and science, 10,* 101-104).

Алипханова, Ф. Н. (2010). *Оптимизация педагогической деятельности как фактор эффективной профессиональной подготовки студентов*. Москва: Медиа-Принт (Alipkhanova, F. N. (2010). *Optimization of pedagogical activity as a factor of effective professional training of students*. Moscow: Media-Print).

Андреев, А. Л. (2008). *Российское образование, социально-исторические контексты*. Москва: Наука (Andrieiev, A. L. (2008). *Russian education, socio-historical contexts*. Moscow: Science).

Андреева, И. Н. (2009). Концептуальное поле понятия «эмоциональный интеллект». *Вопросы психологи, 4*, 56-66 (Andrieieva, I. N. (2009). The conceptual field of the concept of “emotional intelligence”. *Psychology questions, 4,* 56-66).

Антонова, Е. Е. (2008). Педагогическая креативность как ведущий компонент структуры педагогической одаренности. *Педагогическое образование и наука, 12,* 92-98 (Antonova, E. E. (2008). Pedagogical creativity as a leading component of the structure of pedagogical giftedness. *Pedagogical education and science, 12,* 92-98).

Бердяев, Н. А. (2002). *Философия свободы*. Харьков: Фолио (Berdiaiev, N. A. (2002). *Philosophy of Freedom*. Kharkiv: Folio).

Бикова, М. М. (2017). Емоційна культура креативної особистості в процессі самовизначення. *Педагогічні науки: теорія, історія, інноваційні технології, 3 (67),* 129-139 (Bykova, M. M. (2017). Emotional culture of creativity in the process of self-meaning. *Pedagogical sciences: theory, history, innovation technologies, 3 (67),* 129-139).

Бикова, М. М. (2016). Комунікативні аспекти самовизначення креативної особистості. *Педагогічні науки: теорія, історія, інноваційні технології, 5 (59),* 260-267 (Bykova, M.M. (2016). Communicative aspects of self-designation of creative specialties. *Pedagogical sciences: theory, history, innovation technologies, 5 (59),* 260-267).

Бикова, М. М. (2018). Сучасні підходи до реалізації принципу полікультурності у вихованні. *Педагогічні науки: теорія, історія, інноваційні технології, 5 (79),* 294-304 (Bykova, M. M. (2018). We are now moving towards the realization of the principle of polyculturalism in the wicked. *Pedagogical sciences: theory, history, innovation technologies, 5 (79),* 294-304).

Бикова, М. М. (2019). Толерантність як актуальна проблема виховання закладів дошкільної освіти. *Педагогічні науки: теорія, історія, інноваційні технології, 10 (94),* 117-130 (Bykova, M. M. (2019). Tolerance is an urgent problem of the development of preschool education. *Pedagogical sciences: theory, history, innovation technologies, 10 (94),* 117-130).

Брякова, И. Е. (2010). *Формирование креативной компетентности студентов-филологов педагогического вуза*. Оренбург: ОГПУ (Briakova, I. E. (2010). *Formation of creative competence of students-philologists of a pedagogical university*. Orenburg: OSPU).

Вайнцвайг, П. (1990). *Десять заповедей творческой личности*. Москва (Weinzweig, P. (1990). *Ten Commandments of the Creative Per*son. Moscow).

Витвицкая, Л. А. (2009). *Развитие взаимодействия субъектов образовательного процесса университета*. Москва: Дом педагогики (Vitvytska, L. A. (2009). *Development of interaction of subjects of the educational process of the university*. Moscow: House of Pedagogy).

Витвицкая, Л. А., Мирошникова, Д. В. (2017). Развитие креативности бакалавра в период педагогической практики. *Вестник Оренбургского Государственного университета, 10 (210),* 34-37. Режим доступу: https://cyberleninka.ru/article/n/razvitie-kreativnosti-bakalavra-v-period-pedagogicheskoy-praktiki/viewer. (Vitvytska, L.A., Miroshnykova, D. V. (2017). Development of bachelor’s creativity during the period of teaching practice. *Bulletin of the Orenburg State University, 10 (210),* 34-37. Retrieved from: https://cyberleninka.ru/article/n/razvitie-kreativnosti-bakalavra-v-period-pedagogicheskoy-praktiki/viewer).

Вишнякова, Н. Ф. (1995). *Креативная психопедагогика. Психология творческого обучения. Ч. 1.* Минск: НИОРБ «Полы Биг» (Vyshniakova, N. F. (1995). *Creative psychopedagogy. Psychology of creative learning. Part 1*. Minsk: NIORB “Poly Big”).

Гавриляка, Н. Л. (2017). Проблема формирования креативности педагога в системе высшего педагогического образования. *Вестник Донецкого педагогического института, 4,* 10-14. Режим доступу: https://cyberleninka.ru/article/n/problema-formirovaniya-kreativnosti-pedagoga-v-sisteme-vysshego-pedagogicheskogo-obrazovaniya/viewer. (Havryliaka, N. L. (2017). The problem of the formation of a teacher's creativity in the system of higher pedagogical education. *Bulletin of Donetsk Pedagogical Institute, 4,* 10-14. Retrieved from: https://cyberleninka.ru/article/n/problema-formirovaniya-kreativnosti-pedagoga-v-sisteme-vysshego-pedagogicheskogo-obrazovaniya/viewer).

Глазунова, Л. И., Иванова, Т. И. *Содержание понятия «эмоциональная культура педагога»*. Режим доступа: http://www.emissia.org/offline/2013/1988.htm (Hlazunova, L. I., Ivanova, T. I. *The content of the concept of “emotional culture of a teacher”.* Retrieved from: http://www.emissia.org/offline/2013/1988.htm).

Гнатко, Н. М. (1994). *Проблема креативности и явление подражания*. Москва (Hnatko, N. M. (1994). *The problem of creativity and the phenomenon of imitation*. Moscow).

Горбанева, Л. В. (2009). Развитие профессиональной креативности будущих учителей физики. *Мир науки, культуры, образования, 7 (19),* 174-178. Режим доступу: https://cyberleninka.ru/article/n/razvitie-professionalnoy-kreativnosti-buduschih-uchiteley-fiziki/viewer (Horbaneva, L. V. (2009). Development of professional creativity of future physics teachers. *The world of science, culture, education, 7 (19),* 174-178. Retrieved from: https://cyberleninka.ru/article/n/razvitie-professionalnoy-kreativnosti-buduschih-uchiteley-fiziki/viewer).

Деркач, А. А. (2000). *Методолого-прикладные основы акмеологических исследований*. Москва (Derkach, A. A. (2000). *Methodological and applied foundations of acmeological research*. Moscow).

Еремина, Л. И. (2010). Формирование креативности студентов педа- гогического вуза в процессе социального воспитания. *Человек и образование, 2,* 129-132 (Yeremina, L. I. (2010). Formation of creativity of students of a pedagogical university in the process of social education. *Man and education, 2,* 129-132).

Зеер, Э. Ф., Попова, Л. С. (2012). Влияние уровня креативности на преодоление барьеров профессионального развития педагогов. *Образование и наука, 1,* 94-106 (Zeer, E. F., Popova, L. S. (2012). Influence of the level of creativity on overcoming barriers to professional development of teachers. *Education and Science, 1,* 94-106).

Калугин, Р. *Как развить эмоциональный интеллект EQ*. Режим доступу: https://romankalugin.com/kak-razvit-emocionalnyj-intellekt-eq/ (Kalugin, R. *How to develop emotional intelligence EQ*. Retrieved from: https://romankalugin.com/kak-razvit-emocionalnyj-intellekt-eq/).

Кан-Калик, В. А., Никандров, Н. Д. (1990). *Педагогическое творчество*. Москва (Kan-Kalik, V.A., Nikandrov, N.D. (1990). *Pedagogical creativity*. Moscow).

Кан-Калик, В. А. (1976). *Педагогическая деятельность как творческий процесс.* Грозный (Kan-Kalik, V. A. (1976). *Pedagogical activity as a creative process*. Groznyi).

Кетриш, Е. В. (2013). *Формирование проектировочной компетенции будущих педагогов в процессе непрерывной педагогической практики* (автореф. дис. … канд. пед. наук). Екатеринбург (Ketrish, E. V. (2013). *Formation of the design competence of future teachers in the process of continuous teaching practice* (PhD thesis abstract).

Климов, Е. А. (2983). Психолого-педагогические трудности проф консультации. *Новое в жизни, науке, технике. Сер. «Педагогика и психология», 2*. Москва: Знание (Klimov, E. A. (2983). Psychological and pedagogical difficulties professional consultation. *New in life, science, technology. Ser. “Pedagogy and Psychology”, 2*. Moscow: Knowledge).

Кострюков, А. В., Мирошникова, Д. В. (2015). Подходы к рассмотрению креативности в

педагогической практике будущих учителей. *Вестник Оренбургского государственного университета, 2 (177),* 83-86. Режим доступу: https://cyberleninka.ru/article/n/podhody-k-rassmotreniyu-kreativnosti-v-pedagogicheskoy-praktike-buduschih-uchiteley/viewer. (Kostriukov, A.V., Miroshnykova, D. V. (2015). Approaches to the consideration of creativity in the teaching practice of future teachers. *Bulletin of the Orenburg State University, 2 (177),* 83-86. Retrieved from: https://cyberleninka.ru/article/n/podhody-k-rassmotreniyu-kreativnosti-v-pedagogicheskoy-praktike-buduschih-uchiteley/viewer).

Краевский, В. В. (1994). *Методология педагогического исследования*. Самара (Kraievskyi, V.V. (1994). *Methodology of pedagogical research*. Samara).

Крупник, С.А. (2000). Методологические подходы к предмету педагогики. *Педагогика, 4,* 21-26 (Krupnik, S. A. (2000). Methodological approaches to the subject of pedagogy. *Pedagogy, 4,* 21-26).

Кузьмина, Н.В. (2008). Акмеология — теория фундаментального образования. *Акмеологія – наука XXI століття: развитокпрофесіоналізму: Матеріали 2-й межнар. науково-практичной конф*. К.: КМПУ им. Б.Д. Грінченка (Kuzmina, N. V. (2008). Acmeology is a theory of fundamental education. *Acmeology is a science of the XXI century: development of professionalism: Materials of the 2nd intern. Scientific and Practical Conf*. K.: KMPU named after B.D. Hrinchenko).

Кузьмина, Н.В. (1990). *Профессионализм личности преподавателя и мастера производственного обучения*. Москва (Kuzmina, N.V. (1990). *Professionalism of the personality of the teacher and master of industrial training*. Moscow).

Лазарєв, М. О. (2016). *Педагогічна творчість: Навчальний посібник для студентів, магістрантів, аспірантів педагогічного університету.* Суми: ФОП Цьома С.П. (Lazarev, M.O. (2016). *Pedagogical creativity: Textbook for students, graduate students, graduate students of the pedagogical university*. Sumy: FOP Tsioma S.P.).

Ляхова, Т. Ю. (2012). Креативность и компетентность как основа саморазвития будущего специалиста. *Среднее профессиональное образование, 9,* 51-53 (Liakhova, T. Yu. (2012). Creativity and competence as the basis for self-development of a future specialist. *Secondary vocational education, 9,* 51-53).

Мелекесов, Г. А. (2011). Аксиологическая функция педагогической практики студентов университета. *Вестник ОГУ, 2 (121),* 225-229 (Melekesov, H.A. (2011). The axiological function of the teaching practice of university students. *OSU Bulletin, 2 (121),* 225-229).

Митина, Л. М. (1998). *Психология профессионального развития учителя*. Москва (Mitina, L. M. (1998). *Psychology of teacher professional development.* Moscow).

Мороз, В. В. (2011). *Развитие креативности студентов: монография.* Оренбург: ОГУ (Moroz, V.V. (2011). *Development of students' creativity: monograph*. Orenburg: OSU).

Мороз, В. В. (2014). Креативность как аксиологическая доминанта непрерывного педагогического образования. *Вестник Челябинского Государственного Педагогического Университета, 4,* 109-119 (Moroz, V.V. (2014). Creativity as an axiological dominant of lifelong pedagogical education. *Bulletin of the Chelyabinsk State Pedagogical University, 4,* 109-119).

Никитин, О. Д. (2009). *Развитие креативности как основа профессиональной подготовки студентов педагогических вузов*. (автореф. дис. … канд. пед. наук). Москва (Nikitin, O.D. (2009). *Development of creativity as the basis of professional training of students of pedagogical universities*. (PhD thesis abstract). Moscow).

Попов, А. И. (2013). *Инновационные образовательные технологии творческого развития студентов. Педагогическая практика: учебное пособие*. Изд-во ФГБОУ ВПО «ТГТУ» (Popov, A. I. (2013). *Innovative educational technologies for the creative development of students. Pedagogical practice: textbook*. Publishing house of FGBOU VPO "TSTU").

Про затвердження професійного стандарту вчителя: Наказ Мінекономіки №2736 від 23.12.2020 (About the hardened professional standard of the teacher: Order of the Ministry

of Economics No. 2736 dated 12/23/2020). Retrieved from: https://nus.org.ua/news/zatverdyly-try-profesijni-standart-vchytelya-dokument/.

Пузеп, Л. Г. (2007). Креативность как одна из характеристик личности будущего педагога. *Омский научный вестник, 4,* 115-117. Режим доступу: https://cyberleninka.ru/article/n/kreativnost-kak-odna-iz-harakteristik-lichnosti-buduschego-pedagoga (Puzep, L. H. (2007). Creativity as one of the characteristics of the personality of a future teacher. *Omsk Scientific Bulletin, 4,* 115-117. Retrieved from: https://cyberleninka.ru/article/n/kreativnost-kak-odna-iz-harakteristik-lichnosti-buduschego-pedagoga).

Ревич, И. М. (2003). *Философия как учение о человечности*. Хабаровск: ХГПУ (Revych, I.M. (2003). *Philosophy as a doctrine of humanity*. Khabarovsk: KhSPU).

Рогов, Е. И. (1996). *Личность учителя : теория и практика*. Ростов-на-Дону : Феникс (Rogov, E. I. (1996). *The personality of the teacher: theory and practice*. Rostov-on-Don: Phoenix).

Роджерс, К. К. (1996). Теории творчества. *Личность: внутренний мир и самореализация: идеи, концепции, взгляды*. СПб.: Тускарора (Rogers, K. K. (1996). Creativity theory. *Personality: inner world and self-realization: ideas, concepts, views*. SPb.: Tuscarora).

Рындак, В. Г. (2012). *Педагогика креативности: монография*. Москва: Университетская книга (Ryndak, V. H. (2012). *Pedagogy of creativity: monograph*. Moscow: University Book).

Рындак, В. Г., Москвина, А. В. (2001). *Личность. Творчество. Развитие*. Москва: Педагогической вестник (Ryndak, V. H., Moskvina, A. V. (2001). *Personality. Creation. Development*. Moscow: Pedagogical Bulletin).

Рындак, В. Г. (2014). Формирование креативности будущего цчмтеля при изучении педагогических дисциплин. *Человек и образование, 2 (39),* 4-9. Режим доступу: https://cyberleninka.ru/article/n/formirovanie-kreativnosti-buduschego-uchitelya-pri-izuchenii-pedagogicheskih-distsiplin (Ryndak, V. H. (2014). Formation of creativity of the future cchmtel in the study of pedagogical disciplines. *Man and Education, 2 (39),* 4-9. Retrieved from: https://cyberleninka.ru/article/n/formirovanie-kreativnosti-buduschego-uchitelya-pri-izuchenii-pedagogicheskih-distsiplin).

Рындак, В. Г., Михалева, Е. С. (2017). Теоретические аспекты развития потенциала одаренного подростка в креативном образовании. *Вестник Оренбургского государственного университета, 10 (210),* 139-143. Режим доступу: https://cyberleninka.ru/article/n/teoreticheskie-aspekty-razvitiya-potentsiala-odarennogo-podrostka-v-kreativnom-obrazovanii. (Ryndak, V.G., Mikhaleva, E.S. (2017). Theoretical aspects of the development of the potential of a gifted adolescent in creative education. *Bulletin of the Orenburg State University,* 10 (210), 139-143. Retrieved from: https://cyberleninka.ru/article/n/teoreticheskie-aspekty-razvitiya-potentsiala-odarennogo-podrostka-v-kreativnom-obrazovanii).

Рындак, В. Г. (2003). *Уроки Сухомлинского: монография*. Москва: Педагогический вестник (Ryndak, V. H. (2003). *Sukhomlynskyi's lessons: monograph*. Moscow: Pedagogical Bulletin).

Сигида, Е. А. (2000). *Когнитивная креативность: традиции и новации (методы психологической активизации творческого мышления)*. Москва (Sigida, E.A. (2000). *Cognitive creativity: traditions and innovations (methods of psychological activation of creative thinking*). Moscow).

Сластенин, В. А., Подымова, Л. С. (1997). *Педагогика: инновационная деятельность*. Москва: Магистр (Slastenin, V. A., Podymova, L. S. (1997). *Pedagogy: innovative activity*. Moscow: Master).

Сорокина, О. В. (2010). Развитие креативности как профессионально-значимого качества личности у студентов-психологов. *Вестник МГОУ, 4,* 115-120 (Sorokina, O. V. (2010).

Development of creativity as a professionally significant personality trait among psychology students. *MSOU Bulletin, 4,* 15-120).

Стернберг, Р., Григоренко, Е. (1998). Инвестиционная теория креативности. *Психологический журнал, Том 19,* 2 (Sternberg, R., Grigorenko, E. (1998). Investment theory of creativity. *Psychological journal, Vol. 19,* 2).

Степаненко, Н. А. (2014). *Технология развития креативного потенциала будущего учителя в творческой учебно-профессиональной деятельности: учебно-методическое пособие*. Орск: Издательство Орского гуманитарно-технологического института (филиала ОГУ) (Stepanenko, N. A. (2014). *Technology for the development of the creative potential of the future teacher in creative educational and professional activities: teaching aid*. Orsk: Publishing house of the Orsk Institute of Humanities and Technology (branch of OSU).

Сухомлинский, В. А. (1981). *Разговор с молодым директором школы*. Москва (Sukhomlinsky, V.A. (1981). *Conversation with the young headmaster*. Moscow).

Творческая самореализация как научная проблема. (Справочник школьника). Режим доступу: samorealizaciya-osobistosti-yak-naukova-problema/2/ (*Creative self-realization as a scientific problem. (Student handbook)*. Retrieved from: samorealizaciya-osobistosti-yak-naukova-problema/2/).

Барышева, Т.А. (Ed.) (2014). *Творчество: теория, диагностика, технологии: Словарь-справочник*. СПб.: Изд-во ВВМ (Barysheva, T. A. (Ed.) (2014). *Creativity: theory, diagnostics, technology: Dictionary-reference book*. SPb.: Publishing house).

Тушакова, З. Р. (2013). *Педагогическая поддержка умственного развития учащихся по химии с использованием креативных карт* (автореф. дис. … канд. пед. наук). Москва (Tushakova, Z.R. (2013). *Pedagogical support for the mental development of students in chemistry using creative cards* (PhD thesis abstract). Moscow).

Уварина, Н. В. (2007). *Актуализация творческого потенциала младших школьников в образовательном процессе: монография*. Челябинск: Изд. центр «Взгляд» (Uvarina, N.V. (2007). *Actualization of the creative potential of junior schoolchildren in the educational process: monograph*. Cheliabinsk: Ed. center “Look”).

Флорида, Р. (2011). *Креативный класс: люди, которые меняют будущее*. Москва: Классика XXI (Florida, R. (2011). *Creative class: people who change the future*. Moscow: Classic XXI).

Шумовская, А. Г. (2013). Формирование креативной компетентности будущего педагога в научном сотворчестве (автореф. дис. … канд. пед. наук). Чита (Shumovska, A. H. (2013). *Formation of creative competence of the future teacher in scientific co-creation* (PhD thesis abstract). Chita).

Щербакова, Е. Е. (2006). Формирование педагогической креативности как фактора профессионального развития студентов. *Мир психологии, 1,* 142-152 (Shcherbakova, E. E. (2006). Formation of pedagogical creativity as a factor in the professional development of students. *The world of psychology, 1,* 142-152).

Щербакова, Е. Е. (2006). Педагогическая креативность как фактор профессионального развития студентов (автореф. дис. … докт. пед. наук). Чебоксары (Shcherbakova, E.E. (2006). *Pedagogical creativity as a factor in the professional development of students* (DSc thesis abstract). Cheboksary).

Щуринова, И. А., Тарантей, В. П. (2015). Педагогическая практика в рамках сетевого взаимодействия «школа-вуз» как фактор развития исследовательских компетенций у студентов – будущих педагогов: проблемы и перспективы реализации. *Научно-методический электронный журнал «Концепт», Т. 34,* 166-170. Режим доступу: http://e-koncept.ru/2015/95716. (Shchurinova, I.A., Tarantei, V.P. (2015). Pedagogical practice in the framework of the network interaction “school-university” as a factor in the development of research competences among students-future teachers: problems and prospects for implementation. *Scientific-methodological electronic journal “Concept”, T. 34,* 166-170. Retrieved from: http://e-koncept.ru/2015/95716).

Яковлева, Е. Л. (1996). Развитие творческого потенциала личности школьника. *Вопросы психологии, 3,* 36-43 (Yakovleva, E. L. (1996). Development of the creative potential of the student's personality. *Psychology issues, 3,* 36-43).

Яковлева, Е. Л. *Эмоциональные механизмы личностного и творческого развития*. Режим доступу: http://www.voppsv.ru/iournals all/issues/1997/974/974020.htm (Yakovleva, E.L. *Emotional mechanisms of personal and creative development*. Retrieved from: http://www.voppsv.ru/iournals all/issues/1997/974/974020.htm).

Якубовская, О. М., Гапийчук, И. М. (2001). *Основы дидактического эмоционального взаимодействия: учебно-методическое пособие по спецкурсу*. Винница: Велес (Yakubovska, O. M., Hapiichuk, I. M. (2001). *Fundamentals of didactic emotional interaction: Study guide for a special course*. Vinnytsia: Veles).

Richards, R. (2006). Frank Barron and the Study of Creativity: A Voice That Lives on. *Journal of Humanistic Psychology, Vol. 46, 3,* 352-370.

Runco, M, Richards, R. (1997). Evolution of creativity, information and ourselves. In: Runco M., Richards R. (Eds). *Eminent Creativity, Everyday. Creativity and Health*. London: JAI Press Ltd.

Simonton, D. K. (2012). Quantifying creativity: can measures span the spectrum? *Dialogues Clin Neurosci, 14 (1),* 100-104.

Taylor, C. W. (1998). Various approaches to and definitions of creativity. *The nature of creativity: contemporary psychological perspectives,* (99-121). Cambridge: Cambridge University Press.

ORGANIZATIONAL AND METHODOLOGICAL FOUNDATIONS OF FORMATION OF INFORMATION AND COMMUNICATION COMPETENCE OF FUTURE TEACHER OF HIGHER EDUCATION INSTITUTIONS IN CONDITIONS OF BLENDED LEARNING

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Abstract. The presented research is devoted to the theoretical substantiation of the model of formation of information and communication competence of the future teacher in the context of realization of the concept "New Ukrainian School" in the process of training bachelors. The essence of the key research categories "competence", "information and communication competence", "blended learning" has been analyzed. Based on the theoretical analysis, the structural components of information and communication competence (motivational-value, cognitive, operational-activity, reflexive) have been identified and highlighted. The structural-functional model of the formation of information-communication competence of the future teacher in the context of realization of the Concept "New Ukrainian School" has been substantiated and developed; the structural components of the model have been characterized. The pedagogical conditions of the model of the formation of information and communication competence of the future teacher as an agent of changes in the context of realization of the concept "New Ukrainian School" in the process of training bachelors in conditions of blended learning have been outlined.

Key words: information and communication competence, Concept "New Ukrainian School", bachelor training, blended learning, model, structural components, pedagogical conditions.

Introduction

Radical reform of the system of higher pedagogical education, due to Ukraine's accession to the European educational space and science, is aimed at training future professionals with a high level of professional competence, namely, information. Modernization of national education, introduction of new state educational standards, updating the content of education, changing the needs of the individual, society involves the formation of the social order of the system of pedagogical education.

In today's reality pedagogical education should become the basis and guarantee of ensuring the quality of training of the younger generation in general secondary education, which requires advanced training of future professionals in the field of education, in particular, teachers. In modern conditions the most competitive and successful in the labor market will be professionals who are able to self-study, self-development throughout life, think critically, independently achieve certain goals.

The problem of training future pedagogical specialists is reflected in the Laws of Ukraine "On Education" (2017), "On Higher Education" (2014), the Decree of the President of Ukraine "On the National Strategy for Education Development in Ukraine until 2021" (2013), Resolutions of the Cabinet of Ministers of Ukraine "On Approval of the National Qualifications Framework" (2020), "National Doctrine of Education Development of Ukraine in the XXI Century" (2002), "National Report on the Status and Prospects of Education in Ukraine" (2016), the State Program "Information and Communication Technologies in Education and Science", the Concept of "New Ukrainian School" (2016) and other regulations. The above documents reflect new requirements for the content of education and provide for radical changes in the process of training future teachers in the context of information educational environment.

Obtaining updated knowledge, forms of their acquisition is the basis for the development of the information society, the introduction of concepts to ensure the quality of higher education, "Lifelong learning". However, the question of organizational and methodological foundations of formation of information and communication competence of future teacher in institutions of higher education in the conditions of blended learning needs additional study.

Theoretical and methodological foundations of the competence approach and ways to implement it in the education system are thoroughly covered by domestic and foreign scholars (A. Verbytsky, M. Golovan, O. Goncharova, N. Demyanenko, O. Zhuk, S. Kalashnikova, V. Lugovyi, O. Ovcharuk, O. Pometun, Yu. Rashkevych, J. Talanova, A. Khutorsky and others); theoretical and methodological aspects of the use of ICT in the educational process have been studied in the works of V. Bazurin, V. Wember, N. Gnedko, A. Gurzhiy, M. Kademiya, M. Kerny, O. Kolgatina, A. Kolomiets, L. Konoshevsky, T. Hede, I. Shakhina and others); the preparation of future teachers for the use of ICT in professional activities is analyzed in the scientific works of M. Bubnova, M. Kohler, O. Semenikhina, O. Skafa, O. Spirina, O. Tutova and others.

Theoretical and practical principles of combining different forms of organization of educational activities are covered in the scientific works of V. Bykov, I. Voitovych, S. Gorobets, V. Kukharenko, N. Morse, V. Osadchy, K. Osadcha, O. Samoilenko, S. Semerikov, S. Sysoeva, E. Smirnova Trybulska, Y. Trius and others. Peculiarities of introduction of blended forms of education (traditional and distance) in the educational process are reflected in the works of N. Demyanenko, K. Kolos, O. Rafalska, N. Rashevska, O. Spirina, Y. Trius, O. Samoilenko, E. Smirnova-Trybulska and others.

The aim of the study is the theoretical substantiation of the model of formation of information and communication competence of future teacher in the context of realization of the concept "New Ukrainian School" in the process of training bachelors in the conditions of blended learning.

A set of interrelated research methods has been used to solve the tasks, in particular, theoretical methods: analysis, synthesis, generalization, comparison and systematization of scientific sources to determine the nature and content of key definitions of research; structural and logical analysis to determine the components, criteria, indicators and levels of information and communication competence; the modeling method has been used to develop a model for the formation of information and communication competence of the future teacher in the conditions of blended learning.

Research results

The dynamic development of the information society, information, and communication technologies (ICT) makes new demands on the educational training of future teachers, their professional skills, and abilities. Future professionals must be able to think freely and actively, independently generate and implement new ideas and educational technologies, model the educational process creatively, continuously develop using ICT. The focus is on the organization and implementation of distance learning, which allows creating a virtual educational environment for each student and apply innovative teaching methods using ICT.

Considering the new state requirements for the training of professionals of the current generation with a competitive level of qualifications, able to effectively solve educational problems, leads to an update of the content of education. The need to improve the professional training of future teachers is associated with the transition of the educational field from the knowledge (cognitive-informational) paradigm to the competence, as the new content of education is based on the formation of such competences that are important for the successful implementation of pedagogical activities in general secondary education in modern conditions.

Leading international organizations dealing with education, in particular UNESCO, UNICEF, and the Council of Europe, pay great attention to the development of competence-based education. Thus, the documents define the key competences that students must acquire for further successful work and/or study in higher education institutions. Competence-based guidelines focus on skills and

attitudes in accordance with the "Recommendations of the European Parliament and the Council of Europe on the development of key competences for lifelong learning" (December 18, 2006) (*On core competences for lifelong learning: Recommendation 2006/962/EU of the European Parliament and of the Council (EU),* 2006).

Theoretical analysis of the essence of the key concepts of the study "competence", "information and communication competence", "blended learning"

We will analyze the definition of the essence of the concept of "competence" by the experts from international organizations:

- ability to use knowledge and skills that ensure the active application of learning achievements in new situations (experts from the European Union (Eurydice, 2002)) (EURYDICE, 2002);
- a combination of knowledge, skills, values and attitudes applicable in daily activities (UNESCO Conference, 2004) (*Quality education and competencies for life,* 2004);
- ability to meet successfully personal and societal needs, to act and perform tasks ("Defining and selecting competencies: theoretical and conceptual principles" ("DeSeCo" within the Swiss Federal Statistical Office and the National Center for Educational Statistics of the United States and Canada (*DeSeCo,* 2001).

The UNESCO "ICT Competency Standards for Teacher" (ICTCST) emphasizes the need to use ICT by both teachers and students to succeed, study and work in the information society, in particular, to search for data, their analysis, to conduct certain operations with them; solve professional tasks and make decisions; creatively and effectively use all possible means to increase the productivity of training and professional work; become full citizens of the information society (*Competency Standards Modules,* 2008).

In the domestic educational space at the state level, the essence of the concept of "competence" is defined in the Law of Ukraine "On Higher Education" (2014), the National Qualifications Framework of Ukraine. Thus, according to the Law of Ukraine "On Higher Education" competence is interpreted as a dynamic combination of knowledge, skills and practical skills, ways of thinking, professional, ideological and civic qualities, moral and ethical values, which characterizes the ability of the individual to successfully implement professional and further educational activities and is the result of training at a certain level of higher education (*On Higher Education. With changes and additions,* 2014).

Therefore, according to the National Qualifications Framework, competence/competencies are considered as the ability of a person to perform a certain type of activity, which is expressed through knowledge, understanding, skills, values and other individual qualities (*National Qualifications Framework,* 2020).

However, the Concept of the New Ukrainian School defines the essence of the concept of "competence" as a dynamic combination of knowledge, ways of thinking, views, values, skills, abilities and other personal qualities that determine a person's ability to successfully perform professional and/or further educational activities (*New Ukrainian School,* 2016).

In the Ukrainian Encyclopedia of Education, the essence of the term "competence" is considered "as an integrated result that shifts the emphasis on the accumulation of normatively defined knowledge, skills and abilities to form and develop students' ability to act, apply successful experience in a particular field" (*Encyclopedia of Education,* 2008, p. 408).

Theoretical analysis of scientific and pedagogical literature, documentary sources, resolutions, recommendations provides an opportunity to state the fact that the problem of competence and competence approach in education has become the subject of study of well-known foreign (F. Weinert, G. Galazh, J. Goody, J. Delors, J. Consant, John Kullahan, W. Moser, T. Oates, J. Raven, D. Reichen, L. Salganik, G. Hallash and others), and prominent domestic scientists (I. Bekh, N. Bibik, L. Vashchenko, O. Matyash, O. Ovcharuk, O. Pometun, O. Savchenko and others). According to the competence approach, the transformation of the content of education is

determined primarily by the principles of its selection and structuring, aimed at the result of the educational process, namely the acquisition of competences by students.

We will try to present a terminological analysis of the essence of the concept of "information and communication competence" based on the analysis of theoretical sources on the research problem by different scientists in Table 1.

Table 1

Characteristics of the essence of the concept of "information and communication competence" (ICT)

Author	The essence of the concept of «information and communication competence» (ICT)
I. Vorotnikova	A set of knowledge, skills and abilities that are formed in the process of learning and self-learning of information technology, as well as the ability to perform pedagogical activities with the help of information technology (Vorotnikova, 2020)
S. Litvinova	An ability of a subject teacher to navigate in the information space, receive information and operate it in accordance with their own needs and requirements of modern high-tech society (Litvinova, 2008)
N. Pakhotina	Use of computers to collect, store, produce, and share information in teaching, research, work, and leisure (Pakhotina, 2008)
L. Popova	It manifests itself in the activity of solving various tasks and situations with the use of personal computers and computer information processing tools (Popova, 2018)
O. Ovcharuk	An ability to use ICT in education and everyday life; rational use of computers and computer tools in the process of solving problems, related to information processing, retrieval, systematization, storage, presentation and transmission; build information models and research them with the help of ICT tools (Ovcharuk, 2004)
O. Spirin	As a proven ability of the individual to use ICT in practice to meet personal needs and solve socially important, including professional problems in a particular subject area (Spirin, 2009)
O. Bigich	As knowledge of professionally significant sources of information and data; ability to search, accumulate, modify and use information and data to produce new knowledge in the process of professional communicative and cognitive activities (Bigich, 2007)
L. Pyetukhova	As a volume of knowledge, skills and abilities to acquire, transform, transmit and use information in various fields of human activity for the quality implementation of professional functions (Pyetukhova, 2007)

Thus, based on the analysis of theoretical sources on the research problem, it can be noted that the category of "information and communication competence" is complex and multifaceted. At the same time, it provides an opportunity to identify common components in understanding the essence of the concept of "information and communication competence", namely, the ability of the individual to navigate in the information space; possession of the appropriate level of knowledge, skills and abilities; ability to solve relevant tasks using information and communication technologies.

Within the framework of the New Ukrainian School Concept, it is determined that "the end-to-end use of information and communication technologies in the educational process and management of education institutions and the education system should become a tool for ensuring the success of the New Ukrainian School. The introduction of ICT in education should move from one-off projects to a systemic process that covers all activities. ICT will significantly expand the capabilities of the teacher, optimize management processes, thus forming in the student important for our century technological competencies" (*New Ukrainian School,* 2016, p. 8).

At the present stage of implementation of the provisions of the Concept "New Ukrainian School" there are significant changes in the domestic education system; appropriate conditions are provided for the gradual transition to a new level of education on the basis of information and communication technologies (equipping schools with computers, connecting them to the Internet, developing electronic educational programs, retraining teachers in terms of educational renewal).

Thanks to the efforts of the state, the material and technical foundations of the process of informatization of general secondary education in Ukraine are gradually being laid. In view of the above, it is necessary to state the fact that the training of the future teacher as an agent of change in the information educational environment requires a radical transformation.

We emphasize that the essence of the term "informatization of education" is interpreted as the process of providing education in the methodology and practice of development and optimal use of modern information technology, focused on the implementation of psychological and pedagogical goals of teaching, education (*Pedagogical Terminology Dictionary*, 2016).

In the context of scientific research, we consider it appropriate to note that information and communication competence is related to information and communication technologies (ICT), which are actively used in the pedagogical practice of higher education, which leads to a fundamentally new way of teaching, contributes to the enrichment and renewal of traditional teaching methods.

First of all, we highlight that the active use of modern ICT in higher education allows teachers to modernize the goals, content, methods, tools and forms of learning, to expand their own pedagogical opportunities, and it gives learners the opportunity to get closer to active work with information available to them. Scientist K. Wittenberg considers that the use of ICT provides an opportunity to constantly update the content, methods, forms of learning in accordance with the changes taking place in the information space of Ukraine and abroad (Wittenberg, 2010). Therefore, the problem of formation of information and communication competence of the future teacher in the conditions of blended learning is actualized.

In the domestic system of higher education, it is possible to distinguish the organization of the educational process in the form of blended learning, which depends on a number of factors, namely, readiness of the teacher to work in new conditions, readiness and needs of students, academic discipline, ICT competence of participants of educational process.

In the context of this study, we consider it appropriate to provide a definition of the essence of the concept of "blended learning", which allows us to implement one of the key tasks of informatization of the educational process, in particular "Implementation of modern information and communication technologies that provide improving the educational process, accessibility and effectiveness of education, preparing the younger generation for life in the information society" (*On the National Strategy for Education Development in Ukraine for 2012-2021*, 2013). Thus, in the current challenges, the issue of combining the traditional educational system with modern pedagogical innovations and ICT tools is relevant, namely in the form of learning as blended.

In the "Ukrainian-English educational dictionary of pedagogy" the concept of "blended learning" is mentioned (Avshenyuk, 2013, p. 174). However, in the scientific and pedagogical literature it is possible to find such concepts as "blended learning", "hybrid learning". We should make an attempt to characterize the different approaches to the interpretation of the essence of the concept of "blended learning" (Table 2).

Thus, there are different approaches to understanding the essence of the concept of "blended learning", namely, as a learning process, an educational concept, a purposeful learning process, a combination of traditional and distance learning, combinations of teaching methods, a hybrid of traditional full-time and online learning.

It should be added that within the concept presented by the Cristensen Institute, the phenomenon of "blended learning" is interpreted "as a formal curriculum in which the student studies as follows: the share of the educational process falls on online learning, which involves an element of student self-control in the choice of time, place, methods and/or pace of learning; a small part of the educational process falls on distance learning from home in specialized institutions under the supervision/guidance of someone; the learning process involves coherence and modality

between the learning activities of each pupil/student throughout the course or subject in order to provide an integrated learning experience" (Staker, 2012, p. 3).

Table 2

Interpretation of the essence of the concept of "blended learning"

Author	The essence of the concept of "blended learning"
N. Rashevska	A learning process, in which traditional learning technologies are combined with innovative technologies of electronic, distance and mobile learning in order to harmoniously combine theoretical and practical components of the learning process (Rashevska, 2011, p. 8)
A. Minina	An educational concept in which the student acquires knowledge both independently (online) and in person (with a teacher) (Minina, 2016)
A. Striuk	A purposeful process of acquiring knowledge, skills and abilities in the context of integration of classroom and extracurricular educational activities of educational entities based on the complementarity of traditional, electronic, distance and mobile learning technologies (Striuk, 2012, p. 29)
I. Stoliarenko	A combination of traditional learning with elements of synchronous and asynchronous electronic distance learning (Stoliarenko, 2015, p. 140)
R. Shivam	A combination of traditional teaching methods and online learning (Shivam, 2015, c. 36)
M. Nikitina	"A teaching system that combines full-time, distance and self-learning, which includes interaction between subjects and interactive sources of information, which reflects all the inherent components of the educational process (goals, content, methods, organizational forms, teaching aids), functioning in constant interaction with each other, creating a single whole" (Nikitina, 2012)
Yu. Tryus	"purposeful process of acquiring knowledge, acquiring skills and abilities, mastering the ways of cognitive activity by the subject of learning and development of his creative abilities on the basis of complex and systematic use of traditional, innovative pedagogical technologies and ICT learning on the principles of mutual complementarity quality of education" (Tryus, 2012, p. 304)
B. Collis	"a hybrid of traditional full-time and online learning, in which learning takes place both in the classroom and abroad, and the online component becomes a natural extension of traditional classroom learning" (Collis, 2001)

In the context of this study, we define the essence of the concept of "blended learning" as a purposeful process of forming ICT competence of future teachers in a combination of classroom and extracurricular educational work of students based on the use and mutual complementarity of traditional and electronic (distance and mobile) learning technologies.

So, we consider traditional learning as a process of forming a system of knowledge, skills, abilities, which occurs through direct interaction between teacher and students within the classroom and using traditional methods, tools and forms of organization of the educational process. At the same time, e-learning is characterized as "learning in which the main carriers of educational information are electronic educational resources, and communication between teachers and students takes place using ICT" (Maksak, 2013, p. 248).

According to the "Regulations on distance learning' (Order of the Ministry of Education and Science of Ukraine of 25.04.2013 № 466) distance learning is defined as "an individualized process of acquiring knowledge, skills, abilities and ways of human cognitive activity, which occurs mainly through the indirect interaction of distant participants in the learning process in a specialized environment, which operates on the basis of modern psychological, pedagogical and information and communication technologies" (*On approval of the Regulation on distance learning,* 2013).

In the scientific pedagogical literature, we find the term "mobile learning" (m-learning), which aims to create an educational environment using mobile electronic devices, which students can use as a means of access to educational materials contained on the Internet, anywhere and anytime (Semerikov, 2009, p. 119).

Modern challenges facing society around the world are leading to the emergence of new teaching methods, namely, mobile-oriented learning. However, the analysis of scientific and methodological literature proves that this issue requires a thorough study, clarification of the conceptual apparatus, coverage of methods of mobile-oriented learning, positive and negative aspects of the use of mobile devices.

At the present stage mobile-oriented learning is considered a new stage in the development of e-learning and aimed at using mobile devices as a learning tool. There is no doubt that the pedagogical potential of the latest mobile devices has led educational scientists to rethink mobile technologies and their implementation in the educational process.

Thus, mobile-oriented learning is introduced in parallel with traditional, distance, computer-based learning and allows the implementation of new blended forms of learning. However, the use of a mobile device is the main means of learning and access to information and educational resources. Such training takes place regardless of the location of the subjects of the educational process.

In our opinion, introduction of mobile-oriented learning has prospects for further development, as mobile devices are rapidly evolving along with mobile applications that students can use.

Theoretical analysis of scientific and pedagogical literature provides an opportunity to identify several models of blended learning.

1. Rotation model involves organization of training in one discipline/course, the alternation of classroom training of teachers and student or group of students and indirect interaction of educational participants process using ICT. We should note that the change of types of training activities can be fixed (scheduled) or flexible.

During the training the teacher uses interactive teaching methods, project method (individual or group), individual consultations, written assignments, etc. This model consists of a number of submodels: Station Rotation; Lab Rotation; "Flipped Classroom"; Individual Rotation.

2. Flexible model is aimed at mastering most of the curriculum in e-learning, with the bulk of the study material is initially presented online (within the institution of higher education). Thus, the teacher acts as a coordinator who organizes consultations (individual or group) to work out topics that are difficult to understand.

3. Self-Blend or A La Carte model gives students the opportunity to choose additional courses for basic education. Providers of educational services may include various education institutions. The effectiveness of this model of blended learning is due to the high degree of motivation of students to learn.

4. Online Driver or Enriched Virtual model involves mastering most of the training programs through electronic resources, as well as additional face-to-face or online consultations with the teacher (*iNACOL Blended Learning Teacher Competency Framework,* 2015, p. 7).

The presented foreign models are useful for studying and implementing in the educational process in order to modernize the national education system. However, it should be noted that the most optimal for use are the models "rotation by stations" (alternation of different activities), rotation of laboratories (alternate change of laboratories) and "flipped classroom", which combine traditional and distance learning technologies.

In our opinion, blended learning provides an opportunity to take advantage of traditional and distance learning with the use of ICT, especially creating a comfortable educational environment for learning, in which teachers and students will be able to carry out the process of teaching and learning effectively.

The organization of blended learning requires the definition of goals, objectives of the course, needs, scope of material and intellectual tasks. Every teacher must have online teaching strategies,

provide effective learning, and establish a clear schedule of face-to-face and online classes for students.

Within the framework of scientific research it is possible to single out a number of advantages of the organization of blended learning, in particular, students can independently acquire new knowledge with the help of electronic resources at a convenient time, and during communication with the teacher and classmates to practice new skills; students choose a convenient time and place (flexibility and accessibility); the teacher manages the process of organizing independent cognitive activity of students to obtain theoretical material; organization of group learning activities (group work on projects, discussions, seminars organized in the form of electronic teleconferences, forums) involves the formation of online communication skills; motivates students to self-education (forms a responsible attitude to learning, rational time planning, choosing the pace of learning material); the student improves the skills of using modern software and hardware; use of new tools and teaching methods, construction of new learning models; accountability and transparency of student learning outcomes; reduction of costs for the organization of the educational process (efficiency).

Despite the advantages of blended learning, there are some problems with its implementation. Foreign researcher J. Hoffman identifies not only problems but also the ways how to solve them, in particular:

1. Technology challenges: providing participants in the educational process with technology, that is the gradual introduction of technology into the educational process (from simple to complex).

2. Organizational challenges: recognition of the effectiveness of blended learning; management and monitoring of students' academic performance.

3. Instructional/design challenges: careful planning of each stage of the lesson, the use of various forms of work, creating a learning environment to achieve the goal (defining goals using Bloom's taxonomy); introduction of online interactive exercises; requirements for assessing the educational activities of students; ensuring coordination of all elements of the course (Hofmann, 2014).

Thus, the educational process, organized in the form of blended learning, is aimed at the development of personality-centered learning and the formation of a comprehensively developed personality. Specific features of blended learning include: interactivity and adaptability of educational material; flexibility, informativeness of educational material; clear structure and novelty of educational material; manufacturability; independent and individual work of students; availability of materials for visual support of the educational process; mobility; modularity; combining digital content with material received in the audience.

In the context of the study the components of blended learning have been identified: face-to-face learning – traditional classes in the classroom under teacher's guidance; online learning – work of the students and teachers in the mode of synchronous interaction online (webinars, conferences, forums, etc.); self-place learning – students' independent work: performance of practical and laboratory works, search of educational materials; work in cloud environments and with online services (Shivam, 2015).

Valuable for our study is the definition of twelve basic competences that a future teacher should have to conduct effective activities in a blended environment. These competences are grouped into four blocks, namely:

1. Mindsets: includes priority values and beliefs that govern the processes of thinking, behavior, actions of the individual and related to the goals of educational change, tasks in blended learning activities. Such competences as a new vision of teaching and learning, focus on change and improvement are included.

2. Personal qualities: personal traits and patterns of behavior that help the teacher make the transition to new methods of teaching and learning. Such competences include flexibility, mobility, purposefulness, foresight, determination, desire for further self-improvement and so on.

3. Adaptive skills: complex skills that help teachers collaborate, solve new problems and find constructive solutions, implement innovations in the educational process. The following competences are singled out: constant self-improvement and innovation, communication.

4. Technical skills: assessment of learning, learning management not only the whole group, but also everyone, the organization of individual forms of learning with a combination of work in small and large groups, ability to apply different teaching aids, methods, online and offline resources, the ability to combine teaching aids and administration dynamically. The following competences are identified: information experience, learning strategies, experience of blended learning activities, learning tools or equipment (Powell, Ed, 2014, pp. 10-12).

Thus, the combination of traditional and online learning technologies helps teachers to create a new information and educational environment in order to achieve the goals of the educational process and to make new demands on the professional and pedagogical training of future teachers.

We are convinced that in the future the development of blended learning can become one of the priority areas of transformation of the modern system of higher education, as it helps to increase the effectiveness of learning through a combination of traditional and distance learning, involves the formation of a future specialist with the necessary set of key competences, able to solve a variety of professional problems in future.

Substantiation of the structural-functional model of formation of information and communication competence of the future teacher in the conditions of blended learning

Theoretical analysis of the research problem is the basis for developing a structural-functional model of information and communication competence of future teacher in the context of realization of the concept "New Ukrainian School" in the process of training bachelors in the conditions of blended learning (Fig. 1), which provides for such structural blocks, namely, target, content, procedural-activity and criterion-effective (Chernyakova, 2021). The target block consists of a clearly defined goal, methodological approaches, and principles. The content block defines the system of knowledge, skills, and abilities on ICT. The procedural-activity block contains the forms, methods and means of forming the information and communication competence of the future teacher. The criterion-effective block covers the structural components of information and communication competence, namely, motivational-value, cognitive, operational-activity, reflexive; criteria – axeological, semantic, technological, personal; indicators and levels of formation of information and communication competence (high, medium, low). The result is formation of information and communication competence of the future teacher in the context of the implementation of the Concept "New Ukrainian School".

In the context of our study, we characterize certain structural blocks of the presented model of formation of information and communication competence of the future teacher. Thus, the target block contains the methodological and didactic basis for the implementation of the model, first of all, the purpose, methodological approaches and principles of formation of information and communication competence of the future teacher.

The study of this problem provides an opportunity to highlight the most appropriate methodological approaches to its solution, namely, systems, activity, student-centered, competence, synergetic, acmeological, information technology.

In the context of the study, the systems approach provides research on the system-forming connections of the process of development of information and communication competence of the future teacher in the process of professional training; allows tracking general properties and qualitative characteristics of individual elements considered in the interaction. This approach is the starting point for the formation of information and communication competence of future teachers of the new Ukrainian school. In our opinion, it is the system approach that helps to consider the structure of information and communication competence as a dynamic system, helps to explore the interaction of its components that ensure its effective functioning.

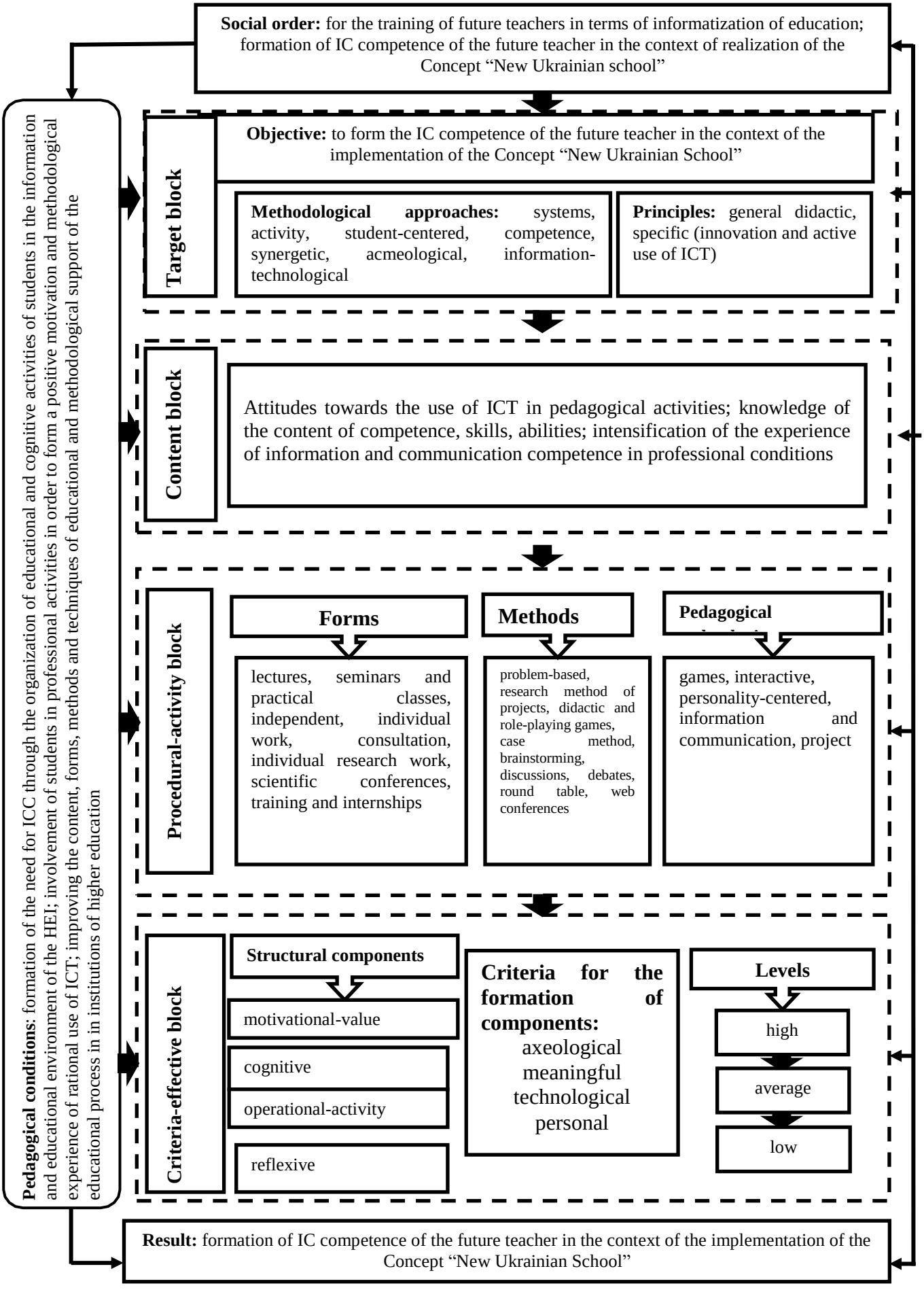

Fig.1. Model of formation of information and communication competence of the future teacher in the context of realization of the Concept "New Ukrainian school"

The activity approach is aimed at the organization of students' activities, which involves the use of ICT in the development of academic disciplines and solving problems of future professional activity, self-development on the formation of information and communication competence in future professional activities and personal development, changing the level of creative thinking and professional competence of students. The activity approach provides a practical focus of the process of training future teachers on the formation of skills to use ICT in professional and pedagogical activities in the implementation of the Concept "New Ukrainian School".

The student-centered approach involves finding out the individual characteristics, needs, interests of each student to provide conditions that stimulate him to active learning activities with the use of ICT, in order to form ICT competence.

Competence approach is crucial in the process of transformation of all parts of the educational system in Ukraine, so training of modern future teachers in higher education institutions must meet the needs of society in need of highly qualified specialists. We fully share the opinion of G. Shevchenko that the competence approach is aimed at comprehensive training and education of the individual not only as a specialist, a specialist in a particular case, but also as a person, who strives for self-improvement, creative development and creativity, self-realization, humanistic behavior in society (Shevchenko, 2009). Competence approach reflects learning outcomes not only through the expansion of knowledge, skills and abilities in ICT and their use in professional activities, but also experience, emotional and value attitude to ICT as a tool lifelong learning as a means of cooperation and social communication.

Synergetic approach promotes self-realization, self-development of the individual future teacher of the new Ukrainian school and is carried out through his constant interaction with the subjects of the educational process through and with the help of ICT. We will add that the synergetic approach is based on dominance in education activities of self-education, self-organization, self-government and consists in stimulating or arousing influence on the subject for its purpose self-disclosure and self-improvement in the process of cooperation with other people and with himself. The application of a synergetic approach to the organization of the educational process provides an opportunity to consider the dynamics and mechanisms of self-organization of the subjects of the educational process, ensures the formation of a holistic, creative personality of the future teacher.

Acmeological approach is aimed at improving and correcting the professional activities of the individual, provides management of individual and professional development of the future teacher, orients him to continuous self-improvement and the ability to self-realization, self-regulation and self-organization. This approach ensures development of the teacher's personality through the organic unity of the processes of professional education, socialization, as well as self-education and self-development. We consider that implementation of the acmeological approach will ensure the ability of each individual to self-realization and self-expression in professional activities; to self-control and self-assessment in professional activities; stimulation to self-organization, constant self-improvement, increase of professional skill for achievement of success in the further professional activity.

The information-technological approach promotes activation of cognitive and practical activity of students by means of free possession of ICT, increase of efficiency of training and social and professional adaptation of future professionals. This approach is used to enrich students' experience with the ability to navigate in modern software, work with information, apply new digital technologies in the field of professional activities and have the technology to use information and digital technologies.

Thus, each of these approaches in research provides an opportunity to consider the process of formation of information and communication competence of the future teacher from the standpoint of its versatility and integrity, to find out the mechanisms that ensure its integrity, various types of connections to build a structural and functional model.

In the context of the study, it has become possible to identify a set of principles based on the outlined methodological approaches. The principles that underlie the formation of information and

communication competence of the future teacher at the Ukrainian school include general didactic: the principle of scientificity, the principle of systematicity and consistency, the principle of accessibility; the principle of consciousness and activity; the principle of clarity; the principle of strength of assimilation of knowledge, skills, and abilities; the principle of individual approach.

So, the principle of scientificity involves the disclosure of causal relationships of phenomena, processes, events, the inclusion in the teaching aids of scientifically proven knowledge that corresponds to the current level of development of science. It is implemented in the content of curricula, which should combine scientific knowledge with accessibility, comprehensibility for students of the appropriate age and level of training.

The principle of systematic and consistent learning involves systemic and consistent teaching and learning of educational material, learning in a certain order, system. This principle requires a logical construction of both content and educational process. Depending on the content of the work, its goals, the teacher uses a certain system of teaching methods, directs the cognitive activity of students from simple reproduction to independent creative activities with the studied material.

The principle of accessibility of education is realized through compliance with the rules: from simple – to complex, from known – to unknown, from close – to distant, as well as considering the level of development of students of higher education institutions, their individual characteristics. This principle is aimed at ensuring the variability of content and different forms of presentation of educational material.

The principle of consciousness and activity is realized through directing cognitive activity of students and its management. Conscious assimilation of knowledge is facilitated by explanation of the purpose and tasks of the subject, its importance for overcoming life problems and for student prospects; use in the learning process of mental operations (analysis, synthesis, generalizations, inductions, deductions); positive emotions and learning motives; proper control and self-control.

The principle of clarity promotes mental development, facilitates the process acquisition of knowledge, develops the motivational sphere, and stimulates interest in acquiring new knowledge. The presented clarity should be meaningful, aesthetically designed, comply with the psychological laws of perception and not cause additional associations, for example, multimedia presentations, which students perceive with several senses, which helps to optimize the educational process.

The principle of strength of assimilation of knowledge, skills and abilities is focused on conscious and thorough assimilation of facts, concepts, ideas, rules, deep understanding essential characteristics of objects and phenomena, the relationships between them and within them. Implementation of this principle involves: repetition of educational material by sections and structural parts, memorizing new material in combination with the studied, isolation when repeating the main ideas, use in the process of repetition of various techniques, forms and approaches, exercises, independent work on the creative application of knowledge.

The principle of individual approach gives each student the opportunity to master the study material in their own way, considering their level of development, knowledge and skills, cognitive and practical independence, interests, will, ability to work.

It is necessary to focus attention not only on the basic general didactic principles in the process of forming information and communication competence of the future teacher, but also on specific principles, namely, the principle of innovation and the principle of active use of ICT learning.

Hence, the principle of innovation allows you to quickly make changes in the educational process, to introduce new innovative methods, techniques, pedagogical technologies, tools, based on the latest advances in science, technology, technology. This principle is actualized due to the scientific and technical process, informatization of education.

The principle of active use of information and communication technology is the skillful use of appropriate multimedia software, in the competent selection of electronic learning tools, forms and methods of working with them throughout the educational process in a pedagogical institution of higher education.

In our opinion, this principle is important for training of a competitive graduate, whose professional activity will be aimed at implementing the provisions of the Concept "New Ukrainian School" and formation of key competences of future school graduates.

In the context of our study, we emphasize that the content block includes the content of pedagogical education in general, the assimilation of which creates conditions for the formation of students' professional knowledge, skills related to ICT and features of ICT in future careers. In particular, we are talking about the disciplines of pedagogical direction: "Pedagogy", "History of Pedagogy", "Comparative Pedagogy", "Pedagogical Creativity", "Methods of educational work".

In today's conditions distance learning with the use of ICT during training in a pedagogical institution of higher education is becoming more widespread and intensified. Thus, within the study it is possible to identify the organization of the educational process in the form of blended learning, which depends on a number of factors, namely, teacher readiness to work in new conditions, readiness and needs of students, discipline, ICT competence of participants.

Our own experience provides an opportunity to assert that during the performance of students' independent work increases the degree of freedom and responsibility for the organization and implementation of educational and cognitive activities (Chernyakova, 2018). According to blended learning, the roles of the teacher change, becoming a researcher, developer, integrator, leader, tutor at the same time. In other words, the teacher acts as a facilitator in blended learning. For the first time in the scientific community, the term "facilitator" was introduced by psychologist K. Rogers, who emphasizes that the facilitator should help students learn, express themselves as individuals, interest, support in the search for knowledge (Rogers, 2002).

Therefore, the combination of traditional and ICT learning technologies is aimed at effectively achieving the goals of the educational process using the potential of each educational environment. Positive features of blended learning are the implementation of competence-based and personality-centered approaches in the educational process, ensuring communication and interaction between students and teachers, the development of ICT competences, critical thinking, increasing motivation to learn, optimal distribution of educational resources, incentives to engage in self-education using ICT.

Procedural and activity block of the model of formation of information and communication competence includes forms (lectures, seminars and practical classes, independent, individual work, consultations, individual research work, conferences, training and internships), methods (problem, research, project method, didactic and role-playing games, case method, brainstorming, discussions, debates, round tables, web conferences), technologies (game, interactive, personality-oriented, information-communicative, project).

The criterion-effective block indicates the processes of diagnosis and control of changes that occur in the process of forming information and communication competence of the future teacher, provides an opportunity to compare the results with the expected ones.

Characteristics of structural components of information and communication competence of the future teacher at the new Ukrainian school

According to the logic of our research, it is necessary to clarify the content and structural components of information and communication competence of the future teacher and to outline the pedagogical conditions for its formation.

Theoretical analysis of scientific and pedagogical literature shows the diversity of approaches to the interpretation of the content and structure of information and communication competence. We describe the most distinguished approaches in our study Thus, according to A. Tolkachyova, the structure of information and communication competence determines: cognitive and social motivation; knowledge system; a set of skills and abilities; methods of activity and subjective experience; individual and personal characteristics of the teacher; accordingly, the following components were identified, namely, motivational-value, cognitive, operational-activity, practical and personal (Tolkachyova, 2012).

At the same time the scientist L. Ismagilov reveals the following components: the presence of a sufficient level of functional literacy in relation to ICT; effective substantiation of the use of ICT in activities to solve professional, social and personal problems; understanding of ICT as the basis of a new paradigm in education aimed at developing students as subjects of information space, capable of creating knowledge, handling information to obtain a new intellectual or activity result (Ismagilova, 2012).

The following components in the structure of information and communication competence are characterized in Yu. Plaksina's research: cognitive (readiness and ability to master new information, its interaction with existing knowledge); motivational (level of motivational motivations that influence the choice of important value orientations in the new information environment); communication (knowledge, understanding, application of technical means of communication in the process of transmitting new information); reflexive (the level of self-regulation of the individual associated with the expansion of self-awareness, as well as self-realization in professional activities); technological (understanding of the principles of operation and capabilities of information technology) (Plaksina, 2007).

In the context of our study on the basis of the analysis of scientific and pedagogical literature it has become possible to identify the structural components of information and communication competence of the future teacher of the new Ukrainian school, namely: motivational-value, cognitive, operational-activity, reflexive.

We characterize the above structural components of information and communication competence of the future teacher. Thus, the motivational-value component includes motives, goals, needs for professional training, improvement, self-education, self-development, values of actualization in professional activities, stimulates the creative expression of personality in professional activities. This component implies the presence of interest in professional activities, which characterizes the human need for knowledge, in mastering effective ways of organizing professional activities.

The cognitive component contains a set of knowledge of theoretical and practical nature; provides knowledge of information and information processes, methods of its processing to solve professional problems, provides free mastery of the teacher's skills of information processing and work with information objects, which accordingly affect the skills of improving professional knowledge and skills, knowledge of interdisciplinary links, etc.

The operational component is aimed at the active use of information technology and computers in professional activities as a means of knowledge and development of ICT competence, self-improvement and creativity, as well as the formation of similar qualities in their students. It involves the formation of skills to process information in various forms of its receipt, the ability to use ICT. The communicative component is important because it is manifested in the ability to establish interpersonal relationships, choose the optimal style of communication in different situations and master the means of verbal and nonverbal communication.

The reflective component of the information and communication competence of the future teacher is determined by his attitude to himself and the world, to his practical activities and its implementation, as well as self-realization in the professional sphere. We believe that reflective activity involves the development of self-awareness, which is manifested in self-knowledge, self-esteem and self-regulation of behavior; desire for personal development, self-expression and self-regulation.

According to the logic of scientific research, it is necessary to clarify the criteria for determining the levels of formation of information and communication competence. The axiological criterion determines the students' professional orientation in the formation of information and communication competence in future professional activities; awareness of the goals of information activities of future teachers. The axiological criterion expresses the readiness of the future teacher to actualize information and communication competence.

The semantic criterion characterizes the knowledge of ICT methods and tools; mastering the system of knowledge necessary for information and communication competence; knowledge of the

peculiarities of the use of ICT in future professional activities. The semantic criterion expresses the possession of knowledge of the content of information and communication competence of the future teacher of the new Ukrainian school.

The technological criterion determines the formation of practical skills and abilities to use ICT in future professional activities; ability to work with pedagogical software, ability to solve professional problems with the help of mobile, computer and cloud-oriented multimedia systems, create electronic educational resources based on them (multimedia teaching aids, didactic and methodological materials, interactive tests, etc.). This criterion expresses the experience of information and communication competence of the future teacher in various standard and non-standard situations in professional activities.

The personal criterion includes personal qualities and abilities necessary for professional activity with the use of ICT the ability to self-development, self-organization, interaction with participants in the educational process, creativity, creativity through ICT, and also provides an appropriate attitude to the implementation of professional activities using ICT, analysis of its results, identifying further needs for professional and personal development.

Accordingly, the content of each criterion is specified by a set of indicators that allow us to diagnose the general level of information and communication competence of the future teacher of the new Ukrainian school.

So, the indicators of the axeological criterion are the presence of interest in mastering ICT; defining ICT as a tool for lifelong learning, as a means of cooperation and social communication; awareness of the personal meaning and significance of ICT; striving for professional self-improvement in mastering ICT.

The indicators of the content criterion are the completeness, depth, systematic knowledge about the use of ICT; knowledge and understanding of methods of search, classification, transformation, analysis, and storage of information; knowledge of the peculiarities of the implementation of ICT in professional activities.

At the same time the indicators of the technological criterion are the possession of ICT, a set of operational skills; possession of information processing skills; ability to work with pedagogical software; the ability to find, transmit and produce a variety of educational information using ICT, the ability to master new ICT, in particular, subject-oriented, assess their functionality and effectiveness for solving professional problems.

The indicators of personal criteria are mastery of ICT, information processing skills; ability to exercise self-control, self-analysis, self-assessment of ICT use; ability to reflect on educational and cognitive and professional activities with the use of ICT, to a creative approach to solving professional problems with the use of ICT; formation of critical thinking.

Based on the defined criteria and indicators, the levels of information and communication competence of the future teacher of the new Ukrainian school are singled out, namely, high, medium, low. We will consider the dynamics of the development of information and communication competence of the future teacher.

The students with a high level of information and communication competence are characterized by such features as adequacy and completeness of ideas about the content of ICC, its peculiarities, personal and social significance, the presence of a lasting interest in mastering ICT, plans and prospects for professional growth. Motivation of professional self-improvement in relation to mastering ICT, stability of professional intentions, persistence, awareness of personal meaning and importance of information and communication competence are clearly expressed are clearly expressed.

The students are characterized by completeness, depth, systematic knowledge of ICT. They have knowledge of the peculiarities of the use of ICT in future professional activities. Such students show a high level of cognitive activity, creativity and independence during classes, have excellent knowledge of ICT, operational skills and information processing skills; are able to carry out self-control, self-analysis and self-assessment of the use of ICT, systematically work on professional self-development.

The students with an average level of information and communication competence show interest in the chosen profession, consider their professional choice correct, generally have a positive attitude to professional growth, however, they are not very aware of the importance of information and communication competence and have somewhat fragmentary ideas about ICT. Students are generally familiar with the peculiarities of the use of ICT in professional activities, but the use of ICT in pedagogical practice causes them some difficulties. They are interested in ICT, but the structure of motivation is dominated not by professional motives, but the desire for knowledge.

The students have sufficient ICT, operational skills and information processing skills, but do not always know how to work with pedagogical software; their desire for professional self-improvement in mastering ICT is not always supported by the necessary willpower. Self-monitoring and self-assessment of the use of ICT is carried out with the support of the teacher.

So, the students with a low level of information and communication competence are characterized by a cursory interest in professional activities, the motives for which do not correspond to its internal content but are mostly external to the mastery of ICT. They are insufficiently aware of the personal meaning and importance of information and communication competence for their professional activities. The students have unstable professional intentions, so they do not strive for professional self-improvement in mastering ICT. They have superficial, stereotypical knowledge about ICT. The students rarely think about the possibility and necessity of using ICT in professional activities. Such students also have a low level of operational skills and skills of information processing, which leads to cognitive inactivity during classes, inability to exercise self-control, self-analysis and self-assessment of ICT, inability to reflect; insufficient attention to professional self-improvement in relation to mastering ICT in general.

Thus, we are certain of the fact that the criteria, indicators and levels determined on the basis of the analysis of scientific and pedagogical literature and own research objectively reflect the real process of formation of information and communication competence of the future teacher of the new Ukrainian school.

In the context of scientific research, it is necessary to substantiate the pedagogical conditions for the implementation of the presented model of formation of information and communication competence of the future teacher of the new Ukrainian school. The basis for determining the pedagogical conditions have been the Law of Ukraine “On Higher Education”, “On the National Informatization Program”, the requirements of the Industry Standard of Higher Education of Ukraine, the Concept “New Ukrainian School”.

The first pedagogical condition includes the formation of the need for ICT through the organization of educational and cognitive activities of students in the information and educational environment of higher education institutions. The formation of information and communication competence of the future teacher takes place in the information and pedagogical environment with the use of ICT (Internet, electronic conferences, e-mail, Web-technologies, network communities, etc.). In accordance with the implementation of ICT in the educational process the didactic tools, methods, forms of learning, pedagogical technologies, which involves the transformation of the traditional educational environment to a new – information and pedagogical environment, are changing. Consequently, it will provide a system of opportunities for effective personal development of future teachers during training in pedagogical institutions of higher education.

The second pedagogical condition is involvement of students in professional activities to form a positive motivation and methodological experience of rational use of ICT in future professional and pedagogical activities. It is contextual learning that makes it possible to bring learning activities closer to the future professional activities through its reproduction or imitation. Therefore, the leading forms of education can be distinguished simulation, role and business games, modeling of real problems, situations, solving pedagogical problems, training, etc.

However, the implementation of this condition involves the modernization of the information and pedagogical environment of the pedagogical institution of higher education in accordance with the provisions of the Concept “New Ukrainian School”; active involvement of students in professional activities in this environment.

The third pedagogical condition is the improvement of the content, forms, methods and techniques of educational and methodological support of the educational process in the institution of higher education, which is aimed at forming the information and communication competence of the future teacher of the new Ukrainian school. Fulfillment of the specified condition provides the student-centered approach to educational process, partnership relations between the student and the teacher, aimed at cooperation, organization, and management of the learning process, focused on the end result – it is the achievement of learning goals and tasks. The use of ICT allows students to adapt to the educational process taking into account modern requirements for professional and pedagogical training and opens new opportunities for future teachers of the new Ukrainian school.

We fully agree with the opinion of G. Ponomaryova, who emphasizes that the effectiveness of student training depends on the ability of the teacher to create a motivational mood, an atmosphere of cooperation, mutual understanding. The researcher emphasizes the importance of implementing pedagogical techniques and teaching methods, this is what helps students feel part of the educational process, to experience a situation of success during professional training (Ponomaryova, 2014).

Therefore, in order to implement this condition, it is necessary to update the content of work programs of academic disciplines with the active use of ICT; improving the forms, methods and techniques of the educational process; proper educational and methodological support in order to form the information and communication competence of the future teacher of the new Ukrainian school.

In our opinion, compliance with the above pedagogical requirements will ensure the formation of information and communication competence of the future teacher in the context of the implementation of the Concept "New Ukrainian School" and professional and pedagogical training of future professionals.

Conclusions

In the conducted research based on the theoretical analysis of psychological and pedagogical literature:

- the essence of key categories of research "competence", "information and communication competence", "blended learning' in scientific research of domestic and foreign scientists has been analyzed;
- it has been found out that information and communication competence is the ability of an individual to navigate in the information space and have the appropriate level of knowledge, skills and abilities to solve pedagogical problems;
- the structural components of information and communication competence (motivational-value, cognitive, operational-activity, reflective) have been identified and highlighted;
- the structural-functional model of formation of information and communication competence of future teachers in the context of the Concept "New Ukrainian School", which includes the following structural blocks: target, content, procedural and criteria-based has been substantiated and developed;
- the pedagogical conditions that contribute to the effectiveness of the process of forming information and communication competence of the future teacher in the context of the implementation of the Concept "New Ukrainian School" have been identified and characterized.

The study does not cover all aspects of the outlined problem. A promising area of further research will be the experimental verification of the effectiveness of this model in the conditions of blended learning in pedagogical institutions of higher education.

References

Авшенюк, Н.М. (2013). *Українсько-англійський навчальний словник з педагогіки: словник.* К. : Педагогічна думка (Avshenyuk, N.M. (2013). *Ukrainian-English educational dictionary of pedagogy: dictionary*. K.: Pedagogical thought)

Бігич, О. (2007). Інформаційно-комунікаційна компетенція викладача іноземної мови: розробка авторських додатків. *Vědecký potencial světa. «Dil 3. Pedagogika. Filologicke vědy. Psychologie a sociologie»*: *materialy IY mezinarodni vědecko-prakticka konference*. Praga: Publishing House «Education and Science» (Bigich, O. (2007). Information and communication competence of the teacher foreign language: development of author's applications. *Vědecký potencial světa. «Dil 3. Pedagogika. Filologicke vědy. Psychologie a sociologie»*: *materialy IY mezinarodni vědecko-prakticka konference*. Praga: Publishing House «Education and Science».)

Віттенберг, К. (2010). *Підготовка майбутніх вихователів засобами інформаційно-комунікаційних технологій до навчання дітей іноземних мов* (автореф. дис… канд. пед. наук: 13.00.04). Херсон (Wittenberg, K. (2010). *Preparation of future educators by means information and communication technologies for teaching children foreign languages* (PhD thesis abstract). Kherson).

Воротнікова, І. П. (2020). *Система підготовки вчителів до використання інформаційних технологій у професійній діяльності у післядипломній освіті.* Retrieved from: http://www.loippo.lg.ua/konference (Vorotnikova, I. P. (2020). *Teacher training system for use information technology in professional activities in postgraduate education*. Retrieved from: http://www. loippo. lg. ua/konference).

Исмагилова, Л. М. (2008). *Информационно-коммуникационная компетентность педагога в условиях перехода на новые стандарты.* Retrieved from: http://nsportal.ru/shkola/materialy-kattestatsii/library/informatsionno-kommunikatsionnaya-kompetentnost-pedagogav-us (Ismagilova, L. M. (2008). *Information and communication competence of the teacher in the transition to new standards*. Retrieved from: http://nsportal.ru/shkola/materialy-kattestatsii/library/informatsionno-kommunikatsionnaya-kompetentnost-pedagogav-us).

Енциклопедії освіти (2008). К.: Юрінком Інтер (*Encyclopedia of Education* (2008). K.: Jurinkom Inter).

Компетентнісний підхід у сучасній освіті: світов. досвід та укр. перспективи (2004). К.: К.І.С (*Competence approach in modern education: worlds. experience and Ukrainian perspectives* (2004). K.: KIS).

Литвинова, С. Г. (2008). Шляхи формування інформаційнокомунікаційної компетентності вчителів-предметників. *Комп'ютер у школі та сім'ї, 2,* 8 (Litvinova, S. G. (2008). Ways of formation of information and communication competence of subject teachers. *Computer at school and family, 2,* 8).

Максак, І. В. (2013). «Blended learning» як інноваційний підхід у формуванні професійної компетентності вчителя англійської мови початкової школи. *Вісник Чернігівського національного педагогічного університету ім. Т.Г. Шевченка, 110,* 247-249. Retrieved from: http://visnyk.chnpu.edu.ua/?wpfb_dl=1334 (Maksak, I. V. (2013). «Blended learning» as an innovative approach of professional competence formation of primary school English teachers. *Bulletin of Chernihiv National Pedagogical University named after T.G. Shevchenko, 110,* 247-249. Retrieved from: http://visnyk.chnpu.edu.ua/?wpfb_dl=1334).

Національна рамка кваліфікацій: додаток до постанови Кабінету Міністрів України від 23.11.2011 р. № 1341 (у редакції постанови Кабінету Міністрів України від 25.06.2020 р. № 519 (National Qualifications Framework: Annex to the Cabinet Resolution of Ministers of Ukraine dated 23.11.2011 № 1341 (as amended by the resolution of the Cabinet Ministers of Ukraine of June 25, 2020, № 519). Retrieved from: https://zakon.rada.gov.ua/laws/show/1341-2011-%D0%BF#n37

Минина, А.А. (2016). *Модель смешанного обучения иностранным языкам: преимущества и недостатки*. Retrieved from: http://www.nop-dipo.ru/ru/node/473 (Minina, A.A. (2016). *The model of blended learning of foreign languages: advantages and disadvantages*. Retrieved from: http://www.nop-dipo.ru/ru/node/473).

Никитина, М. С. (2012). Теоретико-методологические аспекты исследования проблемы смешанного обучения. *В мире научных открытий, 1,* 167-176 (Nikitina, M. S. (2012). Theoretical and methodological aspects of studying the problem of blended learning. *In the world of scientific discoveries, 1,* 167-176).

Нова українська школа: Концептуальні засади реформування середньої школи. (2016). Рішенням колегії МОН від 27.10.2016 р. Retrieved from: https://www.kmu.gov.ua/storage/app/media/reforms/ukrainska-hkolacompressed.pdf. The *New Ukrainian School: Conceptual Foundations of Secondary School Reform. (2016). By the decision of the Board of the Ministry of Education and Science dated 27.10.2016.* Retrieved from: https://www.kmu.gov.ua/storage/app/media/reforms/ukrainska-hkolacompressed.pdf).

Пахотіна, П. К. (2008). *Формування інформаційно-комунікаційної компетентності майбутніх фахівців з аграрних спеціальностей* (дис. … канд. пед. наук: 13.00.04). К. (Pakhotina, P.K. (2008). *Formation of information and communication competencies of future specialists in agricultural specialties* (PhD thesis abstract). K.).

Педагогічний термінологічний словник (2016). Retrieved from: http://pedagogical_dictionary.academic.ru/ (*Pedagogical terminological dictionary* (2016). Retrieved from: http://pedagogical_dictionary.academic.ru/).

Плаксина, Ю. Г. (2007). *Формирование информационно-коммуникационной компетенции студентов вуза при изучении общих математических и естественнонаучных дисциплин* (дис. … канд. пед. наук. 13.00.08). Челябинск (Plaksina, Yu. G. (2007). *Formation of information and communication competence of university students in the study of general of mathematical and natural science disciplines* (PhD thesis). Cheliabinsk).

Пєтухова, Л. Є. (2007). *Теоретичні основи підготовки вчителів початкових класів в умовах інформаційно-комунікаційного педагогічного середовища: монографія*. Херсон: Айлант (Pyetukhova, L. E. (2007). *Theoretical foundations of primary teacher training classes in the information and communication pedagogical environment: monograph*. Kherson: Island).

Пономарьова, Г. Ф. (2014). Взаємодія викладача і студента у навчально-виховному процесі педагогічного ВНЗ. *Проблеми інженерно-педагогічної освіти, 45,* 25-36 (Ponomaryova, G.F. (2014). Interaction of teacher and student in the educational process of pedagogical university. *Problems of engineering and pedagogical education, 45,* 25-36).

Попова, Л. М. (2018). *Формирование информационно-коммуникационной компетентности у студентов педагогического колледжа в процессе изучения информатики*. Retrieved from: http://festival.1september.ru/articles/510835/ (Popova, L.M. (2018). *Formation of information and communication competence in students of pedagogical college in the process of studying computer science*. Retrieved from: http://festival.1september.ru/articles/510835/).

Про вищу освіту: Закон України від 16.07.2014 р. (2014). № 37-38. Retrieved from: https://zakon.help/law/1556-VII/ (*On higher education: Law of Ukraine of 16.07.2014* (2014). № 37-38. Retrieved from: https://zakon.help/law/1556-VII/).

Про затвердження Положення про дистанційне навчання: МОН України; Наказ, Положення від 25.04.2013 № 466. Retrieved from: http://zakon3.rada.gov.ua/laws/show/z0703-13 (*On approval of the Regulation on distance learning: MES of Ukraine; Order, Regulations from 25.04.2013 № 466.* Retrieved from: http://zakon3.rada.gov.ua/laws/show/z0703-13).

Про Національну стратегію розвитку освіти в Україні на 2012-2021 роки / Указ Президента України від 25.06.2013 № 344/2013. Retrieved from: http://zakon2.rada.gov.ua/laws/show/344/2013 (*On the National Strategy of Education Development in Ukraine for 2012-2021 / Decree of the President of Ukraine of 25.06.2013 № 344/2013*. Retrieved from: http://zakon2.rada.gov.ua/laws/show/344/2013).

Про основні компетенції для навчання протягом усього життя (2006). Рекомендація 2006/962/ЄС Європейського Парламенту та Ради (ЄС) від 18.12.2006 р. *Official Journal of the European Union. P. I. 394/10 – I. 394/18*. Retrieved from: http://zakon3.rada.gov.ua/laws/show/994_975 (On the basic competences for lifelong learning. (2006). Recommendation 2006/962/EU of the European Parliament and of the Council of 18 December (2006). *Official Journal of the European Union. P. I. 394/10 - I. 394/18.* Retrieved from: http://zakon3.rada.gov.ua/laws/show/994_975).

Рашевська, Н. В. (2011). *Мобільні інформаційно-комунікаційні технології навчання вищої математики студентів вищих технічних навчальних закладів:*(автореф. дис. … канд. пед. наук. 13.00.10). Київ (Rashevska, N.V. (2011). *Mobile information and communication technologies for teaching higher mathematics to students of higher technical education institutions* (PhD thesis abstract). Kyiv).

Роджерс, К. (2002). *Свобода учиться*. М.: Смысл (Rogers, K. (2002). *Freedom to learn*. M.: Sense).

Семеріков, С.О. (2009). *Теоретико-методичні основи фундаменталізації навчання інформатичних дисциплін у вищих навчальних закладах* (дис. … доктора пед. наук: 13.00.02). Київ (Semerikov, S. O. (2009). *Theoretical and methodological foundations of fundamentalization teaching of computer science disciplines in higher education institutions* (DSc thesis). Kyiv).

Спірін, О. М. (2009). Інформаційно-комунікаційні та інформатичні компетентності як компоненти системи професійно-спеціалізованих компетентностей вчителя інформатики. *Інформаційні технології і засоби навчання, 5 (13).* Retrieved from: http://journal.iitta.gov.ua/index.php/itlt/article/download/183/169 (Spirin, O. M. (2009). Information and communication and information competencies as components of the system of professionally specialized competencies of a computer science teacher. *Information technologies and tools training, 5 (13).* Retrieved from: http://journal.iitta.gov.ua/index.php/itlt/article/download/183/169).

Столяренко, І. С. (2015). Особливості організації змішаного навчання у підготовці майбутніх учителів інформатики. *Інформаційні технології в освіті, 24,* 38-147 (Stolyarenko, I. S. (2015). Peculiarities of the organization of blended learning in the training of future teachers of computer science. *Information Technologies in Education, 24,* 38-147).

Стрюк, А.М. (2012). *Система «Агапа» як засіб навчання системного програмування бакалаврів програмної інженерії* (дис. ... кандидата пед. наук: 13.00.10). Київ (Striuk, A.M. (2012). *"Agapa" system as a means of systemic learning programming of bachelors of software engineering* (PhD thesis). Kyiv).

Толкачева, А. А. (2012). *Развитие информационно-коммуникационной компетентности классных руководителей* (автореф. дисс. … канд. пед. наук: 13.00.01). Тула (Tolkacheva, A.A. (2012). *Development of information and communication competencies of class teachers* (PhD thesis abstract). Tula).

Триус, Ю. В. (2012). Комбіноване навчання як інноваційна освітня технологія у вищій школі. *Теорія та методика електронного навчання: збірник наукових праць, Вип. III,* 299-308 (Tryus, Yu. V. (2012). Blended learning as an innovative educational technology in higher education. *Theory and methods of e-learning: a collection of scientific papers, Issue III,* 299-308).

Чернякова, Ж. Ю. (2018). Структурно-функціональна модель формування управлінської культури майбутніх педагогів у контексті організації самостійної роботи з педагогічних дисциплін. *Педагогічні науки: теорія, історія, інноваційні технології, 2 (76),* 206-220 (Chernyakova, Zh. Yu. (2018). Structural-functional model of formation of managerial culture of future teachers in the context of organizing independent work in pedagogical disciplines. *Pedagogical sciences: theory, history, innovative technologies, 2 (76),* 206-220).

Чернякова, Ж. Ю. (2021). Формування інформаційно-комунікаційної компетентності майбутнього вчителя як агента змін у контексті реалізації Концепції «Нова українська

школа», *Теорії та технології інноваційного розвитку професійної підготовки майбутнього вчителя в контексті концепції «Нова українська школа: монографія,* (сс. 203-227). Суми: Вид-во СумДПУ імені А. С. Макаренка. DOI 10.24139/978-966-698-308-7/203-227 (Chernyakova, Zh. Yu. (2021). Formation of information and communication competence of the future teacher as an agent of change in the context of realization of the Concept "New Ukrainian school". *Theories and technologies of innovative development of professional training of future teachers in the context of the concept «New Ukrainian school»: monograph,* (pp. 203-227). Sumy: Publishing house of Sumy State Pedagogical University named after A.S. Makarenko).

Шевченко, Г. П. (2009). Концептуальна сутність компетентнісного підходу: європейський вимір. *Реалізація європейського досвіду компетентнісного підходу у вищій школі України. Київ: Педагогічна думка,* 121-130 (Shevchenko, G. P. (2009). The conceptual essence of the competency approach: European dimension. *Implementation of European competence experienceapproach in higher education in Ukraine. Kyiv: Pedagogical Thought,* 121-130).

Blending Learning: The Evolution of Online and Face-to-Face Education from 2008–2015 (2015). *Promising Practices in Blended and Online Learning.* Retrieved from: https://www.inacol.org/resource/blending-learning-theevolution-of-online-and-face-to-face-education-from-2008-2015/.

Collis, B. (2001). *Flexible learning in a digital world: experiences and expectations*. London: Kogan Page Limited.

Competency Standards Modules: ICT competency standards for teacher (2008). *Scientific and Cultural Organization.* Paris: United Nations Educational.

DeSeCo (2011). *Definition and Selection of Competencies. Theoretical and Conceptual Foundation (DESECO). Strategy Paper on Key Competencies. An Overarching Frame of Reference for an Assessnent and Research Program OECD*.

EURYDICE (Network on Education Systems and Policies in Europe) (2002). *Key Competencies. A Developing Concept in General Compulsory Education*. Brussels: European Eurydice Unit.

iNACOL Blended Learning Teacher Competency Framework (2014). *iNACOL, The International Association for K-12 Online Learning.* Retrieved from: https://www.inacol.org/wp-content/uploads/2015/02/iNACOL-BlendedLearning- Teacher-Competency-Framework.pdf.

Hofmann, J. (2014). *Top 10 Challenges of Blended Learning (And Their Solutions!)*. Retrieved from: http://blog.insynctraining.com/top-10-challenges-ofblended-learning.

Powell, A., Rabbitt, B., Kennedy, K. (2014). *iNACOL Blended Learning Teacher Competency Framework.* Retrieved from: http://learningaccelerator.org/media/4f1a35f3/.

Quality education and competencies for life (2004). *Workshop 3. Background Paper*.

Shivam, R. (2015). Implementation of Blended Learning in Classroom: A review paper, *International Journal of Scientific and Research Publications, 5 (11),* 369-372.

Staker, H. (2012). *Classifying K–12 Blended Learning. Innosight Institute*. Retrieved from: https://www.christenseninstitute.org/wp-content/uploads/2013/04/Classifying-K-12-blended-learning.pdf.

STRUCTURAL AND CONTENT CHARACTERISTICS OF FUTURE MUSICAL ART TEACHERS' PROFESSIONAL TRAINING IN THE EUROPEAN UNION: A COMPARATIVE ANALYSIS

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Abstract. The study compares the structural and content characteristics of future musical art teachers' professional training in the European Union countries, namely: Denmark, Finland, Latvia, Poland, Austria, Germany, Sweden and so on. It is found that most of the studied training programs for future musical art teachers are practice-based and include performance, music theory, music-historical, psychological-pedagogical, and didactic cycle subjects. The main activities in higher education institutions that train future musical art teachers are playing musical instruments, singing, conducting, composition and improvisation, and sometimes rhythmic activities (Austria), facts and discussions about the role of music in school and Danish society (Denmark), electroacoustic training (Latvia), etc. It is stated that education in the studied EU countries is aimed at the comprehensive professional development of a specialist; it is logically structured and systematized; it involves the use of creative music; it is built on a combination of folk, academic and contemporary music; it provides development of the necessary professional performing and analytical skills; it applies effective teaching methods; it uses modern technical means and learning technologies.

Key words: musical art teachers, professional training, music education, art education, European Union.

Introduction

Integration of Ukraine into the European educational space is a requirement of modern politics. Therefore, we consider one of the most important tasks of music-pedagogical theory and practice to be training of such a specialist who will meet the goals, content, methods and forms of teaching and upbringing of the younger generation of student youth. Accordingly, this vocation of a teacher determines the purpose of his/her professional training, namely:

1) to ensure the future musical art teacher's readiness to include in the learning process the knowledge of all the best that has been accumulated by society;

2) to prepare the future musical art teacher to promote the child's development, growth of his own strength, disclosure of internal potential;

3) to prepare the future musical art teacher for the implementation of the educational influence on the child – ensuring his integration into the system of social requirements and values (Pukhovska, 1997, pp. 8-9).

In the context of the present study, we agree with M. Tkachenko, who interprets training of the future musical art teacher as a complex pedagogical system that provides education for professionals of a wide profile. According to him, the teacher should be able to play various musical instruments, have a vocal-choral and conducting culture, as well as be ready to carry out pedagogical activities, etc. (Tkachenko, n.d.).

Researchers I. Dubinets and L. Filonenko claim that the result of professional training of the future musical art teachers is mastery of a set of special knowledge, practical skills, and abilities (Dubinets, 2016, p. 95; Filonenko, 1994, p. 24).

We cannot but agree with the views of Ye. Provorova, who emphasizes that training of future musical art teachers covers methodological and musical-pedagogical knowledge. Thus, the result of successful music-pedagogical activity of a teacher is the high quality of the pedagogical process

organized by him, which is a condition for the effective activity of students. In turn, methodological training is a professional feature that provides mastery of orderly ways of interconnected work of teachers and students, which is aimed at music education and upbringing of students (Provorova, 2015, p. 50).

According to T. Reisenkind, the basis of professional training of future musical art teachers is, first of all, his artistic and performing development, formation of musical and pedagogical skills, education of creative abilities, accumulation of performing experience (Reisenkind, 2008, p. 12).

At the same time, we find a different opinion in T. Pliachenko, who reveals the essence of professional training of the future musical art teachers in the context of the competence approach and interprets it as a set of competencies, possession of which promotes professional competence and ensures the success of professional activities, the ideal that teachers should focus on in the professional training of students and the model that a music teacher should be guided in professional activities (Pliachenko, n.d.).

In this context, M. Przychodzińska's opinion is expedient. She is convinced that a modern musical art teacher should promote students' learning of the aesthetic value of music (activation of observation, formation of attention, etc.), cultivating moral and patriotic feelings; developing imagination and creative attitude to music in children and youth" (Białkowski, Przychodzińska, n.d., p. 313).

It should be noted that professional training of future teachers is based on the principles outlined in the legislative and regulatory documents on education, in particular: the Law of Ukraine "On Higher Education" (2014), the Law of Ukraine "On Education" (2017), the Law of Ukraine "On General Secondary Education" (2019), the Law of Ukraine "On Complete General Secondary Education" (2020), the National Strategy for Education Development in Ukraine until 2021 (2013), the Concept of Teacher Education Development (2018), the Concept "New Ukrainian School" (2016), State Standard of Primary Education (2018), State Standard of General Secondary Education (2011), Resolutions of the Cabinet of Ministers of Ukraine "On Approval of the National Qualifications Framework" (2011), Orders of the Ministry of Education and Science of Ukraine: modular system of organization of the educational process" (2005), "On approval of the Action Plan for ensuring the quality of higher education in Ukraine and its integration into the European and world educational community and society for the period up to 2010" (2007); "Guidelines for the development of industry standards of higher education (competence approach)" of the Institute of Innovative Technologies and Content of Education of the Ministry of Education and Science of Ukraine (2013). Accordingly, the basic provisions of professional training of the future teachers of musical art are presented in such documents as: The concept of humanitarian development of Ukraine for the period up to 2020 (2012); The concept of artistic-aesthetic education of students in the secondary schools, Comprehensive program of artistic-aesthetic education in general and out-of-school education institutions (2004), Action Plan to improve the quality of artistic-aesthetic education for 2009-2012 (2009) and so on.

Today, scientists in their studies are looking for and proposing ways, means and methods of activating the cognitive activity of future teachers (L. Dolynska, T. Mochan, N. Telychko), including musical art teachers (M. Nazarenko, O. Oleksiuk), exploring the general features of methodological, performance training of future musical art teachers (T. Bezshaposhnikova, D. Budianskyi, O. Zinchenko and others); determining modern educational paradigms, concepts, methodological approaches to professional training of future musical art teachers (A. Zaitseva, Zh. Kartashova, H. Padalka, O. Radetskyi, A. Romanenko, L. Tkachuk, O. Shevniuk); studying the historical development of music-pedagogical education in Ukraine (A. Kozyr); outlining the specifics of professional and personal qualities formation in the future musical art teacher in the process of professional training (H. Kondratenko, S. Kutsenko, M. Nazarenko, L. Ovsianetska, A. Pashina, O. Perets and others).

It should be noted that the leading idea of the analyzed studies is the idea of the urgent need to modernize the system of music-pedagogical education by studying foreign experience.

Attention is also drawn to the scientific research of foreign scholars, who focus on such aspects of the education of the future musical art teachers, as: conceptual foundations of music teacher training (Z. Helms, W. Sasher, K. Swanwik); updating the content and introduction of new organizational forms of education (B. Danielsen, G. Yohansen); didactic issues of education (F. Gandzel); intercultural training (R. Kafurke, G. Kleinen, P. Krakauer); integration of music of different cultures, cultural socialization (E. Georgii-Hemming); introduction of active teaching methods (P. Kahnik, T. Kivestu, A. Leijen) and others.

Today, in the context of development of a globalized society, intensification of ties between specialists from different countries, we feel the need for teachers to thoroughly study the work of foreign researchers and creatively apply these developments in their own professional activities.

Thus, we can confidently say about the increasing role of comparative pedagogy, the use of which allows to study the theoretical and practical achievements of education theorists and practitioners from different countries and successfully implement their experience in a particular country, taking into account its socio-cultural, political and economic development.

It should be noted that in recent years, comparative pedagogy has become especially important around the world. Undoubtedly, taking into account the achievements of comparativists allows to enrich the theoretical concepts of further reform of the national education systems, to ensure further development of professional thinking and practical activities of teachers by acquainting them with valuable educational achievements, major trends, regional and national peculiarities in the field of education, results of conducted studies, the role of international educational organizations and programs to create an innovative educational environment (Zhelanova, 2016; Yudzionok, 2011; Tkachova & Du Jingxu, 2020).

Various aspects of music-pedagogical education are covered in the comparative-pedagogical research of N. Abashkina, T. Desiatov, N. Lavrychenko, L. Leferd, O. Lokshyna, O. Matviienko, N. Nychkalo, B. Navrochynskyi, R. Pakhochynskyi, L. Pukhovska, A. Sbruieva, Ya. Frontchak and others.

Professional training of pedagogical staff of different European countries, including musical art teachers training, was considered by such domestic and foreign researchers as E. Vyshnevska, S. Gaievsky, R. Gozdetska, I. Kryvokhyzha, H. Nikolai, V. Pavlenko, A. Pasternak, Ya. Prosnak, M. Przyhodzynska (Poland), Y. Vasiutova, R. Vildova, L. Podkhalova, V. Spilkova (Czech Republic), N. Bazeliuk, S. Hryniuk, K. Kotun, L. Liashenko, P. Smalberg (Finland), L. Volynets, H. Kogan, N. Kosharna (Sweden), V. Semiletko (Norway), J. Abel, G. Bellenberg, D. Benner, F. Bonzak, W. Brainin, R. Neumann, I. Stashevska, E. Terhart, K. Chervenko (Germany), T. Kharchenko (France), K. Binytska, T. Koshmanova, M. Mikhaskova, L. Pukhovska, L. Riakitianska, V. Yakovlev and others.

However, the need to systematize and generalize foreign experience in the implementation of conceptual ideas for professional training of future musical art teachers in the world, in particular in the European Union, in the system of music-pedagogical education in Ukraine.

In this study, we aim to compare the structural and content characteristics of the future musical art teachers' professional training in the European Union countries, namely: Denmark, Finland, Latvia, Poland, Austria, Germany, Sweden, which offer many opportunities for youth, who seeks to obtain modern music-pedagogical education, to expand their knowledge and capabilities.

Research results

In order to achieve the aim of our study, we have identified criteria for comparative analysis of the music-pedagogical education, namely:

1) description of the curriculum;
2) structure of the curriculum;
3) structure of the educational program.

We selected the following countries for analysis: Denmark, Finland, Latvia, Poland, Austria, Germany, Sweden.

It should be noted that professional training of the future musical art teachers in the European Union is carried out in two areas: music teacher (Type A); instrumental or vocal teacher in music schools, private practices (Type B), etc. Training of musical art teachers is carried out in conservatories, music schools (colleges), academies and universities and lasts on average from 4 to 4.5 years, and 87.6 % of institutions have pedagogical disciplines in the curriculum (*A web site analysis of music teacher education in Europe,* 2007).

Note that training of musical art teachers for secondary schools in almost all European countries is regulated by public authorities, but this does not apply to teachers of instrumental performance and vocals who do not intend to teach in the general education system. It should be emphasized that mobility, i.e. training of music teachers abroad, is very low. In 25 % of institutions there were no foreign students who studied according to the music teacher training programs.

Below we will describe each of the above-mentioned countries.

Structural and content characteristics of future musical art teachers' professional training in Denmark

First of all, it should be stressed that in Denmark, music is compulsory in schools for the first six years, and then optional. The main part of Danish music teachers' training is carried out in three or four types of institutions, such as:

- The Danish University of Education (DPU), which trains teachers for general education institutions;
- Teacher Training Colleges (CVU), which also train teachers for general education institutions;
- Universities (in the faculties of musicology), which train teachers for senior middle level;
- Conservatoires, which train teachers for public music schools.

We consider interesting the educational services provision at the Danish University of Education, which includes the Royal Danish School of Educational Studies (DLH). It should be noted that this university is considered to have a higher level for continuing education and providing research services. At the same time, it should be noted that traditionally training is focused on musical performance. The main disciplines include subject specialization, which was not included in the bachelor's degree in pedagogical colleges.

It should be noted that Denmark is characterized by a clear separation of teacher training for upper secondary education and general education. However, there are changes, which indicate a growing interest in music pedagogy in higher education institutions. Pedagogical colleges, focused on grades 1-6 of the elementary school, have four main subjects and provide a bachelor's degree of 240 ECTS. Moreover, in our opinion, it is important that education is clearly pedagogically oriented. A characteristic feature is the large number of hours devoted to teaching practice in secondary schools.

There are no entrance exams in colleges, only upper secondary education is required, sometimes a B-level in music is required, although no explanation of what this means is mentioned. A bachelor's degree is required for the final exam.

The university offers three years for a bachelor's degree and an additional two for a master's degree. There are at least two basic and one additional subject. The study is academic in nature and focuses on musicology. In order to obtain the appropriate qualification for teaching in a secondary school, two additional years of pedagogical training are required after obtaining the master's degree, which mainly includes teaching practice.

Conservatories also offer three years of study for a bachelor's degree and two more for a master's degree. Here the central place is occupied by training of musicians-performers, and at the second place is pedagogical training. The pedagogical practice is carried out in public music schools.

Below we will describe the features of the future musical art teachers' training in the most popular education institutions of Denmark.

Aarhus College of Education provides training for future musical art teachers to teach music as an optional second subject. The main focus of the program for teachers is clearly educational. It provides:

- formation of skills and provision of pedagogical-personal qualifications;
- formation of the future teacher's personality;
- granting the right to work in a democratic school;
- assessment of comprehensive knowledge and ways of self-expression.

Training is aimed at teaching in a compulsory school, duration – four years and 240 ECTS points. Moreover, a student who graduates from this education institution has the right to further study at the university. Learning is based on the close relationship between theory and practice. We also emphasize that the mandatory components of learning are reflection and self-esteem.

Studying in college gives the opportunity to get a bachelor's degree. Each semester, students must complete five or six subjects, which is 30 ECTS points. In percentage terms, subjects are divided as follows: 21 % of time is devoted to psychological and pedagogical disciplines, 18 % – to the main subject (mathematics or Danish), 15 % – teaching practice (24 weeks), and basic subjects – 14 %. The bachelor's thesis constitutes 4 %.

Music is studied as one of the four main subjects. Moreover, duration of each major is four semesters. These core subjects should include Danish language and/or mathematics. There are also optional music courses.

No special qualifications are required for students to enter the institution, except for high school grades (level B) obtained to gain access to music education. Musical subject is taught in groups, piano accompaniment – in small groups, the main instrument of one's choice, vocals are taught individually. Music is studied in the context of three main approaches – theory-based, technically oriented and practice-based.

The result of studying at Aarhus College of Education is:

- understanding of music as an artistic, cultural, social and historical phenomenon and knowledge of the possibilities of music as a means for experience and personal development;
- formation of practical and theoretical musical skills as a means of achieving a broad and comprehensive music education.

While studying at Aarhus College of Education, students learn vocals and playing a musical instrument. The curriculum also includes such subjects as choir, music theory, music history, composition, movement exercises, use of computer music equipment, music pedagogy and psychology, facts and discussions on the role of music in school and Danish society.

In the context of this study, we consider it necessary to focus on the description of the examination procedure. The exam in the main subject – music – consists of a practical part and an oral test. The practical exam consists of vocal and instrumental performance, an eye reading task and a music theory test. A composition prepared during the course is performed. In addition, the student must submit several small compositions covering at least three different genres or target groups. The song selected from the list must also be performed and approved. The exam is summed up as one point.

Thus, the curriculum is well organized, pedagogically oriented (http://www.aardassem.dk/).

Silkeborg Teacher Seminarium provides training for music teachers as an optional subject. Training is based on three main components:

- teaching subjects;
- pedagogical and psychological theory;
- pedagogical practice.

We emphasize the close connection between theory and practice, and the fact that this program has an educational focus. The main place of work for a teacher is a secondary school (folkeskolen). College-level study consists of 8 semesters, corresponding to 240 ECTS credits. After studying at the Silkeborg Teacher Seminarium, the student receives a bachelor's degree. 30 % of the total number of hours is devoted to music as a secondary subject.

Note that in the Silkeborg Teacher Seminarium, music is one of the three main subjects, apart from Danish, and is studied during the third and fourth years, which is 15 % of the program.

The training program for future music teachers at Silkeborg Teacher Seminarium includes such subjects as: basic musical instrument, vocals, concertmaster class, auditory analysis, basics of music theory, ensemble, choir, movement, creative music activities, information computer technology, music didactics, leadership exercises.

The aim of the program is to acquire practical, theoretical, pedagogical and didactic competences by a student in order to work as a teacher in secondary school, as well as to continue development of music education in both educational and school subjects.

The student must also submit eight arrangements with didactic comments for the use in the learning situation. These arrangements should cover different genres and be created in a music program. In addition, two tasks must be performed: one of musical knowledge and listening, and the other of basic music education. Teaching practice lasts 23 weeks. The final exam consists of oral and written assignments divided into six parts (http://www.silkeborgsem.dk/).

As a result of the content analysis of the websites of the higher music-pedagogical education institutions in Denmark, we can say that such education is aimed primarily at studying musical art as an educational tool. Moreover, the study of this discipline is allocated an average of 30 % of the total number of hours. We are convinced that the lack of training for future musical art teachers in Denmark is a lack of attention to the development of musical skills and a lack of practical musical activities.

Structural and content characteristics of future musical art teachers' professional training in Finland

The next country, we have chosen to characterize the system of future musical art teachers training, is Finland, where music is taught at all levels and is mandatory for children aged 7-15. Note that teacher training in Finland is provided by universities and vocational institutes of higher education (polytechnics).

It should be noted that at the primary level, from grades 1 to 6, music is taught by general teachers with a master's degree (240 ECTS), and grades 7-9 – subject teachers with special training of a music teacher and a master of music (at least 270 ECTS).

As a result of the analysis of the websites of Finnish higher education institutions, we can say that there are three universities in the country with training for future musical art teachers: Sibelius Academy, Oulu University, and the University of Jyväskylä. Sibelius Academy specializes in the education of subject teachers (music), while Oulu University and the University of Jyväskylä focus on the training of primary and secondary school teachers (universalists and specialists). Note that instrumental teachers and vocal teachers are trained by Sibelius Academy or in vocational and technical institutions. There are ten such institutions in Finland.

Much attention at Sibelius Academy is drawn to pedagogical practice, which is carried out in special, regular or music schools.

In addition, professional musicians are trained at the Sibelius Academy Continuing Center in Finland. At the same time, pedagogical disciplines are also taught in this institution.

An important feature of music-pedagogical education at Sibelius Academy, in our opinion, is the high level of cooperation between formal and non-formal education institutions. Moreover, the teacher training program in Finland is regulated by national legislation.

Sibelius Academy in Helsinki offers curriculum in music education, and training is organized by the Department of Music Education. According to the analyzed documents presented on the Academy's website, graduates can work in schools and other education institutions, such as music schools and music schools for children, adolescents, and adults.

At the Academy, the educational process is focused on musical art and pedagogy; dialogue, critical analysis and self-reflection; personality-oriented learning (http://dept.siba.fi/muka/eng/).

The subject (pedagogical) of the program must meet the qualification requirements established for teachers in accordance with the Decree on the qualification of teachers (986/1998).

According to the Bologna Process, Sibelius Academy uses a two-cycle system, which includes three years of study for a Bachelor of Music (180 ECTS) and five and a half years for a Master of Music (330 ECTS credits).

The plan for a bachelor's degree provides the minimum number of ETCS credits required for each subject group, such as a core subject (music education), pedagogical studies, a second subject, and so on. Of these groups, the percentage calculation is about 37/63 between theory and practice. In addition to the main subject, students also learn playing the instrument, vocals, accompaniment, conducting, music history and more.

Thus, compared to most general pedagogical academies, it can be said that Sibelius Academy trains only teachers of musical art, with music being the main and not the secondary subject (Website www.siba.fi).

The University of Helsinki provides training for future musical art teachers as an optional second subject. Training takes place at the Faculty of Applied Sciences of Education.

The chair is divided into four departments:

- training of class teachers;
- training of subject teachers;
- educators for kindergarten and preschool education institutions;
- special education.

The department strives for the relationship between high-level research and teaching. The goal is to educate professional teachers who have the appropriate skills, knowledge, and willingness to conduct, analyze and develop learning.

Interesting, in our opinion, is the fact that the general description of the teacher training program, including musical art, emphasizes research training.

As a result of their studies, future teachers trained at The University of Helsinki must master their learning skills, their ability to research and develop their own professionalism, and their skills to develop new knowledge. In addition, a significant aspect of the training program is based on such general skills as cooperation, communication, and IT skills, as well as language skills, cultural knowledge and openness in international life.

To obtain a bachelor's degree, students should master 180 ECTS credits, respectively, for a master's degree – 300 ECTS credits. Moreover, the right to further university education is provided only by obtaining a master's degree.

Education consists of a core subject, pedagogy or pedagogical psychology, and a compulsory secondary subject. In addition, the student may choose one or two additional minor subjects. The University of Helsinki works closely with Sibelius Academy to qualify as a music subject. As a result, the received education gives the right to teach music in all types of the education institutions and at all levels.

It is noteworthy that 22.3 % of the total workload was devoted to music training at the University. Accordingly, 34.3 % is devoted to general pedagogy, psychology and didactics, 7 % – to specific pedagogical and didactic courses, 5 % – to cultural training, 31 % – to language training and IT (Website http://www.helsinki.fi/sokla/english/classteacher.html).

Åbo Academy is another Finnish higher education institution that trains future musical art teachers. Note that this institution provides training for musical art teachers as an optional second subject, as well as The University of Helsinki. The graduating department is the Department of applied pedagogy in the Faculty of Pedagogy. Moreover, the Faculty offers music education according to the program of the homeroom teacher and the program of the subject teacher.

Regarding the structure of education, each semester at Åbo Academy is divided into 2 periods, and training covers 6-11 subjects per semester. Each semester – 30 ECTS credits. Åbo Academy provides both a bachelor's degree (180 ECTS credits) and a master's degree (300 ECTS credits). A master's degree gives the right to further university education.

Training consists of a core subject, pedagogy or pedagogical psychology, and a compulsory secondary subject. In addition, the student can choose an elective course. Additional training in a secondary subject gives the homeroom teacher the qualification to teach the subject also at the highest level of secondary school.

Åbo Academy also provides musical art teacher education in collaboration with Sibelius Academy. 60 % of the total workload is devoted to pedagogical training at the Academy. And students after graduation get the right to teach in all types of general secondary education institutions.

It is interesting that music in Åbo Academy is also part of the overall teacher training program and consists of hearing development, piano playing, school repertoire and singing/playing. In addition, all students can choose a course called General Music Knowledge, which is based on listening to music.

Music education according to the class teacher program constitutes 25 % of the required subjects of the total study load and 40 % – optional, and to music is devoted 6 % of the total time in the second year. Interestingly, the additional subject is studied for at least 30 weeks, and the most common way is to study two secondary subjects for 15 weeks. A student who decides to study one subject for 35 weeks will receive a qualification to teach in high school.

Note that the purpose of the subject of "Music" ("Musical Art") is to deepen theoretical knowledge and musical skills; to develop didactic competence with an emphasis on music education in grades 1-6 of the secondary school; prepare for further study of music (musical art).

As a result of studying the training program for future musical art teachers, it has been found that the curriculum includes such subjects as solo singing, piano playing, piano accompaniment, hearing and notation, history of music and listening, choral pedagogy, ensemble, music and computer (IT), music didactics, Finnish/Swedish music (Website http://www.vasa.abo.fi/pf/li/ped/).

Structural and content characteristics of future musical art teachers' professional training in Latvia

In Latvia, training of the future music teachers is provided by the Academy of Music and universities. Type A and Type B training are integrated into the same music training program.

The Academy of Music offers specialized courses. There are two types of programs – a four-year program that provides a bachelor's degree in music pedagogy, and a two-year program that provides a master's degree. A bachelor's degree gives the opportunity to work in the elementary school, and a master's degree – in high school.

It should be noted that in Latvia there is close cooperation between universities and the Academy on training programs for future music teachers.

Jazeps Vitols Latvian Academy of Music is the only university-type education institution in Latvia where one can obtain a higher music education in performing arts, composition, musicology, music pedagogy, choreography, as well as a PhD degree (www.music.lv/academy/).

Music education has a double emphasis on the fact that a graduate of the Academy can pursue a professional career in music and/or education. By studying at JVLMA, you can get a bachelor's degree with a duration of 4 years, which is equivalent to 240 ECTS. Further studies are also offered – a master's degree with an additional duration of study of two years, equivalent to 120 ECTS, and a postgraduate course with an additional duration of study of 3 years, equivalent to 216 ECTS. Training is aimed at preparing instrumental art teachers for music schools.

The curriculum at the Academy consists of several cycles:

- Part A: Compulsory courses that provide the necessary professional skills, practical and theoretical knowledge (according to each specialization – playing a musical instrument, chamber ensemble, orchestra, composition, etc.). This part also includes general humanities courses that provide knowledge in the humanities and social sciences, develop communication (Latvian language culture, history of religions, history of literature, etc.). The subjects of this cycle have the following volume: professional practical courses – 30-50

ECTS credits, practice – 26 ECTS credits, professional theoretical courses – 30-50 ECTS credits, general humanities courses – 20 ECTS credits;

- Part B: this cycle prepares students for pedagogical activities (future musical art teachers study psychology, pedagogy, ethics, methodology, as well as pedagogical practice). This cycle allows students to teach a subject corresponding to his/her specialty in the system of professional music education. Note that 16-26 ECTS credits are awarded for the subjects of the pedagogical cycle;
- Part C: elective courses – offer the opportunity to master various subjects that correspond to the individual educational trajectory of the student: special computer programs, electroacoustic music, improvisation, composition, jazz, etc. Elective courses have a much smaller number of credits than previous cycles, namely 6 ECTS credits. At the same time, 12 ECTS credits were allocated for the final exam.

At Jazeps Vitols Latvian Academy of Music, enrollment takes place through entrance exams. The mechanisms for issuing a diploma differ depending on the student's major. For example, the study of vocals as the main subject envisages such final exams as:

1. Concert-exam on academic singing.
2. Opera and chamber singing.
3. Colloquium on the specialty, history and theory of music.
4. Methods of vocal performance.
5. Pedagogical practice (lesson with a pupil).

For graduates of the choral conducting program, final exams include:

1. Concert-exam on choral conducting.
2. Work with the choir.
3. Colloquium on the specialty, history and theory of music.
4. Defense of bachelor's thesis.
5. Methods of conducting.
6. Pedagogical practice (lesson with a student) (Website http://www.music.lv/Academy/).

Riga Teacher Training and Educational Management Academy (RTTEMA) offers a training program for future musical art teachers at the Faculty of Music. The program is focused on the educational or educational-music component. A bachelor's degree qualifies a student as a music teacher. Studying at the Academy differs in the general academic approach.

The future musical art teacher training program lasts five years with two semesters per year of 30 ECTS credits each. It should be noted that students have the right to choose one specialization, and, starting from the third year, students are offered additional specialization programs.

It is interesting that the number of subjects per semester ranges from 7 to 21 according to the course and the chosen profile. This assessment is based solely on what appears to be mandatory courses in the five-year curriculum.

After estimating the number of subjects and their percentage during the five-year program, the following data were obtained: 12-43 % is devoted to music training, 8-11 % – to specific didactic training, general pedagogical/psychological/didactic training is taught between 18 and 22 %; 10 and 13 % are allocated for cultural training, other components – 7 and 10 %. In the percentage between theory and practice, the above figures give the following results: theory 45 % and practice 55 %. If the program is reduced to 300 ETCS credits, then 230 ETCS credits are allocated to compulsory courses, and the remaining 70 ECTS credits represent the volume of elective courses, which is 77 % and 23 %, respectively.

Note that the methods of assessment to verify the achievement of the objectives of the program are tests, exams, concerts and various competitions. The assessment system has a 10-point scale and applies to all curricula.

Thus, we can say with confidence that RTTEMA offers a training program for future music teachers with an emphasis on both practical and theoretical aspects (Website www.rpiva.lv).

Structural and content characteristics of future musical art teachers' professional training in Poland

Music is taught in Polish schools for the first nine years (up to 16 years), and general and public music schools are mostly free.

Future music teachers in Poland are trained in music academies, universities or pedagogical academies. Category A teachers study at music academies or at the departments of musicology at the university, and sometimes at the department of art or music pedagogy at the pedagogical academies.

A master's degree is required in Poland for teaching in public and public music schools. Training usually lasts five years (300 ECTS credits). Pedagogical and didactic (teaching methods) subjects are required. They include at least 150 hours of teaching practice.

The training focuses on ensemble and choral conducting and consists of one main subject, teaching methods, IT courses and a foreign language. To continue education, postgraduate courses, as well as methodological and pedagogical courses are organized in the academies. The links between formal and non-formal music education are not regulated but exist mainly on private and personal initiatives.

Training of the future musical art teachers in Poland is under the control of the Ministry of Culture, which, among other things, sets qualification requirements for teaching. Public music schools are also traditionally controlled by the Ministry, but control has recently been transferred to local authorities.

Adam Mickiewicz University in Poznan provides training for music teachers as a major. Training takes place at the Faculty of Pedagogy and Fine Arts. The main focus of the program can be described as educational and musical, as the courses have both musical and pedagogical/methodological content. In addition, which we find very interesting, the curriculum includes social and historical aspects and marketing courses. The study involves obtaining a bachelor's degree (180 ECTS credits) and a master's degree (300 ECTS credits). The master's program is divided into 10 semesters with approximately 3-10 courses per trimester. Each course consists of 30 ECTS credits.

Music education envisages a number of specializations:

- piano;
- popular music;
- organ music;
- conducting;
- leadership of vocal and instrumental groups.

Musical training constitutes about 54 %, specific didactics – 30 %, general didactics, pedagogy and psychology – 10 % respectively. Cultural training includes about 2 % of courses, and language courses (English, German) cover 4 %. There are also classes in music and computer, as well as courses in Polish folk music.

The main forms of education are lectures, seminars, laboratory classes. Regarding the control of students' knowledge, there are two forms: "Exam" (mostly test, oral or written) and "Test with a grade" (usually a formative exam). A master's thesis is required to obtain a master's degree.

It is interesting to note that every 5 years the program is evaluated by the State Accreditation Committee.

The Stanislaw Moniuszko Academy of Music in Gdansk has four faculties that offer a major or a specialty. At the Instrumental Faculty (II Faculty) such specialties as instrumental performance and instrumental pedagogy are offered to students. Graduates of the instrumental faculty receive a pedagogical certificate under the program, which entitles them to pedagogical work in many areas. The specialty of instrumental pedagogy envisages distance learning, which prepares teachers of basic instruments for music schools of the 1st and 2nd degrees.

Note that the focus of the program is music, and this becomes clear if you look at music and instrumental courses, such as basic instruments, public performances, ensembles, etc., which seem

quite voluminous compared to pedagogy, music didactics, teaching methods of basic instruments, etc. Great importance for the preparation of future teachers of music is given to writing a master's thesis. Moreover, on the website of the Academy we find information that the master's thesis should raise issues of performance, interpretation and technical problems, analysis of works and historical research (Website www.amuz.gda.pl).

The study at Stanislaw Moniuszko Academy of Music at the Instrumental Faculty lasts five years with two semesters per year of 30 ECTS credits each. To obtain a master's degree, you have to master 300 ETCS credits. As for the number of subjects, they can range from 2 to 12 subjects per semester, which increases in the middle of the study and decreases at the end. Thus, in the first year of study higher education applicants have to master 7-12 subjects, in the third – 10-14 subjects, and in the last – 2 subjects.

We'd like to focus on the relationship between theory and practice in the process of training future musical art teachers. The analysis of curricula has shown that approximately 3,200 hours were devoted to the study of the theoretical disciplines, and about 5,000 hours were devoted to practical training.

In percentage terms, we have the following results: musical training – 10-88 %, specific didactic training – 1 %, general pedagogical/psychological/didactic training – 2 %, cultural training – 9 %, other subjects – 5 %. The estimated ratio between theory and practice from the above figures is: theory 11 % and practice 89 %. As a result of the analysis of the higher education institution presented on the website, it has been concluded that there is no elective courses in this education institution.

Unfortunately, we did not find information on methods of assessing student achievements but found that the final exam consisted of public presentations and preparation of a master's thesis. In our opinion, interesting is the information about the evaluation system. Thus, we see a grade scale from 0 to 25 with the corresponding grades of the Academy and an adequate ECTS scale: 21-25, A and B (very good); 16-20, C (good); 11-15, D and E (passing score), and 0-10, F (failed).

Thus, the Stanislaw Moniuszko Academy of Music (i.e. Instrumental Faculty) focuses on the methods of teaching music and performing music. This can be seen in the curriculum, where, for example, general pedagogical training corresponds to two ECTS credits and didactic training to four ECTS credits of the general five-year program. One notable aspect that distinguishes this institution from others is the lack of electives. The diploma of the instrumental faculty together with the certificate of pedagogical training gives the opportunity to graduates to work as teachers in various institutions of higher music education (Website www.amuz.gda.pl).

We consider it expedient to refer also to the characteristics of another institution of higher education, which trains teachers of musical art – Fryderyk Chopin Academy of Music. The Academy of Chopin (AMFC) has six different faculties:

- Composition and theory of music;
- Conducting;
- Instrumental studios;
- Vocals;
- Music education;
- Sound technicians.

AMFC also offers an additional branch in the Bialystok. The master's degree is available in three different forms of study: full-time, evening and part-time. All students must study:

- complex music courses and profile courses (audio training, history of music and musical literature, musical forms, piano, conducting);
- general courses (foreign language, physical education);
- humanities courses (philosophy, aesthetics, history of art, art of the twentieth century, history of cinema).

Let's turn to the characteristics of the Faculty of Music Education. The faculty's website presents four different subgroups with a list of disciplines taught there:

- choir conducting – conducting, methods of conducting of vocal-instrumental ensembles, music literature, psychology, pedagogy, audio training, vocals and vocal teaching methods, reading and analysis of scores, piano and vocal-instrumental ensembles;
- church music – organ, liturgical accompaniment, improvisation and basso continuo, vocals, conducting classes;
- rhythmics – rhythmics, ensemble rhythmics, movement technique, dances, piano improvisation, rhythmics technique, music assessment technique, psychology, pedagogy, Dalcroze technique seminar and pedagogical training;
- training of ballet teachers – dance methods (classical, folk, characteristic and historical), modern dance and methods, jazz dance and methods, principles of dance composition, dance literature, partner dances, methods of musical ensemble, pedagogy, psychology, teaching practice, dance aesthetics and the history of ballet.

To determine the direction of the program (educational/musical/both), you need to read the curricula presented in the program. Note that the different curricula have five blocks.

The core courses contain 21 subjects, all of which are compulsory. This group is equivalent to 218.5 ECTS credits and is characterized by a clear musical direction.

The second block, on a web page called Elementary, contains 8 different subjects, also with a musical focus, all of which are compulsory, and together they amount up to 45 ECTS credits.

The third block – teacher training – focuses on education, but the total number of ECTS credits is only 14.5.

The fourth block – humanities and other courses – consists of 5 subjects and they are not directly related to the subject of music. This block includes, for example, “Fundamentals of Latin”, “Physical Education” and so on. In total, this unit is designed for 12 ECTS credits.

The fifth block – practice – also has an educational focus, and in total this block adds up to 10 ECTS credits.

Thus, we can say with confidence that education has a clear musical direction in its structure.

Note also that entrance exams vary depending on the profile of education. For example, if an entrant applies for choral conducting, the exam consists of:

- Ear training – written and oral;
- Test of conducting and vocal predisposition;
- Selected instrument.

Students must also submit, in addition to the application form and high school diploma, a medical certificate issued by a specialist in occupational medicine, in accordance with the provisions of the Ministry of Health of 15.09.1997.

Duration of study is 5 years. Upon graduation, students receive a master’s degree. Each year is divided into two semesters, one winter (October 1 to late January) and one summer (early February to late May). After the summer semester, two weeks of examination sessions are held, followed by final and entrance exams. The summer semester ends in late June.

Unfortunately, there is no information on the institution’s website regarding the assessment of students’ academic achievements. However, in the graduation profile with a description of learning outcomes, skills and values we can see the following: “Graduates of the pedagogical studies programs receive a teacher’s certificate in the chosen specialty. This gives them full pedagogical qualifications (which are also recognized abroad) and entitles them to higher pay if they work as teachers” (http://www.chopin.edu.pl/angielskie/).

Thus, the curricula of the academy have practice-based and music-based learning.

Structural and content characteristics of future musical art teachers’ professional training in Austria

Music education in Austria can be obtained in three types of higher education institutions: universities (Universitaenen, such as the Vienna University of Music and Performing Arts), colleges

(Academien des nicht – universitaeren Bereich), institutions where future social workers and fachhochschule teachers are trained (Mukasheva, 2014, p. 124).

According to the analysis of the websites of higher education institutions, including music, the Vienna Conservatory is the leading institution of music education. It is interesting that the conservatory teaches both traditional disciplines, namely performing and music-theoretical, and alternative subjects, such as: "Computer music and electronic media", "Organization of events", "Author's song and oratorio", "Composition in the style of G. Schenker" and others (Mukasheva, 2014, p. 125).

It should be noted that in Austria the ideas of the German composer and teacher K. Orff (the successor of the traditions of the Swiss teacher E. Jaques-Dalcroze) became widespread. This music-pedagogical system is the basis for the training of teachers of primary general music and dance education in kindergartens and schools, children's health establishments in Salzburg.

An important role in the musical art teachers training is played by a practical course aimed at teaching students to play in an ensemble, "staging movements" and conducting, directing and organizing collective improvisation, solfeggio and voice production, language education, basics of instrumental and dance improvisation, etc. Thus, K. Orff's concept is based on a synthetic approach, the essence of which is a combination of word, movement, music and theater (Rostov, 2003, pp. 165-166).

Thus, we conclude that the system of training future musical art teachers in Austria is focused on its integrative study with word, movement, and theater. Consequently, the program of professional education introduced practice-based subjects in such areas as performance, rhythmics, dance, etc.

Structural and content characteristics of future musical art teachers' professional training in Germany

As in most European countries, the main task of music education in Germany is primarily to ensure the connection of education with practical and professional activities (Bobrakov, 2013, p. 12).

Note that in Germany, higher education has a special principle of education organization – the principle of "academic freedom", which is to provide autonomy to institutions, teachers, students. There is no strict compulsory education system in the country. Every student has the right to choose subjects to study. Therefore, everyone is personally responsible for learning and develops self-discipline.

The course at the university consists of 2 stages, namely:

- basic (3-4 semesters), after which students receive a bachelor's degree (Vordiplom – Pre-Diploma);
- basic (4-6 semesters), which gives the opportunity to obtain a master's degree (Magister Artium).

It is interesting that after graduation the higher education seeker can defend a thesis or dissertation for a doctorate. However, not every student can get it, but only those who have teaching practice and passed the qualifying exams (*Music Education and Upbringing in Germany*).

Music teachers in Germany study in Berlin, Cologne at the Musikhochschule or Hoshshule füz Musik (Higher Schools of Music) according to a model that includes performing, music-theoretical, music-historical and music-pedagogical education (Brainin & Neumann, 2007).

Music pedagogy is not only a theory and methods of teaching, but also a theory of the development of musical life (Brainin and Neumann, 2007). It includes musicology, sociology, psychology, music psychology, music sociology, philosophy, aesthetics and pedagogy.

At the faculties of Musikvermittlung, a bachelor's degree opens up various non-school career paths. Required subjects are:

- instrument (main and additional);
- piano;

- singing;
- drums;
- guitar;
- school practice of playing the piano (Schulpraktisches Klavierspiel) – the practice of listening, creating an accompaniment, reading from a sheet of simple literature;
- improvisation/bass general/reading scores;
- choir;
- jazz choir;
- classical chamber ensemble;
- music theory;
- development of hearing (Gehörbildung);
- analysis of forms;
- musicology (Musikwissenschaft) – which includes knowledge of the history of music, the ability to write a critical article, the ability to prepare an exhibition or conference, to organize a sociological study on the functioning and perception of music;
- music pedagogy (Brainin & Neumann, 2007).

In Germany, future music teachers are trained separately for primary (Grundshule, grades 1-4) and main (Hauptschule, grades 5-9) schools. At the same time, they have a number of common subjects to study, such as instrument, singing, theory, pedagogy, and so on. Besides, the Higher School of Music or the University additionally offer to study general subjects – didactics, philosophy, psychology, etc.

Germany's experience in organizing pedagogical practice is interesting. Thus, during the bachelor's stage, students are involved in three types of pedagogical practice:

- introductory;
- professional-didactic (music lesson 2-3 hours a week);
- psychological-pedagogical.

Thus, the practice lasts about a year. During the internship, students attend lessons of experienced teachers, prepare syllabi. Later, they teach on their own, but under the supervision of a mentor. And only a year later, the mentor evaluates the students-trainees, and the latter take the first exam.

In addition, some federal states differ in that future teachers must also undergo internship before professional training and integrated school practice during the semester in their free time (Kamalova & Novgorod, 2017, p. 98; Donska, n.d.; Bobrakov, 2013, p. 12).

As musical art is integrated with other arts, education in Germany is aimed at a diverse study. The comprehensive study of the history and theory of music in education institutions, as well as the practical testing of skills and abilities of future musical art teachers attracts our attention.

Structural and content characteristics of future musical art teachers' professional training in Sweden

In Sweden, music is a compulsory subject for grades 1 to 9. In high school, it is part of the compulsory subject "Aesthetic Activities". The high schools also have aesthetic programs where music is the main subject and often function as preparatory to higher music education.

Music teachers in Sweden are trained by five academies affiliated with local universities and the Royal Academy of Music in Stockholm, which is an independent university. Teachers' colleges and universities also offer music teacher training as part of general pedagogical education.

In six academies (including Stockholm) the main subject is music, and the second subject can be music or another school subject.

In academies, the teacher training program ranges from 4.5 to 5.5 years, depending on the student's choice of electives. Education is provided for both type A and type B. The student has the opportunity to significantly shape his/her education path through elective courses.

In 2001, teacher education (including higher music education), controlled by the Swedish Higher Education Agency, was reformed, and structured into a subject area with 90 ECTS credits, of which 30 were ECTS specialization credits.

It should be noted that special emphasis in future musical art teachers' training in Sweden is placed on the scientific approach and freedom of the student in planning their studies. To complete the study, you need to write and defend a thesis for which 15 ECTS credits are allocated. Upon graduation, students receive a master's degree. At the same time, a bachelor's degree will be enough only for primary school education.

Teaching practice is included in the learning process, divided into 4.5 years in the amount of 30 ECTS credits and covers all levels of school education. However, type B has no teaching practice in secondary schools. A type A teacher who has been trained in academies is qualified to work at all levels of the school at any age. A type B teacher is trained mainly to work in music schools and music programs in high schools.

To enter the academy, a student must pass national and local entrance tests for both musical and pedagogical skills. Senior high school grades are also required. In educational programs for general education teachers (universities and colleges), the amount of music education varies from country to country, but in general, with some exceptions, a 90-credit program is offered.

It should be noted that mostly music in grades 1-6 is taught by teachers without musical specialization. At the same time, continuing education for musicians and music teachers is very well provided by short- or long-term courses. In addition, there are close links between higher music education and public music schools, orchestras, and voluntary music institutions. However, such connections are generally not regulated.

We will give a brief description of the individual education institutions in Sweden, which train future music teachers.

Malmö Academy of Music is one of six academies in Sweden with a specialized music education at university level. The training takes place at the Faculty of Arts of the University of Lund. The Academy trains music teachers as teachers of a separate subject, teachers of music and other school subjects and teachers for public music schools, schools of culture and voluntary music education. Program is aimed at teaching in grades 1-6. Interesting, in our opinion, is the fact that, in addition to the general, the study has two profiles: rock music and folk music. The academy also teaches musicians and church musicians, has its own department of music education. The program has a more musically oriented character, but at the same time attention is paid to the pedagogical component.

Qualifications for teaching and further university education are provided by a master's degree. Education consists of music as a primary subject and a secondary subject, which may be a musical or other school subject. Education gives the student the qualification to teach at all levels in all school forms.

The teacher training program is divided into three parts: the main subject (180 credits), the secondary subject (60, 90 or 120 credits) and one general for different fields.

The main subject provides an opportunity to develop general pedagogical skills, study teaching methods and undergo pedagogical practice. Some minor subjects develop specific skills, provide knowledge of pedagogy and didactics, as well as teaching practice. In addition, the secondary subject is the choice of educational profile. While the general part concerns issues, common to all teachers, it is part of the education of every teacher in Sweden, although developed differently.

Note that 20 % of primary and secondary subjects are optional. The training covers many musical styles from classical to rock, jazz and folk music, Swedish and world music. At the academy, 60 % of the total workload is devoted to music training, 25 % to special pedagogy, didactics and practice, 14 % to general education, 1 % to cultural training, and from 20 % to 30 % – if a student chooses to study another school subject.

The internship program is approximately 30 ECTS credits and consists of 4.5 years of school internship as well as various projects. The academy cooperates with approximately 80-100 different schools from kindergarten to high school. Training is provided at all levels of the school.

Admission to music education is based on special music and educational tests, as well as grades of high school or equivalent. And for graduation you need a thesis, which is allocated 15 ECTS credits. Its content should be related to the role of the student as a music teacher.

The main teaching methods are individual, group or project, and the form of assessment – an exam. The exam is mostly conducted for each course in a formative manner. Some courses include written or practical tests. There are two types of assessments: passed or failed. There is no final exam at the end of the study.

Thus, we can say that there is a noticeable focus on music teachers' training compared to other teachers' training (Website http://www.mhm.lu.se).

The University of Umeå provides education to teachers working in kindergarten, as well as at primary and secondary school levels. Because the program trains teachers, and music is one of the subjects you can choose to become a teacher, there is a clear emphasis on educational goals, not music. The level of education is university. The total duration of study is 330 ECTS credits, where 1.5 credits are musical knowledge.

Assessment and examination are conducted both with the help of written tests and with the help of abstracts. One of the following grades is used in the assessment: "Väl Godkänd" (well approved), "Godkänd" (passed) or "Underkänd" (not passed). To receive Väl Godkänd, students must have the ability to in-depth analysis with a reflective and dissociative attitude (http://www.utbildningar.umu.se/pluto/portal/SelmaPortlet).

The Stockholm Institute of Education offers educational programs of various duration and with music as one of the possible accents or profiles. The concept profile is used in the documents to indicate the area of teaching that the programs are considering. As for the direction, it can be considered both musical and educational, although in general the context is educational.

The Stockholm Institute of Education is a university where a duration of study is three and a half years (210 credits) for a profile/degree leading to compulsory school teaching – initial stages, up to a maximum of five and a half years (330 credits) to obtain the qualification of a teacher of the high school.

One year of study consists of two semesters of 30 credits. Each degree consists of a total field of teaching subjects of 90 credits. Students also choose one or two accents specific to a subject or subject area.

The Stockholm Institute of Education collaborates with the Royal College of Music in Stockholm (www.kmh.se). The collaboration is that students of the Institute will study music at the Royal College and vice versa, students of the Royal College will study the general direction of teaching at the Institute.

To complete the music program, you must write a required 15-credit dissertation thesis (Website www.lhs.se).

Conclusions

As a result of the study, we came to the following conclusions.

Most of the studied training programs for future musical art teachers are practice-based and include performance subjects (musical instrument, vocal and instrumental ensemble, choir, arrangement, piano improvisation, conducting, vocals, etc.), music theory (harmony, analysis of musical forms, polyphony, solo etc.), music-historical (author's song and oratorio, composition in the style of Schenker, general musical knowledge, history of music, etc.), psychological-pedagogical and didactic cycle (pedagogy, psychology, musical organization of events, IT technologies, etc.). At the same time, we can say that there are certain disciplines that are narrowly focused on certain types of professional training (leadership exercises (Denmark), directing (Austria), jazz (Latvia), etc.).

The main activities in higher education institutions that train future musical art teachers are playing musical instruments, singing, conducting, composition and improvisation, and sometimes rhythmic activities (Austria), facts and discussions about the role of music in school and Danish society (Denmark), electroacoustic training (Latvia), etc.

It is found out that in practical training music-pedagogical systems of outstanding teachers-musicians are used, namely: Z. Kodály (Poland); S. Suzuki (Poland); K. Orff (Austria); E. Jaques-Dalcroze (Switzerland, Austria) and others.

Thus, the analysis of the experience of professional training of the future musical art teachers in the EU countries provided an opportunity to state that:

- education is aimed at the comprehensive professional development of the specialist;
- it is logically structured and systematized;
- it involves the use of creative music;
- it is built on a combination of folk, academic, contemporary music;
- it provides development of the necessary professional performing and analytical skills;
- it applies effective teaching methods;
- it uses modern technical means and learning technologies.

References

Бобраков, С. В. (2013). Реалізація практико-орієнтованого підходу в контексті реформаційних процесів у педагогічній освіті Німеччині. *Мистецька освіта в контексті європейської інтеграції: інтеркультурний вимір: матеріали III Міжнародної наукової конференції «Теоретичні та методичні засади розвитку мистецької освіти в контексті європейської інтеграції», м. Суми, 1-3 жовтня 2013 року,* (сс.12-14). Суми (Bobrakov, S. V. (2013). Implementation of a practice-based approach in the context of reform processes in pedagogical education in Germany. *Art education in the context of European integration: intercultural dimension: materials of the III International Scientific Conference "Theoretical and methodological principles of art education in the context of European integration", Sumy, October 1-3, 2013*, (pp. 12-14). Sumy).

Брайнин, В. Б., Нойманн, Р. (2007). Музыкально-педагогическое образование в Германии и Болонский процесс. *Музыка в школе, 3,* 11-16 (Brainin, W. B., Neumann, R. (2007). Music and pedagogical education in Germany and the Bologna process. *Music at School, 3,* 11-16).

Донська, І. (б.д.). *Як влаштована музична освіта в Німеччині*. Режим доступа: http://osvita.media/opinions/yak-vlashtovana-muzychna-osvita-v-nimechchyni dosvid-ukrayinskoyi-vchytelky/ (Donska, I. (n.d.). *How music education is arranged in Germa*ny. Retrieved from: http://osvita.media/opinions/yak-vlashtovana-muzychna-osvita-v-nimechchyni dosvid-ukrayinskoyi-vchytelky /).

Дубінець, І. В. (2016). Музично-теоретичні дисципліни в процесі фахової підготовки майбутнього вчителя музичного мистецтва: цілі і задачі. *Наукові записки. Серія: Педагогічні науки, 3,* 95-99 (Dubinets, I. V. (2016). Music-theoretical disciplines in the process of professional training of future music teachers: goals and objectives. *Scientific Notes. Series: Pedagogical Sciences, 3,* 95-99).

Желанова, В. В. (2016). Суб'єкт-суб'єктна взаємодія вихователя і вихованців як засіб творчої самореалізації особистості. *Педагогічний часопис Волині, 2 (3),* 71-75 (Zhelanova, V. V. (2016). Subject-subject interaction of the educator and the pupils as a means of creative self-realization of the individual. *Pedagogical Journal of Volyn, 2 (3),* 71-75).

Камалова, Г., Новгородова, Е. (2017). Музыкальное образование в Германии, Великобритании и России. *Вестник КАЗГУКИ, 2,* 96-102 (Kamalova, G., Novgorodova, E. (2017). Music education in Germany, Great Britain and Russia. *KAZGUKI Journal, 2,* 96-102).

Музыкальное образование и воспитание в Германии. Режим доступа: https://knowledge.allbest.ru/music/2c0b65625b3bc78a4c43b88421306c26_0.html (*Music education and upbringing in Germany*. Retrieved from: https://knowledge.allbest.ru/music/2c0b65625b3bc78a4c43b88421306c26_0.html).

Мукашева, А. (2014). Организация высшего музыкального образования в Чехии, Болгарии и Автрии: сравнительный аспект. *Вестник КазНУ. Серия «Педагогические науки», 1(41)* (Mukasheva, A. (2014). Organization of higher music education in the Czech Republic, Bulgaria and Austria: a comparative aspect. *Bulletin of KazNU. Pedagogical Sciences Series, 1 (41)*).

Пляченко, Т. М. *Компетентнісна модель у структурі фахової підготовки майбутнього вчителя музики*. Режим доступу: http://elibrary.kubg.edu.ua/570/1/T_Plyachenko_Kompetentnisna%20model.pdfBiałkowski, Przychodzińska (Pliachenko, T. M. *Competence model in the structure of professional training of future music teachers*. Retrieved from: http://elibrary.kubg.edu.ua/570/1/T_Plyachenko_Kompetentnisna%20model.pdfBiałkowski, Przychodzińska).

Проворова, Є. М. (2015). Підготовка майбутнього вчителя музики до проектування уроку: праксеологічний підхід. *ScienceRise, 10/5 (15),* 49-52 (Provorova, Ye. M. (2015). Preparing a future music teacher for lesson design: a praxeological approach. *ScienceRise, 10/5 (15),* 49-52).

Пуховська, Л. (1997). *Професійна підготовка вчителів у Західній Європі*. Київ: Вища школа (Pukhovska, L. (1997). *Teacher training in Western Europe*. Kyiv: Higher School).

Рейзенкінд, Т. Й. (2008). *Теоретико-методичні засади професійної підготовки майбутнього вчителя музики у вищих навчальних закладах* (автореф. дис. … д-ра пед. наук: 13.00.04). Київ (Reisenkind, T. J. (2008). *Theoretical and methodological foundations of professional training of future music teachers in higher education institutions* (DSc thesis abstract). Kyiv).

Ростовський, О. Я. (2003). *Лекції з історії західноєвропейської музичної педагогіки*. Ніжин: Видавництво НДПУ ім. Миколи Гоголя (Rostovskyi, O. Ya. (2003). *Lectures on the history of Western European music pedagogy*. Nizhyn: NSPU Publishing House. Nikolai Gogol).

Ткаченко, М. О. (б.д.). *Специфіка та зміст фахової підготовки майбутніх учителів музичного мистецтва*. Режим доступу: http://dspace.hnpu.edu.ua/bitstream/123456789/201/1/%D0%A2%D0%BA%D0%B0%D1%87%D0%B5%D0%BD%D0%BA%D0%BE%20%D0%9C.%D0%9E.%20.pdf (Tkachenko, M. O. (n.d.). *Specifics and content of professional training of future musical art teachers.* Retrieved from: http://dspace.hnpu.edu.ua/bitstream/123456789/201/1/%D0%A2%D0%BA%D0%B0%D1%87%D0%B5%D0%BD%D0% BA% D0% BE% 20% D0% 9C.% D0% 9E.% 20.pdf).

Філоненко, Л. П. (1994). *Українська музична культура як компонент професійної підготовки майбутнього вчителя музики* (дис. … канд. пед. наук: 13.00.04). Київ (Filonenko, L. P. (1994). *Ukrainian musical culture as a component of professional training of future music teachers* (PhD thesis). Kyiv).

Юдзіонок, Н. М. (2011). *Формування професійної компетентності майбутніх учителів в музично-інтерпретаційній діяльності* (дис. ... канд. пед. наук: 13.00.04). Ізмаїл (Yudzionok, N. M. (2011). *Formation of professional competence of future teachers in music-interpretation activity* (PhD thesis). Ishmael).

A web site analysis of music teacher education in Europe 2007. Retrieved from: http://lup.lub.lu.se/luur/download?func=downloadFile&recordOId=1325479&fileOId=1325480

Aarhus College of Education. Retrieved from: http://www.aardassem.dk/

Åbo Academy. Retrieved from: http://www.vasa.abo.fi/pf/li/ped

Adam Mickiewicz University in Poznan. Retrieved from: https://amu.edu.pl/

Fryderyk Chopin Academy of Music. Retrieved from: http://www.chopin.edu.pl/angielskie
Jazeps Vitols Latvian Academy of Music. Retrieved from: www.music.lv/academy
Malmö Academy of Music. Retrieved from: http://www.mhm.lu.se
Riga Teacher Training and Educational Management Academy. Retrieved from: www.rpiva.lv
Royal Collage of Music in Stockholm. Retrieved from: www.kmh.se
Silkeborg Teacher Seminarium. Retrieved from: http://www.silkeborgsem.dk/
The Sibelius Academy. Retrieved from: http://dept.siba.fi/
The Stanislaw Moniuszko Academy of Music in Gdansk. Retrieved from: www.amuz.gda.pl
The Stockholm Institute of Education. Retrieved from: www.lhs.se
The University of Helsinki. Retrieved from: http://www.helsinki.fi/sokla/english/classteacher.html
Tkachova, N., Du, Jingxu (2020). Prospective areas of creative using the Chinese experience in forming students' entrepreneurial competence within the Ukrainian higher school. *Polish science journal, 3 (24),* 75-81.
University of Umeå. Retrieved from: http://www.utbildningar.umu.se/pluto/portal/SelmaPortlet

INTERNATIONAL COOPERATION IN THE FIELD OF VOCATIONAL EDUCATION IN THE EUROPEAN UNION COUNTRIES: GENESIS, REGULATORY FRAMEWORK AND CONTENT-PROCEDURAL FOUNDATIONS

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Abstract. The study deals with genesis, regulatory framework, and content-procedural foundations of the international cooperation in the field of vocational education in the European Union countries. The stages in the development of EU policy in the field of international cooperation in the field of vocational education and training are characterized: initial; formation and expansion; intensification; institutional integration based on the synthesis of external and internal components. On the basis of the analysis of the EU documents, the main areas of international cooperation in the field of VET are defined: development, coordination and/or implementation of international VET policy; increase in the institutional capacity of public authorities/technical assistance, including development of VET standards and qualification systems; development and management of international networks of VET institutions (information exchange and joint projects); certification and quality assurance of VET educational services abroad; marketing of VET providers and business development; development of mobility programs; development of research, information exchange and networking; development of training systems, curriculum and training equipment.

Key words: international cooperation, vocational education, European Union countries, international cooperation in the field of vocational education.

Introduction

In the context of Ukraine's European integration, the reform of all elements of the education system based on international cooperation, including vocational education, is becoming especially important. The outlined course is accompanied by the relevant state policy and is reflected in the regulatory and legal support of the processes of modernization of the system of vocational education. Virtually every strategic document ("State target program for the development of vocational education for 2011-2015" (2011), "National strategy for the development of education in Ukraine for 2012-2021" (2011), "Strategy of state personnel policy for 2012-2020" (2012), etc.) contains provisions on international cooperation. A similar emphasis is placed on the concepts and development programs of vocational education institutions, as well as research institutions that provide scientific support for modernization to build a flexible and open system of lifelong learning with involvement of all social partners. Thus, the Concept of Development of the Institute of Vocational Education of the National Academy of Pedagogical Sciences of Ukraine (2009) provides for participation in the international projects, creation of joint scientific and methodological research projects with foreign scientists, exchange of scientific information, organization and holding of international scientific conferences and seminars, publishing international collections of scientific papers on the theory and practice of vocational education, etc. For the effective implementation of the outlined tasks of great practical importance is the analysis of the choice of the main principles and tools of integration, success factors and the main patterns of development of cooperation in vocational education in Europe and the world.

It should be noted that the European Union's programs in the field of education, including vocational and technical, are an important resource for political influence on the processes of integration and their perception in society. The European Commission has accumulated extensive

experience in using financial, political and information resources to create and develop transnational networks that promote integration processes, initiate and support educational projects, ensure the publicity of their results, thus helping to increase the role of European institutions. Learning and mastering the methods and tools of cooperation in the field of vocational education of EU member states can be useful for Ukraine's active participation in the formation of a single European educational space, as well as for cooperation with the EU's Eastern Partnership countries.

The study of the European experience of internationalization of vocational education – involvement in global cooperation and international academic mobility of students and teachers of VET, and researchers; launching joint training programs and research with foreign VET institutions; accreditation and active participation in the activities of international educational organizations, such as the Association for Teacher Education in Europe (ATEE), the European Educational Research Association (EERA), the European Association for the Education of Adults (EAEA), etc.; mastering the culture of project activities with the subsequent presentation of research results in leading scientific publications in the world (according to SCOPUS), etc. – will help intensify the integration of vocational education in Ukraine in European and world education areas.

Despite the large number of scientific papers on the experience and documents that laid the foundations for the formation of a single space for higher education in Europe, the experience of integration processes in the field of European vocational education has been studied much less. Recent landmark events, such as the adoption of the Bruges Communiqué on strengthening European cooperation in vocational education and training for the period of 2012-2020 (December 7, 2010), and the launch by the European Education Foundation of the Turin Process (2010), which complements the Copenhagen process and enables EU and partner countries to share knowledge and experience, etc. In the context of these initiatives, Ukraine has the opportunity to develop and evaluate vocational education policies based on evidence and cooperation.

In the late 20th – early 21st century, domestic scientists conducted research on current trends and features of the vocational education development in foreign countries. Particular attention was paid to the study of national strategies and experience in modernizing the systems of vocational education in Western countries (N. Abashkina, N. Avsheniuk, N. Bidiuk, T. Desiatov, A. Kaplun, L. Lokshyna, N. Nychkalo, A. Sbruieva, O. Shcherbak and others).

The aim of the study is to characterize genesis, regulatory framework, and content-procedural foundations of the international cooperation in the field of vocational education in the European Union countries.

A set of interrelated research methods was used to achieve the goal: general scientific: analysis, synthesis, comparison, generalization; specific scientific: systems analysis, which made it possible to establish relationships between elements of international cooperation in the field of vocational education in the European Union as a holistic phenomenon; terminological analysis – to develop sources on the problems of international cooperation in the field of vocational education in order to compare the content of educational terms and concepts; historical-genetic and retrospective analysis, which revealed the origins and features of the formation and development of international cooperation in vocational education in the EU.

Research results

Genesis of the international cooperation in the field of vocational education in the European Union countries

Since Ukraine has entered the Bologna Process (May 2005), the term "in the European context" has been actively spread in the scientific life of our country, which began to be used as self-evident and advertise a comparative study of the interactions of relevant Ukrainian and European socio-cultural phenomena, considering them as a whole that combines and explains these phenomena. However, the problem of contextualization (context analysis) in research is quite a

challenge. In particular, we emphasize the problematic contextual issues regarding the future of Ukraine's education system as part of the "Europe of Knowledge".

The analysis of scientific and pedagogical literature, international, European, state educational recommendations and regulations shows that the issues of studying the impact of modern integration processes on the educational sphere and their relationship are widely discussed. Scientific searches of V. Andrushchenko, M. Zgurovskyi, V. Kremen, V. Kudin, N. Nychkalo, A. Sbruieva are directed at revealing the essence, characteristics and defining the consequences of the influence of globalization processes on education development. The issues of globalization have become the subject of the study of Ukrainian researchers O. Lokshyna, O. Matviienko, O. Miliutina, L. Pukhovska, A. Sbruieva and others.

In particular, studying the problem of cooperation in vocational education in Europe, L. Pukhovska (Pukhovska, n.d.) found a number of contradictions related to the specifics of social development in the region, focused on forming an open intercultural European society, which focuses on strengthening integration processes in all spheres of public life, including education, in particular, between: the global needs of European society in unification and the local needs of each national culture; the need to update the quality of education in accordance with the needs of an open European society and traditional approaches to this problem in the education systems of European countries; significant potential of education in forming the readiness of European citizens for intercultural interaction and partial use of this potential in some countries; growing opportunities for intercultural interaction due to the development of the European Union's education policy and the unwillingness of professionals (education policy-makers, administrative staff, teachers, educators and so on) to implement it; strengthening the upbringing function of modern education and insufficient activities of teachers to train in the national education system a European citizen who, while maintaining his national and cultural identity, is ready to live and work in an open society at various levels – local, regional, national, European, world (Pukhovska, n.d.).

It should be noted that the term "vocational education" (in Ukrainian – professional-technical education) in modern conditions has no counterpart in the European terminology database. In European dictionaries, as well as in official documents of the European Commission and other European institutions, this part of the education system is called "vocational education and training" (VET) (*Glossary. Quality in education and training,* 2011, p. 167). Therefore, in our study both terms: "vocational education" – in relation to the domestic context and "vocational education and training" – in relation to the European context will be used synonymously.

As L. Pukhovska rightly points out, for Ukrainian researchers the coordination of differences between key terms of education is of fundamental importance, because in the formation of the European space of education and science domestic theoretical developments and best practices should be recognized by foreign scientists, politicians, leaders and practitioners. The content of the concept of "policy in the field of vocational education" is also important for our study.

Educational policy is often identified with a course of action adopted and followed by the government or some other organizations that promote and define the goals, methods and programs used in education and lead to the acquisition of skills, knowledge and development of thinking. Further clarification of this concept depends on the subject of policy (state, public, regional, institutional, European, etc.). Further, the difference between the terms "politics" (political interaction of interest groups within the educational sphere) and "policy" (strategy and identifying ways to achieve this goal) is important, as well as its relationship with the social policy of the state, how it is produced, through which mechanisms and levers it is implemented. The issue of reconciling the differences between the terms "state policy" and "public policy" is also fundamental – in Ukrainian translations of foreign scientific literature, these concepts are often replaced (Klepko, 2006, p. 38-40).

A study on the development of vocational education in the European Union has shown that an important area of research in this area is research on the history of integration processes on the continent, including the problems of educational policy, which developed under the influence of various factors. Based on the analysis of economic, social and political determinants, researchers

have substantiated the historical periods of development of the EU education policy and identified its current features, such as multi-vector character, dynamism, focus on the needs of European societies and so on. Comparative analysis of the author's periodizations of policy development: H. Ertl (in the field of education and training), R. Dale (in the field of education), Ye. Brazhnyk (in the field of pedagogical education), O. Lokshyna (in the field of school education), etc., as well as elaboration of the official EU documents defining the strategy of education development, made it possible to identify the following stages in the development of EU policy in the field of vocational education and training: initial (1951-1963); formation and expansion (1963-1992); intensification (1992-2000); institutional integration based on the synthesis of external and internal components (from 2000 to the present).

The initial stage is characterized by creation of a legal framework for the functioning of the system of VET specialists training of European communities. These include: the ECSC Treaty (1951); Art. 56 on the financing by Brussels of professional retraining programs for employees; Euratom Treaty (1957); Art. 9 on the establishment of education institutions for the training of qualified specialists; EEC Treaty (1957); Art. 41, 50, 57 on the coordination of Member States' efforts in the field of vocational training, the exchange of young professionals and the mutual recognition of diplomas and qualifications in order to facilitate the movement of workers within the Commonwealth, etc.

The stage of formation and expansion (1963-1992) is characterized by the introduction of the basic principles of policy in the field of vocational training, developed in accordance with Art. 128 of the EU Treaty. They have become the framework for the coordination of actions and initiatives aimed at implementing the provisions of the Treaty. In particular, in 1975 the European Center for the Development of Vocational Training (CEDEFOP – French abbreviation of the official name of the center) was established to "strengthen European cooperation, support the European Commission, Member States and social partners in developing and implementing vocational education policies, enhancing social inclusion and skills" (*Cedefop historical archives: first deposit ceremony*, 2004). At that time, SEDEFOP was one of the first specialized international centers aimed at supporting the development of European policy in the field of vocational education. For more than 20 years, its main office was based in Germany, where in 1969 the Federal Institute for Vocational Training was opened. Almost simultaneously, such institutes were established in France (1970), Austria (1970) and Italy (1973), which became a breeding ground for the development of Europeanization policy in the field of vocational education and training. Numerous comparative studies and research projects have been carried out at the European Center for the Development of Vocational Training, and many best practices and various national vocational education systems have been described and documented.

This was in line with the objectives of the first Program of Education, approved by a resolution of the Council and Ministers of Education in 1976, which called for the collection of information on education not only to transfer experience between Member States but also to identify general trends and recommendations (*European Union/Resolution of the Council and the Ministers of Education, Meeting within the Council, of 9 February 1976 Comprising an Action Programme in the Field of Education*).

At the end of the 80's of the twentieth century, another significant event took place, which became a sign of the policy of Europeanization in the field of vocational education and education in general. The European Education Information Network, Eurydice, has been launched, making comparisons of statistics and best practices an integral part of Community education and training policy development. It has become an essential component of the mechanism for ensuring the quality of cooperation in the field of education. The network includes national units established by the Ministries of Education and a central unit established by the EU Commission. The network's divisions collect, monitor, process and disseminate comparable analytical information and statistics on EU education systems and education policy. Significant information material is contained in the "Key date on education in Europe", which is published every two years (*Eurydice – Key Data Series*).

This publication contains data on vocational education in European countries. As for thematic publications, the analysis has shown that they are mainly devoted to the development of school and higher education. After the launch of the Bologna Process, the network conducts biennial reviews of the implementation of the objectives of the European Higher Education Area in the signatory countries.

According to O. Lokshyna, in the 80's of the last century, the boundaries of education policy in Brussels were expanding through the inclusion of general education, as well as the active launch of various programs aimed at exchanging human resources (ROTECNET, COMETT, ERASMUS, PETRA, Youth For Europe, LINGUA, FORCE, TEMPUS, SOCRATES) (Lokshyna, 2009, p. 44).

In other words, the European Union's policy is being expanded both vertically – by level of education and horizontally – and the exchange of human resources is added to the exchange of information and statistics.

The stage of intensification (1992-2000), the boundaries of which are determined by two significant events – the adoption of the Maastricht Treaty (EU Treaty) and the proclamation of the Lisbon Declaration. Researchers of the European integration processes call this period a period of "liquid state" of the educational policy, when the principle of subsidiarity operated, according to which Brussels had the right only to support and supplement some aspects of educational policies of member states. The transition to a "solid state" policy is linked to the introduction of open coordination during the extension of the Lisbon Strategy to education. Such a transformation started the organization of measures aimed at the gradual unification of national educational policies by member states by establishing common goals, deadlines for their achievement and introduction of measurement tools (Lokshyna, 2009, p. 43). It is believed that the use of this method takes cooperation to a qualitatively new level.

The stage of institutional integration based on the synthesis of external and internal components (from 2000 to the present), which began with the adoption by the European Commission of the Lisbon Strategy (March 2000) (*European Commission. Communiqué of the European Ministers for Vocational Education and Training, the European Social Partners and the European Commission, convened in Bruges on 7 December 2010, on enhanced European Cooperation in Vocational Education and Training for the period 2011–2020,* p. 3) and the program "Education and Training 2010" (March 2002). This period is aimed at achieving the strategic goal of transforming Europe into the most competitive and dynamic knowledge-based economy capable of sustainable economic growth, improving the quality of jobs and ensuring the social cohesion of society.

Regulatory framework of the international cooperation in the field of vocational education in the European Union

In the field of vocational education at the beginning of the 21st century the scenario for the implementation of the Lisbon Strategy was developed: the adoption of an action plan for the development of mobility and skills (Nice, December 2000) and the Recommendations of the European Parliament and the Council (June 2001); approval of the Report "The Concrete Future Objectives of Education and Training Systems" (March 2001) (*European Union. Report from the Education Council "The Concrete Future Objectives of Education and Training Systems",* 2001) and holding a Conference in Bruges (October 2001) aimed at initiating a process of cooperation in vocational education and training, etc. These initiatives took concrete form in the Copenhagen Declaration, the starting document that launched the so-called The Copenhagen process, named after the meeting place of the European Commission and the Ministers of Education of European countries in November 2002.

The declaration forced European Community to address the following issues:

- creation of a European area in the field of vocational education and training;
- ensuring transparency of qualifications;
- solving the problem of recognition of competences and qualifications;

- increasing support for the development of competences and qualifications at the sectoral level;
- developing common principles for the recognition of non-formal and informal (spontaneous) learning;
- promoting cooperation in the field of quality assessment with an emphasis on the exchange of models and methods, as well as general criteria and principles for assessing the quality of vocational education and training;
- paying attention to the educational needs of teachers and masters in all forms of vocational education and training (*Directive (EU) 2016/801 on the conditions of entry and residence for the purposes of research, studies, training, voluntary service, pupil exchange schemes or educational projects and au pairing*).

The key concept of the Copenhagen process is to ensure the quality of vocational education and training. More specifically, this task was formulated as follows: "Development of cooperation in the field of quality assurance with an emphasis on the exchange of models and methods, as well as development of common criteria and principles of quality for vocational education and training".

The focus on global quality standards is reflected in the basic principles of the Copenhagen process, related to the voluntary nature of cooperation, optimization of models formed within national VET systems, focus on the needs of citizens, participation of social partners and so on.

Since the main provisions and achievements of the Copenhagen process have been fully considered by domestic researchers (N. Nychkalo, O. Shcherbak, T. Desiatov and others), we can only note that introduction of the European mechanisms such as Europass, the European Qualifications Framework (EQF), the European credit system for vocational education and training and the European Quality Assurance in Vocational Education and Training (EQAVET) have formed the basis for a real pan-European space for vocational education and training.

However, after eight years of European cooperation, arose a need to define long-term strategic goals for the period 2011-2020 based on a review of the strategic approach and priorities of the Copenhagen process. Two important developments in European vocational education took place in 2010 – on July 9, 2010, the European Commission adopted a document entitled "A new driving force for European cooperation in vocational education and training to support the Europe 2020 strategy", which set out in detail future European policy in this area, and on December 7, 2010 in Bruges was adopted a Communiqué on strengthening European cooperation in vocational education and training for 2011-2020 (*European Commission. Declaration of the European Ministers of Vocational Education and Training, and the European Commission, convened in Copenhagen on 29 and 30 November 2002, on enhanced European cooperation in vocational education and training "The Copenhagen Declaration"*).

The provisions of these documents are not only of academic interest to the Ukrainian educational society. They contain valuable information for the processes of modernization of vocational education in Ukraine in the context of European integration. First of all, let's focus on the global vision of vocational education systems, which by 2020 should provide:

- attractive and inclusive vocational education, including qualified teaching staff, innovative teaching methods, high-quality infrastructure, high labor market relevance and adequate ways of further education and training;
- quality basic vocational education (initial VET), which can be called by students, parents and society as a whole an attractive alternative to general education. Basic vocational education should equip students with key competences and special professional skills;
- flexible vocational education based on academic achievement, which provides flexible learning pathways as a result of permeability between different educational subsystems (school education, vocational education, higher education, adult education), and recognizes non-formal and informal education, including competences acquired in the workplace;
- pan-European educational space with transparent qualifications systems and support for international mobility;

- increasing the opportunities for international mobility of students and teachers in the field of vocational education;
- easily evaluated and high-quality information, management and lifelong counseling, which forms a coherent network and enables European citizens to manage their own learning and professional activities, taking measured decisions (*European Commission. Communiqué of the European Ministers for Vocational Education and Training, the European Social Partners and the European Commission, convened in Bruges on 7 December 2010, on enhanced European Cooperation in Vocational Education and Training for the period 2011–2020*, p. 8).

Thus, we can state that the Bruges Communiqué outlines the ideal image of the European vocational education and training in the next decade. Based on this, 11 strategic development goals for the period 2011-2020 were formulated, as well as 22 tasks for the implementation of the new strategy for the medium term – 2011-2014.

Content-procedural foundations of international cooperation in the field of vocational education in the European Union

Clarification of the content-procedural foundations of international cooperation in the field of vocational education and training in the European Union involves, first of all, outlining the priorities of modern EU policy in the field of vocational education, including:

- high quality, efficiency and compliance with the current needs of society, economy, each individual;
- result-centered nature of educational and political initiatives: the focus of curriculum on the formation of readiness for employment, development of innovation, civic activity of VET graduates;
- development of educational mobility, cross-border cooperation;
- deepening the relationship between education and business;
- compliance with the needs of the digital age;
- support for the first work experience and on-the-job training;
- access to the labor market: first job;
- increasing attention to the quality of teaching, to the problems of continuous professional development of teachers, development and implementation of standards of professional activity of teachers.

Therefore, international cooperation in the field of VET is carried out taking into account the priorities outlined above. Further, in the context of consideration of the content-procedural foundations of the international cooperation in the field of vocational education and training in the European Union, we find it appropriate to consider the activities of the main agents of cooperation in this field.

European Center for the Development of Vocational Training – Cedefop – an agency of the European Union that supports development of the European vocational education and training – was established in 1975, headquartered in Thessaloniki, Greece. The abbreviation Cedefop is taken from the French name “Center Européen pour le Développement de la Formation Professionnelle”.

The agency’s mission is to support development and implementation of European VET policy. Cedefop has the following goals and objectives:

- assisting the Commission in the development of professional training and retraining of citizens;
- introduction of the all-Union system of vocational education and training;
- preparation of reports related to this situation, the latest research and development in the field of vocational education and training;
- encouraging initiatives that can promote a coherent approach to vocational education;
- conducting discussions on issues with the participation of all stakeholders.

In its activities, the center takes into account the relationship between vocational education and other levels of education.

Cedefop initiated a number of projects, including:

- "New Skills for New Jobs. European Employment Strategy" (2008). Objectives: to minimize the imbalance between existing skills (qualifications) and labor market needs, to coordinate labor markets and education services, to improve methodological approaches to forecast future needs for qualifications Activities: 1) development of the European Qualifications Framework: definition of qualifications based on evaluation of learning outcomes; 2) implementation of the European program for the development of key competences required for lifelong learning; 3) introduction of ESCO – European Classification of Skills/Competences, Qualifications and Occupations; 4) analysis of trends in demand at the sectoral level, formation of sectoral councils by qualifications and areas; 5) development of CEDEFOP forecasts – Panorama of qualifications in Europe: forecasting the demand for labor (by professions and qualifications); replacement of the need for professions/qualifications as a result of the influence of demographic factors (retirement, mortality), transition to the status of the unemployed, net migration and mobility between professions;
- "A new skills agenda for Europe: working together to strengthen human capital, employability and competitiveness" (2016). The main objectives of the project were: to improve quality and the relevance of emerging skills, making skills and qualifications more visible and comparable at the European level, improving skills intelligence and information for better career choices.

The European Training Foundation (ETF) was established in 1990 to promote, in the context of the European Union's external relations policies, the improvement of human capital development, defined as activities that promote life skills and competences through lifelong learning.

The ETF helps 30 countries bordering the EU to improve vocational education systems, analyze skills needs and develop labor markets. Thus, the ETF helps to strengthen social cohesion and ensure more sustainable economic growth in these countries, which in turn has a positive effect on EU member states and the lives of their citizens by improving economic relations.

The main areas of ETF cooperation with partner countries are:

- analysis of national/local needs for skills and employment;
- systems management, including stakeholder involvement;
- development and implementation of reforms in education systems in order to increase employment opportunities and meet labor market needs;
- improving initial and further training to promote the professional integration and reintegration of the adult population into the labor market;
- promoting access to vocational education;
- social dialogue and private sector participation;
- stimulating cooperation in the field of education between education institutions;
- improving the system of recognition of qualifications and ensuring the quality of education;
- on-the-job training;
- teacher training;
- training in entrepreneurship and key competences;
- career guidance.

It should be noted that international cooperation in the field of VET does not have such a long tradition as in the field of higher education, which in modern conditions is a mass phenomenon. In the field of vocational education there is still a number of problems that need to be addressed, in particular: employment of graduates of VET institutions is carried out in the local employment zone, mobility in the field of VET affects a small proportion of students; heterogeneity of VET systems/models in EU/EFTA countries; different levels of importance of vocational education for

educational policy-makers and society as a whole in individual countries; the dependence of international VET cooperation on the commercial and diplomatic strategies of individual countries (e.g., focusing on industries where individual countries have industrial added value), etc., may lead to different focuses of interests, intentions and strategies in different countries (*Building knowledge*, 2015).

Given the novelty of the phenomenon of international cooperation in the field of vocational education, there is currently no single definition of this term. In general, international cooperation means joint actions of participants in any area of their common interests, their interrelated activities to reconcile their positions, coordinate actions, solve problems of mutual importance, and make mutually acceptable decisions (*International law*, 2007).

In the report "Building knowledge on international cooperation in VET" under international cooperation in the field of VET means:

- bilateral cooperation initiated by individual EU/EFTA countries (and Australia) with third countries (i.e. non-EU countries) worldwide;
- multilateral initiatives put forward by international organizations involving countries in cooperation in the VET sector (*Building knowledge*, 2015).

The main areas of international cooperation in the field of VET are:

- development, coordination and/or implementation of international VET policy;
- increase in the institutional capacity of public authorities/technical assistance, including development of VET standards and qualification systems;
- development and management of international networks of VET institutions (information exchange and joint projects);
- certification and quality assurance of VET educational services abroad;
- marketing of VET providers and business development;
- development of mobility programs;
- development of research, information exchange and networking;
- development of training systems, curriculum and training equipment.

In recent years, the European Commission (in particular the Directorate-General for Education, Youth, Sport and Culture, Directorate-General for Employment, Social Affairs and Inclusion, and other Directorates-General) has gained solid experience and knowledge in VET) and cooperation within Europe. Its actions were complemented by a thorough examination by the Cedefop. However, the influence of the European Training Center was limited mainly to EU countries. The European Training Foundation (ETF), as it has been mentioned above, has a wider impact on the development of VET cooperation. The ETF is a decentralized agency of the European Union with 25 years of experience in developing VET systems and conducting political dialogue in 30 countries. Geographical limits of influence of the European Education Foundation cover countries with economies in transition or developing countries, directly in the EU's neighboring regions and Central Asia. The purpose of the ETF was to develop the local workforce to achieve sustainable development, competitiveness and social cohesion in the country. The European Education Foundation has experience in technical assistance, data collection and analysis of policy initiatives.

In addition to these activities, both organizations, as well as the Directorate-General for Education, Youth, Sport and Culture, have participated in working groups and other forums on VET at the international level, including Inter-Agency Working Group on TVET Indicators and the Inter-Agency Working Group on Greening TVET and Skills Development, which bring together several international organizations, such as the OECD, UNESCO, the ILO, World Bank, Asia-Europe Forum, etc.

A number of initiatives supported by the European Commission are aimed at developing VET cooperation. In this context, we are talking, first of all, about the European Alliance for Apprenticeships (EAfA), whose activities are aimed at promoting internship programs within Europe; sectoral skills alliances to promote European cooperation in a particular sector of the economy, the EU Skills Panorama, an online platform that provides quantitative and qualitative

information on short- and medium-term skills needs, skills proposals and skills mismatches. However, these initiatives do not extend to third countries.

In recent years, the Directorate-General for Education, Youth, Sport and Culture has also intensified political dialogue with key partners such as China, India, Australia, Canada and the United States. In some respects, this dialogue concerned VET-related elements. The development of international VET cooperation was emphasized in the EU-US-Canada cooperation agreements in 2006-2013, which set out the priority objectives of increasing the attractiveness and competitiveness of VET institutions in Europe and the US/Canada.

In addition to the Directorate-General for Education, Youth, Sport and Culture and specialized VET agencies, cooperation in vocational education and training is a leading area of the European Commission's cooperation with low-income countries under the auspices of EuropeAid. According to the report on TVET and Skills Development in cooperation with the EU (*TVET and Skills Development,* 2012), prepared for the Directorate-General for International Cooperation and Development, the European Commission's intervention covered the following areas:

- policy and governance;
- legal framework;
- management mechanisms and tools;
- TVET financing;
- compliance with the needs of labor markets;
- platforms for dialogue and interaction between governments, employers, workers' organizations, civil society and communities.

At the national level, the main agents of international cooperation in the field of vocational education are:

- organizations that formulate strategies for international cooperation in VET at the national level;
- organizations that provide technical assistance and support in capacity development to third countries;
- VET providers;
- companies involved in the provision of VET services;
- facilitators of international cooperation in the field of VET.

The main types of international cooperation implemented in the EU countries include:

- policy cooperation includes technical assistance and capacity building for the competent public authorities of the third countries. As a rule, such measures of the European Union are aimed at supporting third countries in developing a system or model of learning that exists in the EU. Such activities lead to structural or systemic changes in VET systems. The following activities take place within this category: political dialogue at the strategic level, for example, between ministries or institutions that set VET standards; technical assistance and capacity building leading to the transfer of EU VET models/standards or processes and providing for: development of VET qualifications; curriculum development; development of procedures for assessment of acquired competences (exams) and their confirmation; development of teaching methods; certification of the specified examinations; recognition of qualifications;
- cooperation within and between VET organizations (education institutions and companies). This category includes initiatives for cooperation at the operational level within and between VET organizations (education institutions and companies) in the country and abroad, including: organization of training abroad; creation of VET training centers abroad; building the capacity of VET providers. Unlike the previous type of cooperation, VET providers are involved directly in this category, not politicians;
- individual cooperation – brings together all initiatives that integrate international elements in the country's VET, and which can benefit both resident students and international students, for example: student mobility programs; financial schemes to support student mobility;

mobility of teachers; adaptation of VET programs to globalization/internationalization in the world of workplace (for example, integration of foreign languages and IT/e-training courses);

- information exchange and awareness raising. This category includes such cooperation activities as: exchange of information; market research to identify needs; marketing activities, such as networking and demonstration of a particular VET model through forums, congresses, etc.; research activities that can be included in the policy-making process (*Building knowledge,* 2015).

Conclusions

Development of the vocational education systems in the European Union is linked to existing political, economic, socio-demographic, and technological factors, which allow to identify potential threats and opportunities for structural and content changes. Possible threats that negatively affect the functioning of vocational education and training systems in the EU include reducing the demand for qualified professionals in the medium term, reorienting some EU member states to the national trajectory of education, reducing their attractiveness. Among the opportunities that will contribute to the improvement of models of professional training of the qualified specialists in the EU countries are: further unification and strengthening the level of convergence of vocational education and training systems; increasing the level of demand for skilled labor with a high level of technological and digital competence; growing demand and social demand for continuing vocational education; unification of educational standards for training qualified specialists and providing flexible trajectories for obtaining professional qualifications and recognition of learning outcomes; ensuring the quality of vocational education and training, updating its content in accordance with technological progress; strengthening the use of ICT in the educational process to ensure its accessibility, interactivity and individualization; the need to develop entrepreneurial competence in student youth; making changes in the content and forms of organization of the educational process and organization of interaction in vocational education institutions (creation of technological hubs, startup incubators, etc.).

The priorities for the development of vocational education and training in the European Union, which contain key policy documents, have become the core of the pan-European approaches formed during the European integration processes. They have created a common theoretical foundation for the development of modern vocational education and training systems in member countries and have become a driving force in the convergence of education systems in the EU. From the very beginning, the course was taken to: improve the quality and efficiency of education and training systems in the EU; facilitating access to lifelong learning for all EU citizens; enhancing the openness of the Community's education and training systems to the world. These strategic goals, specified in the tasks, are consistently implemented through the implementation of ten-year strategies – "Lisbon" (2000-2010) and the strategy – Europe 2020 (2011-2020). A significant contribution to the development of integration processes in vocational education and training on the European continent belongs to the Copenhagen process, which initiated thorough national reforms in the field of VET, formed and tested numerous pilot models (recognition of non-formal education and accreditation of vocational education and training; target groups, new funding schemes that motivate citizens to vocational education, different models of combining theoretical training in an education institution with on-the-job training, models of combining training in vocational schools and universities (integrated programs, etc.). Their gradual accumulation has led to the formation of the concept of lifelong learning, which includes six key provisions and, accordingly, six areas of implementation: basic skills, increased investment in human resources, innovation in teaching and learning, learning assessment, career guidance and counseling on vocational education, bringing learning closer to users. The main principles and characteristics of the concept of lifelong learning are set out in a number of policy documents of the European Commission (the beginning of its development dates back to the 70's of the twentieth century). In the new conditions, a practice-

oriented science in the field of vocational education is born, which is created not in academic institutions, but during implementation of transnational research projects. Significant research activities are carried out by the institutions of the European Union – the European Center for the Development of Vocational Education and Training (CEDEFOP) and the European Education Foundation (ETF), as well as the Federal Institute for Vocational Education and Training in Germany (BIBB) and others. Particularly valuable conclusions and provisions on the VET models are the materials of the fundamental research project "Changing the nature and role of vocational education and training in Europe" (CEDEFOP, 2016-2018), which attempts to conceptually present the development of vocational education in the European countries through different prisms of consideration, namely, epistemological and pedagogical, structural and systemic, socio-economic. It has been found that under the influence of a few reasons (different rates of industrialization; influence of political, philosophical, cultural, religious currents; cultural values, traditions, national mentality, etc.) in Europe formed three main so-called "classic" models – state-regulated model (France), liberal market model (UK), dual corporate model (Germany). They show a few differences, in particular regarding the role of the state in the management of vocational education and training. The study of the above models will become the prospects of our further studies.

References

Клепко, С. Ф. (2006). *Філософія освіти в європейському контексті*. Полтава: ПОІППО (Klepko, S. F. (2006). *Philosophy of education in the European context*. Poltava: POIPPO).

Локшина, О. І. (2009). *Зміст шкільної освіти в країнах Європейського Союзу: теорія і практика (друга половина XX – початок XXI ст.): монографія*. К.: Богданова А. М. (Lokshyna, O. I. (2009). *The content of school education in the countries of the European Union: theory and practice (second half of the XX – early XXI century): monograph*. K.: Bogdanova A.M.).

Международное право (2007). М.: Норма (*International law* (2007). M.: Norma).

Пуховська, Л. (б.д.). Співробітництво в сфері професійно-технічної освіти в Європі: політика, інструменти інтеграції, перспективні шляхи. *Теоретичні і методичні основи професійної підготовки майбутніх кваліфікованих робітників,* 19-25 (Pukhovska, L. (n.d.). Cooperation in the field of vocational education in Europe: policy, integration tools, promising ways. *Theoretical and methodological bases of professional training of future Skilled workers,* 19-25).

Сбруєва, А. А. (2013). Приоритеты модернизации европейского высшего образования в контексте реализации стратегии «Европа 2020». *Международное сотрудничество в образовании в условиях глобализации: материалы второй международной научно-практической конференции* (Sbruieva, A. A. (2013). Priorities for the modernization of European higher education in the context of the implementation of the "Europe 2020" strategy. *International cooperation in education in the context of globalization: materials of the second international scientific and practical conference*).

Центр изучения проблем профессионального образования. Режим доступа: http://www.facebook.com/pages/ (*Center for the Study of Vocational Education Problems.* Retrieved from: http://www.facebook.com/pages/).

Building knowledge on international cooperation in VET: final report (2015). Luxembourg: Publications Office of the European Union.

Cedefop historical archives: first deposit ceremony; 28 October 2002/Cedefop Dossier series: 4. Vol. VI (2004). Luxemburg: Office for Official Publication of the European Communities.

Directive (EU) 2016/801 on the conditions of entry and residence for the purposes of research, studies, training, voluntary service, pupil exchange schemes or educational projects and au pairing.

European Commission. Declaration of the European Ministers of Vocational Education and Training, and the European Commission, convened in Copenhagen on 29 and 30 November

2002, on enhanced European cooperation in vocational education and training "The Copenhagen Declaration". Retrieved from: http://www.ec.europa.eu/education/pdf/doc125_en.pdf.

European Commission. Communiqué of the European Ministers for Vocational Education and Training, the European Social Partners and the European Commission, convened in Bruges on 7 December 2010, on enhanced European Cooperation in Vocational Education and Training for the period 2011–2020. Retrieved from: http://www.bruges_en.pdf.

European Union. Presidency Conclusion. 23–24 March 2000 (2000). Lisbon: European Parlament, Directorate Generally for the Presidency.

European Union. Report from the Education Council "The Concrete Future Objectives of Education and Training Systems". Brussels, 14 February 2001. 5680/01 EDUC 18 (2001). Brussels: Council of European Union.

European Union/ Resolution of the Council and the Ministers of Education, Meeting within the Council, of 9 February 1976 Comprising an Action Programme in the Field of Education (1988). *Official Journal of the European Union, 6-19 February,* 0001-0005.

Eurydice – Key Data Series. Retrieved from: http://www.eacea.ec.europa.eu/education/eurydice/key_data_en.php.

Glossary. Quality in education and training (2011). Luxembourg: Publications Office of the European Union.

Frank, I., Schreiber, D. (2006). Bildungsstandards: Herausforderungen fьr das duale System [Educational standards: challenges for the dual system]. *Berufsbildung in Wissenschaft und Praxis (BWP), Vol. 35, No 4,* 6-10.

Hensen-Reifgens, K., Hippach-Schneider, U. (2014). *ReferNet Germany – Supporting teachers and trainers for successful reforms and quality of VET*.

New priorities for European cooperation in education and training; OJ 2015/C 417/04.

Proposal for a Directive on the condition of entry and residence of third-country nationals for the purposes of highly skilled employment; COM (2016).

Quality assurance principles at European level for general education are subject to ongoing discussions in the context of ET2020.

Recommendation European Qualifications Framework for lifelong learning; OJ 2008/C 111/01.

Strategic framework for European cooperation in education and training (ET 2020); OJ 2009/C 119/2.

Single Community framework for the transparency of qualifications and competences (Europass); OJ 2241/2004/EC.

Supporting growth and jobs – an agenda for the modernisation of Europe's higher education systems; COM (2011) 567 final.

The full range of action to aid integration of third-country nationals is presented in the action plan on the integration of third country nationals: COM (2016) 377.

TVET and Skills Development in EU Development Cooperation: final report (2012). European Commission.

MODERN PERSONALITY-CENTERED CONCEPTS AND LEARNING TECHNOLOGIES AS A FACTOR OF OPTIMAL FORMATION AND DEVELOPMENT OF PROFESSIONAL COMPETENCES OF FUTURE TEACHERS

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Abstract. The study, based on the analysis of changes in the content of education of secondary school students in accordance with the Law of Ukraine "On Education", presents a description of the changes in the methodological basis of future teacher training, which will need to implement the main provisions of school reform. In particular, the conceptual bases of future teacher training in the innovative field of personality-centered concepts and learning technologies that ensure the formation and development of professional competences of the students at the pedagogical University are highlighted. The didactic possibilities of heuristic-modular learning technology in the formation of a teacher at a modern Ukrainian school are highlighted.

Key words: personality-centered learning concepts, innovative learning technologies, heuristic-modular learning technology, professional competencies of a modern teacher.

Introduction

Reforming higher and general secondary education in the light of Ukraine's focus on the European course requires an innovative, qualitatively new theoretical and methodological level of training for future teachers (Nogas, 2020).

According to the Laws of Ukraine "On Education" (2017), "On Complete General Secondary Education" (2020) and the Concept "New Ukrainian School" (2016) there have been radical changes in many areas of general secondary education changed the content of students (Ovsienko, 2017).

Only a competent teacher who can form not only special subject competences, but also key ones, will be able to prepare a competent student which is pervasive in the content of preparing a student capable of conscious professional choice, self-realization, lifelong learning, able to live and work in conditions of continuous change, worthily represent the nation in the world cultural and economic space, ensure its successful entry into the world community.

Formation of such a teacher in the institution of higher pedagogical education allows for qualitative renewal of his professional training, first of all, ensuring the focus on the formation of a high level of professional pedagogical competence, which provides a creative level of professional knowledge and skills. Professional and pedagogical competence is acquired, first of all, in the process of studying psychological and pedagogical disciplines (*Professional Standard (Teacher of General Secondary Education),* 2020).

An important condition for training a competent teacher is implementation of modern personality-centered concepts and technologies in the educational process.

The issue of organization and management of the process of formation of professional competencies of future teachers in the conditions of innovative activity in pedagogical universities are especially acute. This is due to several reasons: a) the need to comply with the Laws of Ukraine "On Education" (2017), "On Complete General Secondary Education" (2020), "On Higher Education" (2014), the Concept "New Ukrainian School' (2016) in order to provide conditions for creative self-realization personality of the future teacher and his training at the level of competencies; b) the need to overcome the contradiction between the requirements of new industry standards of education for the training of specialists capable of solving complex professional

problems at the level of competences and insufficient development of scientific and methodological foundations of their training system; c) trends in the transfer of significant emphasis in training to independent work of the learner, which necessitates changing the approach to the organization of training, seek new approaches to training qualified professionals not only in terms of their professional knowledge, but also in terms of their readiness to adapt to the processes of constant change in the socio-economic sphere of society, to accelerate the pace of scientific and technological progress, the need to constantly update and expand their knowledge and skills to meet these growing demands; e) the expansion of international relations, which has led to the growth of the labor market, the work of a significant number of graduates abroad and, consequently, increasing the requirements for their training.

Considering the above requirements for the training of modern teachers, planning changes in the professional training of future teachers, looking for ways and means of forming professional competencies of students, we have assumed that one of the most promising areas in achieving the appropriate quality of higher education is the humanization of the educational process and the introduction of effective educational technologies (Nikitas, 2018; Nazarova, 2020).

A significant contribution to the study of the problem of forming a competent teacher has been made by outstanding scientists N. Kuzmina, V. Slastionin, L. Spirin, A. Shcherbakov, I. Ziaziun and others who determined that to develop new ways of forming competent future specialists it is necessary to create conditions for modeling the structure of creative activity of the future specialist. Researchers note that this opportunity is created by the use of modern concepts and technologies of personality-centered learning.

What specific concepts and technologies should be used, what changes should take place in the middle of the learning process, so that the student's education acquires a vital meaning, so that he learns with pleasure, so that the process of forming his professional competencies is successful? We have tried to find the answer to these questions in pedagogical research, covered in the works of researchers.

I. Zimnia notes that today there is an active search for new technologies for specialist training, based on the formation of his personality, development of creativity and independence that is personality-centered education (Zimnia, 2010, p. 309).

From the standpoint of psychology, the concept of personality-centered education is enriched by ideas about the functions of personality in human life, the specific nature of the personal level of the human psyche, the substantive sphere of reflection, experience and dialogue as mechanisms of personal experience (L. Antsiferova, V. Davydov, A. Kovaliov, A. Petrovskyi and others).

In the scientific works of G. Ball, I. Bekh, E. Bondarevska, V. Zagviazinskyi, I. Ziaziun, S. Kulnevych, V. Lozova, O. Pekhota, I. Pidlasyi, S. Podmazin, O. Savchenko, V. Serikov, I. Yakimanska and others philosophical and psychological and pedagogical aspects of personality-centered approach in education, in particular, higher education are quite fully covered.

I. Pidlasyi defines the personal approach as a reliance on personal qualities that reflect very important characteristics for learning: personality orientation, its value orientations, life plans, formed attitudes, dominant motives of activity and behavior (Pidlasyi, 2004, p. 52).

Personality-centered education is also based on fundamental didactic research on personal developmental functions of teaching and education. In domestic pedagogy and pedagogical psychology, the works of a methodological nature have recently appeared; they substantiate the need and possibility of implementing personality-centered education in the training of future professionals.

Thus, E. Polat notes that the main strategic direction of the education system in different countries is to solve the problem of personality-centered education – such education, in which the personality of the pupil, the student would be in the center of attention of the teacher, the psychologist, in which the activity of learning, cognitive activity, not teaching, would be leading in tandem teacher – student (Polat, 2009).

According to O. Pekhota, there is only one way to implement a personal approach to learning that is to make learning a sphere of self-affirmation and self-realization of the individual (Pekhota, 2004, p. 27).

Thus, we can state that the problem we are studying is relevant, able to improve the training of future teachers at the level of competencies.

Research results

Modern teaching is based on the theory of humanistic education, according to which "man is the measure of all things", the highest indisputable value, the alpha and omega of social progress, its condition, meaning, driving force and, probably, the result. Any training in its essence is to create conditions for the development of a personality, so it is developmental, personality oriented. The modern humanistic paradigm is defined as the paradigm of self-realization of the individual (Nikitas, 2018).

The concept of humanization of the educational process is associated with the rejection of authoritarian pedagogy with its pedagogical pressure on the individual, which does not allow establishing normal human relations between teachers and students. This is the transition to personality-centered pedagogy, which attaches absolute importance to the personal freedom and activities of learners. The humanization of education has affected, first of all, one of its main parts – higher education. There was a need to change the organizational basis of the educational process, which ensured its significant democratization and created conditions for changing the role and place of the student in education. From the standpoint of humanism, the ultimate goal of education is that each student can become a full-fledged subject of activity, cognition and communication, a free, amateur individual. All preconditions must be created for the self-realization of the individual, the disclosure of his natural inclinations and abilities. Modern humanistic pedagogy, according to I. Ziaziun, is an alloy of ideas of free development of a personality, adaptation of the education system to man, and not vice versa (Ziaziun, 2008).

The new educational policy in the context of the Concept of the new Ukrainian school stimulates an innovative approach to professional training and provides opportunities for students to take an active position in the educational process, to master the experience based on purposeful formation of creative thinking, gaining one's own experience and using the tools of educational and research work. The methodological basis of such training is the theory of personality-centered education and philosophical and pedagogical ideas to ensure the humanization of the educational process in the higher educational institutions of Ukraine, the continuous development of each student as a personality (Khoruzha, 2020).

The scientific idea of personality-centered education has a different conceptual structure depending on the subject of science in which this concept is considered. The philosophy of education examines the personal approach through the categories: subject, freedom, self-development, integrity, dialogue as forms of self-expression. If in the traditional philosophy of education, according to O. Pekhota, socio-pedagogical models of personality development have been described in the form of external given patterns, standards of cognitive activity, then personality-centered learning is based on the recognition of the uniqueness of the subjective experience of the student as an important source of individual life. Thus, there is a "meeting" of what is set and the subjective experience, its «cultivation», enrichment. Recognition of the student as the main figure of the whole educational process is a personality-centered pedagogy (Pekhota, 2004).

Nowadays the representatives of humanistic pedagogy use the synergetic paradigm of education and training and argue that a person should not be formed, it is only necessary to help him in development. Therefore, the task of the theory of education and, in particular, learning, according to S. Kulnevych, moves from improving the traditional content, methods and forms to developing unusual conditions for pedagogical awakening of personal strength, providing pedagogical support to the developing individual. Learning theories need new tools that ensure not

the forcible but voluntary inclusion of the individual in the process of formation of its subjectivity (Kulnevych, 2001).

One of such tools, which we have tested experimentally, has become a heuristic-modular learning technology, which is based mainly on creative forms of interaction between the subjects of the educational process and independent cognitive and creative work of students.

As stated by V. Strelnikov, personality-centered approach means unconditional priority of interests and requests of the student's personality, taking into account his originality and capabilities, maximum realization and self-realization, development of reflection, providing conditions for identifying his talents. The author emphasizes that it is impossible to implement a personality-centered approach without culturally rich content and effective technologies that enhance the activities of the learners (Strelnikov, 2011).

According to scientists, the personality-centered approach, above all, involves creation of subject conditions for the development of valuable forms of student's activity, that is, creation of such developmental tasks that lead to independent discovery, gaining new experience and creating communicative conditions to support the students' self-worth.

At the same time, the researchers V. Slastionin, I. Isaiev, E. Shyianov emphasize: "The personal approach assumes that both teachers and students treat each person as an independent value, not as a means to achieve their goals. This is due to their willingness to perceive each person as clearly interesting, to determine the right to be different from others" (Slastionin, 2002, p. 208).

From the point of view of A. Khutorsky, the personality-centered content of education is understood as all types of content of education, both external and internal, the composition and structure of which are determined by providing or reflecting the development of the student's personality. The main function of personality-centered content of education is to ensure and reflect the formation of a system of personal educational meanings of the student. According to the author, the structure of personality-centered education consists of the following interrelated components: activity content of education, which includes types, forms and methods of student's activity, used educational technologies; the content of educational products of the student, obtained by him as a result of studying the subject; cultural and historical content, which is analogous to the educational product; reflexively manifested and generalized educational products of the student, reflecting his personal innovations (Khutorskyi, 2001, p. 185).

I. Yakimanska's concept envisages the focus of education on the students' individual and personal development, which should be reflected in the curriculum, which should initiate the subjective experience of students, focus on the use of different methods of educational work, change the vector of movement: not from pedagogical influences to the student, but from the student – to the conditions of his learning (Yakimanska, 2000).

Researchers see the main function of personality-centered education in ensuring the personal development of each subject of the educational process, insisting on the recognition of the student's right to self-determination and self-realization in the process of cognition through the mastery of their own ways of learning.

V. Lozova and G. Trotsko consider personality-centered learning as a type of learning based on the recognition of individuality, identity, self-worth of each person, which requires ensuring the development and self-development of the student's personality, based on the identification of his individual subjective experience, abilities, interests, values, opportunities to realize themselves in cognition, learning activities, behavior. At the same time, scientists define the subjective experience of a student as "the experience of his life, which he acquires in the specific conditions of the family, socio-cultural environment, in the process of perception and understanding of the world around him" (Lozova, 2002, p. 293). This experience, abilities, interests of the student then become the foundation for the further formation of pedagogical competencies of the students in professional institutions of higher education.

Fundamental in the study of the process of formation of students' professional competences is the provision that the main task of personality-centered learning is the development of students' creative abilities.

But it should be noted that psychological and pedagogical research focus not only on the benefits but also on the limitations of personality-centered learning and education. Thus, S. Podmazin believes that it is inexpedient to completely displace the authoritarian approach in personal education. He emphasizes that each individual encounters in life both the need for subjective organization of his life and the need to perform under certain conditions of purely authoritarian interaction: order – execution. To be exact, it is necessary to talk about the balance of personal and authoritarian approaches in education (Podmazin, 2003).

We share the point of view of S. Podmazin and T. Rogova (Rogova, 2005, pp. 79-88) that the main operating unit of the educational process is dialogic integrity: the student's personality – the teacher's personality. Such dialogic integrity, in our opinion, provides conditions for professional and creative development of future professionals in the learning process. The key to the successful implementation of a personality-centered approach is the creative personality of the teacher.

Thus, the analysis of psychological and pedagogical research allows us to draw conclusions about the features of personality-centered approach in pedagogy, which can serve as a factor in the optimal formation and development of professional competencies of specialists. First of all, it is: 1) creating conditions for the full development of all subjects of the educational process; 2) the formation of the creative personality of the specialist not only by mastering the normative activities, but also through constant enrichment, transformation of subjective experience as an important source of their own professional and creative development; 3) definition of the main operating unit of the educational process dialogic integrity: the student's personality – the teacher's personality; 4) implementation into the educational process of modern pedagogical technologies of personality development (heuristic-modular technology in our study). These theoretical provisions served as the basis for determining the didactic support of the process of formation of professional competencies of future teachers.

In the light of the considered pedagogical concepts of personality-centered education today many authors name various pedagogical technologies which belong to personality-centered technologies, the generally accepted classification is not present yet.

Having appeared within the framework of the issue of using technical means of teaching, during long scientific research and discussions pedagogical technology in its modern sense has turned into a system of knowledge, which has a certain scientific base, which covers the essence of the problems related to the goals, content and conduct of the educational process.

There are unique studies on the problem, design, research, modular, heuristic, informational pedagogical technologies, which have received recognition. The flow of research on various issues of pedagogical technology gained strength thanks to the works of A. Aleksiuk, V. Bespalko, I. Ziaziun, B. Korotiaiev, V. Lozova, O. Pekhota, I. Prokopenko, I. Pidlasyi and others. Focus the attention of leading scientists on the current problem plays a positive role. A wide range of scientists has developed a sufficient stock of knowledge, which allows adopting the conceptual apparatus necessary for the study, and to reach a deeper understanding of the real and projected results of students' learning activities, including the formation of professional competencies of specialists.

The analysis of the scientific literature of pedagogical concepts and technologies allowed clarifying the essence of the concepts: "pedagogical technology", "personality-centered technologies". Based on the general interpretation of "technology" as a path leading to the desired result, most authors understand technology in education as a set of teaching methods, techniques, characterized by a diverse set of features: "optimal", "scientifically based", "effective", "modern".

Pedagogical technology in the general pedagogical sense characterizes the holistic educational process with its purpose, content, and teaching methods.

G. Selevko defines such a structure of pedagogical technology a) conceptual basis; b) the content of learning: the purpose of learning – general and specific; content of educational material; c) procedural part – technological process: organization of educational process; methods and forms of educational activity of students; methods and forms of teacher's work; activity of the teacher on

management of process of assimilation of material; e) diagnostics of the educational process (Selevko, 2008).

T. Postoian defines pedagogical technology as the organization of a holistic educational process, which involves not only the organization of creative work, but also implies the characteristics of the pupil (student) and teacher, their interaction, education of high organization based on the pedagogical community (Postoian, 2014).

Pedagogical technology in the study of L. Kaidalova is defined as a consistent, logical and holistic process in which harmoniously combined goals, forms, methods and teaching aids, methods of teaching disciplines with high pedagogical skills of the teacher to achieve the ultimate goal – training of a highly qualified competent specialist who is able to think critically and make independent decisions (Kaidalova, 2003, p. 7).

According to V. Yevdokimov, I. Prokopenko, V. Yudin, the composition of technology is not a set of methods, but the certainty of steps (stages) of activity, which lead to the desired result, which can be achieved based on objectively stable links between the components of the pedagogical process. Pedagogical technology must have strict features: a) clarity and specificity in fixing the result; b) the presence of criteria for its achievement; c) step-by-step and formalized structure of the subjects of study, which allows you to transfer and repeat the experience.

Researchers note that modern pedagogical technologies, in contrast to traditional methods, have several significant distinctive features: clarity of goal setting, diagnostic results, algorithmic activity both the teacher and the learner, the design of teaching aids, controllability, systemicity, repeatability, the possibility of correction, economy, guarantee of a sufficiently high level of learning quality.

Thus, learning technology is a complete pedagogical system of organization of the educational process, which includes the conceptual basis, the purpose of learning – general and specific, the content of educational material, as well as the procedural part of the educational process (methods, forms, methods of interaction) and diagnosis of the achieved results.

According to E. Polat, among the various areas of new personality-centered pedagogical technologies, the most adequate to the goals of the future specialist are collaborative learning; project activities; multilevel learning; individual and differentiated approach to learning, opportunities for reflection.

New pedagogical technologies used today for the formation of professional competencies of students, are inconceivable without the use of new information technologies. It is impossible to separate from each other, because only the widespread introduction of new information technologies allows the most effective implementation of the opportunities inherent in new pedagogical technologies (Polat, 2009).

Information technologies have become especially important in the organization of the educational process today, in the conditions of the pandemic, when distance learning has become the leading form of learning for students.

Distance form is considered as an individualized process of acquiring knowledge, skills, abilities and ways of human cognitive activity, which occurs through the indirect interaction of distant participants in the educational process in a specialized environment, operating on the basis of modern psychological, pedagogical, information and communication technologies.

Distance learning can also be considered as a system of technologies, a key element of which is educational content. The main forms of educational content are electronic courses (package of learning content guided learning), simulation (virtual environment that simulates real conditions of activity), webinar.

The task of distance learning is to stimulate the intellectual activity of students by defining the objectives of the study and application of the material, as well as involving students in the selection and processing of material; development of cognitive motivation, which is achieved by clearly defining values and internal motives, development of abilities and skills of self-learning, which is achieved by expanding and deepening educational technologies and techniques. We believe that the

implementation of these tasks creates conditions for the development of professional competencies of future teachers.

Analyzing the didactic support of the process of forming professional competences of students, we have been particularly interested in such methods as: project method, solving heuristic problems, research method. The following forms of training organization have also been studied: collaborative learning, collective creative learning, small group work, multilevel learning, which we have used in the heuristic-modular learning system.

Educational design is focused, first of all, on independent activity of students – individual, pair or group, which students perform during a certain period of time.

Design technology involves solving a professional problem by a student or a group of students, which includes, on the one hand – the use of various methods, teaching aids, and on the other hand, integrating students' knowledge not from one subject, but from different areas of their creative thinking (Mukha, 2019).

The purpose of educational design according to O. Pekhota is the creation of such conditions by the teacher during the educational process, in which the result is the individual experience of the student's project activities (Pekhota, 2004, p. 32).

The results of project implementation should be "tangible" if it is a theoretical problem, then its specific solution, if practical – a specific result, ready for implementation. Project technology involves the use by the teacher of a set of research, research, creative in nature methods, techniques, tools.

From the standpoint of heuristic learning A. Khutorsky determines that the main value of the project learning system is that it orients students to create a personal educational product, rather than simply studying a particular topic. According to the author, an educational project is a form of organization of classes that provides for the complex nature of the activities of all its participants to obtain educational products for a certain period (Khutorsky, 2001). This point of view of the author is close to us because we attribute the professional competencies of future teachers to personal educational products that are created, including through their project activities.

The main requirements for the use of project technology in the training of future professionals are: presence of a significant problem/task in the research creative plan, which requires integrated knowledge, research search for its solution; practical, theoretical, cognitive significance of the expected results; independent (individual, pair, group) activity of students; use of research teaching methods. Thus, the essence of project technology is to stimulate students' interest in certain problems, which involve the possession of a certain amount of knowledge, and through project activities, which involves solving one or several problems, showing the practical application of acquired knowledge. From theory to practice, harmoniously combine academic knowledge with pragmatic, adhering to their proper balance at each stage of learning. This process, in our view, is important in the development of professional competencies of future teachers.

Thus, project activity due to its didactic essence allows us to solve the problem of formation and development of all intellectual skills of critical and creative thinking of students.

An effective technology that we have also used in the study of didactic support for the formation of professional competences of students in the framework of heuristic-modular technology has been the research activities of students in groups. The emphasis has been on independent activity (Vazhynskyi, 2016).

Different types of independent cognitive activity of students have been used in the work on projects, including research ones. Among them, research activities occupied one of the central places and, at the same time, caused the greatest difficulties. Research activities are based on the development of skills to learn about the world around us on the basis of scientific methodology (Antoniuk, 2015).

Implementation of project and research activities in practice leads to a change in the position of the teacher. From a carrier of ready-made knowledge, he becomes the organizer of the cognitive activities of their students. The teacher has to reorient his work and the work of students on

different types of independent activities of students, on the priority of research, creative nature (Pometun & Pirozhenko, 2002).

Thanks to research activities, students participate in scientific cognition: observe and study facts and phenomena, identify research problems, put forward hypotheses, plan ways to test them, study the literature, evaluate the results, draw conclusions about the possibility of using the acquired knowledge.

M. Lazarev points out that the research method in teaching is based on the independent formation of learners, problem questions and the same independent search for facts, arguments, ways of proving, generalizing, modeling and so on. The research method is used for the development of creative abilities and intelligence; it leads to greater understanding and independent mastery of knowledge and creative ways of working (Lazarev, 2016, p. 45).

According to O. Stepanov and M. Fitsula, the use of the research method in educational activities contributes to the deep assimilation of knowledge by students, subjective discovery of new knowledge on the basis of existing ones, formation of skills and interest in cognitive and creative activities. The purpose of research training, according to the authors, is to gain research experience, development of their intellectual abilities, creative potential, formation of active, competent, creative personality (Stepanov & Fitsula, 2005).

From the standpoint of heuristic learning, research activities require each student to receive their own educational result (product), in our study – this is the professional competence of the future teacher.

Based on the theoretical analysis of the psychological and pedagogical literature, it can be concluded that the research activities require incentive motives, which include: the level of formation of students' research skills; orientation of the individual to research activities, the need to independently find the ways to solve professional problems better and resolve conflicts that have arisen; desire to independently search for something new, creativity; confrontation with the problem, opportunity and confidence in its solution. We also believe that without motivational support, students' research activities are hopeless.

Thus, we can conclude that organization of research activities of students reflects the task of personality-centered approach at the stage of learning and skills development, which are the basis of research competence, necessary and sufficient for their further independent, research and creative work.

Joint or individual work on a problem, which aims not only to try to solve this problem and prove its correctness, but also to present the result of their activities in a particular product, implies the need at different points of cognitive, experimental or applied, creative activities to use a set of intellectual creative skills. All these skills need to be taught. One of the methods used for this is an interactive method (collaborative learning), which quite successfully complements the project method (Pometun & Pirozhenko, 2002). We have used this method in our research to prepare students for cognitive and creative activities.

The idea of collaborative learning belongs to such authors as J. Dewey, R. Slavin, Rogers Johnson and David Johnson, etc. and has long been developed by many educators in many countries around the world. The sources of learning in cooperation in domestic pedagogy are the ideas of humanistic pedagogy of the past (P. Blonskyi, S. Shatskyi). The principle of demanding and respect for the individual, which is embodied in trust to students, friendliness, reliance on the positive, not only justified but also implemented in practice of A. S. Makarenko. Subject-subjective interaction is deeply revealed in the pedagogical works of V. O. Sukhomlynskyi, who urged teachers to look at the world through the eyes of those we educate, to address students as like-minded people equal to themselves (Sukhomlinskyi, 1976, p. 231).

Collaborative learning is seen in the world of pedagogy as the most successful alternative to traditional methods. It reflects a personality-centered approach.

V. Lozova, G. Trotsko, summarizing the experience of individual teachers-innovators (I. Volkov, E. Ilyin, S. Lysenkova, M. Paltyshev, V. Shatalov, M. Shchetinin and others) have identified the main ideas of pedagogy of cooperation: a) positive attitude of the students to learning,

for which it is necessary to involve them in the work of learning, to evoke a joyful sense of success, progress, development, due to friendly relations between the subjects of study; b) learning without coercion to give students confidence in success, to teach them to learn; c) the idea of a difficult goal that encourages overcoming difficulties, provided that students are convinced of the ability to overcome these difficulties; e) the idea of free choice of tasks to give students the opportunity to feel their strength, to assert themselves; h) the idea of anticipation, which came to all innovators, which involves anticipatory study of the material; j) the idea of self-analysis, the essence of which is to encourage students to evaluate their activities, their capabilities, opinions, etc. (Lozova & Trotsky, 2002).

Considering the specifics of the organization of the educational process in higher education, we believe that certain ideas of cooperation pedagogy should be leading in the training of future teachers. It should be noted that the purpose of collaborative learning is not only the acquisition of knowledge, skills and abilities of each student at the level of his individual development. The effect of socialization and the formation of communicative competencies of the future teacher are very important here. Thus, the ideas of the pedagogy of cooperation can be summarized in the words of Sh. Amonashvili: "… to make students our voluntary and interested colleagues, like-minded people in their own upbringing, education, training, formation, to make them full participants in the pedagogical process, caring and responsible for this process, for its results" (Amonashvili, 1995, pp. 47-48).

One of the options for collaborative learning that interested us and that we have used in the study was the work of students in small groups. The positive results of group work were obtained in the early twentieth century. In many countries, this method of organizing the educational and cognitive activities of students has been widely used. This activity was based on the philosophical and pedagogical views of John Dewey, who called on all participants in the pedagogical process to democracy, cooperation, mutual assistance and communication in the process of jointly significant activities that take into account the interests of each student.

Various aspects of the problem of organizing education in small groups have been considered by V. Diachenko, A. Matiushkin, M. Skatkin and others.

Group work is to organize such a learning (creative) environment in which a small number of students work on one topic of the educational task, which is a problem not only for students but also for the teacher. At the same time, the creative activity of each individual develops. The organization of such a creative learning environment is an essential and mandatory, in the author's opinion, an element for self-realization of the individual in higher education institutions. Considering that the highest manifestation of self-realization of the individual in the vocational school is formed professional competencies, this provision is directly related to the process of their formation.

Studying the formation of the ability to organize educational work with students in small groups, researchers conclude that this is the type of activity of a teacher and a student in the learning process, which involves the interaction of the teacher with a specially organized small group of students, when the joint activities of students in a small group aimed at meaningful communication in order to practically solve the educational task using common methods, as well as monitoring and evaluation.

M. Rysina and V. Senchurina point out that the introduction of group work of students promotes the development of their critical thinking. This type of activity involves the creation of new ideas and combinations. The main elements of group learning, the authors highlight: positive interdependence, support and interaction of students in direct contacts and personal reporting (Rysina & Senchurina, 2003, p. 246).

Students' ability to work in small groups must be formed in the learning process. The essence and structure of this skill, according to the author, includes five components: communicative, organizational, gnostic, design and innovation. The author defines the criteria for the level of formation of this skill: 1) didactic literacy, which includes students' knowledge of the organization of the educational process in small groups; 2) personal and psychological readiness of students to

work in small groups; 3) technological and methodological readiness of teachers to organize educational work with students in small groups.

V. Grishin, studying the group interaction of students, notes that the use of group forms corresponds to the age characteristics of young people of student age, gradual formation of specialists – organizers, who have to solve production, social and other problems with a large number of partners in the future from different psychological positions: on an equal footing, in the role of leaders or subordinates. According to the author, psychological features of students' behavior in small groups open up opportunities for their effective mutual enrichment with scientific information, organization of mutual assistance and friendly support, cooperation, responsibility for joint results and desire for self-realization. The author characterizes the general technological process of group work as follows: 1) preparation for the group task (setting a cognitive task, instruction, distribution of didactic material in groups); 2) group work (acquaintance with the material, planning work and distribution of tasks within the group, implementation and discussion of the results in the group, discussion of the general task of the group, summarizing the group task); 3) the final part (report on the results of group work, analysis of the cognitive task, a general conclusion about group work and achievements in solving the problem) (Grishin, 2000, p.11).

O. Stepanov and M. Fitsula note that during group learning activities students perform a much larger amount of work, increases the effectiveness of their acquired knowledge and skills, develops the ability to cooperate, motivation to learn, cognitive skills (planning, reflection, self-control, mutual control) (Stepanov & Fitsula, 2003, p. 278).

Thus, the analysis of psychological and pedagogical research of pupils and students in small groups shows that this form of organization of the educational process provides realization of the leading ideas of pedagogy of humanism, dialogical cognitive and creative activity of students, which leads to the formation of flexible, creative, thinking personality of its communicative, organizational, didactic, reflective, research competencies, independent thinking.

Based on the analyzed model, we have developed our own modernized didactic model of students' work in small groups during practical classes in order to form their professional competencies to solve production problems in different life situations.

In the study we have also been interested in the pair work of students, which also involves cooperation in learning. It is known that the student learns quickly and efficiently what immediately after the assimilation of new information is used in practice or passed on to others, that is, there is communication between those who study.

Researcher V. Nazarov collectively defines such a form of activity, which is based on the relationship of cooperation of the students in the process of cognition. This activity is aimed at achieving the goal, the joint action of all its participants. The author identifies the following types of collective learning work: work in a static pair, work in a dynamic pair, work in a variation pair. The researcher also determines the principles of organization of collective educational work: the principle of completeness; the principle of continuous transfer of knowledge and information; the principle of general cooperation and friendly mutual assistance; the principle of division of labor; the principle of diversity of members of the educational team; the principle of ability training (Nazarova, 2020). We have relied on these principles when organizing the work of the students in small groups in the formation of their professional competencies.

Personality-centered learning includes multilevel learning. It is clear that if we want to use seriously personality-centered technologies, then learning must be differentiated. But the question arises, how to differentiate learning to take into account the basic qualities of personality and make learning personality-oriented?

In didactics learning is considered differentiated if in its process the selection of content, methods and forms of learning is carried out depending on the characteristics of groups of students.

In the pedagogical literature there are concepts of "internal" and "external" differentiation. The internal differentiation is understood as an organization of the educational process, during which the individual characteristics of the student are taken into account in the organization of

educational activities during classes in their group. In this case, the concept of differentiation of learning is very similar to the concept of individualization of learning.

In case of external differentiation, students of different levels of training are specially united into study groups (Dychkivska, 2015).

These groups in the learning process can be formed on different bases (abilities, interests, psychological characteristics, etc.). The main purpose of differentiation is to promote creation of conditions for the comprehensive development of the personality of each student, taking into account his inclinations, opportunities and interests. Thus, personality-centered learning, by definition, is differentiated learning.

A. Khutorskoi determines the preservation of individual characteristics of students, their uniqueness, diversity and diversity as a condition for achieving the goals and objectives of personality-centered learning. One of the ways to solve this problem is: differentiation of learning, according to which each student is invited to approach individually, differentiating the material, which he studies by the degree of complexity, direction or other parameters (Khutorskoi, 2001, p. 185).

Multilevel learning allows you to take into account the peculiarities of the pace of educational work of each student, his preparation and style of mental activity (Varianitsa, 2018).

From our point of view, when forming the professional competences of students, it is advisable to use internal differentiation, during which personality-centered learning is achieved mainly through pedagogical technologies and various heuristic techniques that involve these technologies.

Thus, on the basis of the conducted psychological and pedagogical analysis of the basic principles of humanistic pedagogy, the concept of personality-centered learning, pedagogical technologies and didactic methods, it is possible to make certain generalizations.

Professional and creative development of future specialists, the formation of their professional competencies is most effectively carried out in personality-centered education, because it provides the development of creative abilities of students, the creation of the necessary didactic conditions for cognitive and creative activities of each individual, which is transformed from an object into a subject of study.

Formation of professional competences of future professionals, as a leading indicator of the level of their self-realization in professional activities, should be carried out in the didactic conditions of a particular pedagogical technology, which involves the gradual development of creative thinking and cognitive and creative activities of students. This technology in the study, we have identified a heuristic-modular.

We have identified the most appropriate personality-centered methods for the formation of professional competences of future teachers in the framework of heuristic-modular learning technology: a) educational design, which involves solving student problems of professional activity, practical application of acquired knowledge, creating their own educational creative products; b) research work, which provides the formation of professional and creative research competences, promotes interest in cognitive and creative activities, the formation of an active, competent, creative personality; c) solving heuristic professional problems.

The following forms of organization of the educational process are defined as effective:

a) learning in cooperation, the work of the students in small groups during practical classes, which ensures the formation of their communicative, organizational, didactic, reflective, research competencies;

b) multilevel (differentiated) learning, which provides a situation of success for each student in the development of his professional and creative abilities.

Considering that the subject of our study is the process of forming professional competences of students of the pedagogical University, we have set a goal to justify theoretically and test experimentally a modified version of educational technology, based on personality-centered and individual-creative training of future specialists (author M. Lazarev). This technology is aimed at the optimal development of such a professional, the core of whose personality will be developed

creative skills in the chosen field. At the same time, we have proceeded from the provisions that the maximum possible level of professional competence can be ensured only with the direct inclusion of the future specialist in the field of specific professional, social, psychological and pedagogical mechanisms.

Based on the analysis of domestic and foreign research on: creativity; creative activity and creative activity; creative skills of personality; personality-centered pedagogical technologies; modular technologies; heuristic learning, we have constructed in our research project didactic technology of personality-centered *heuristic-modular learning*, integrating the capabilities of the training module and heuristic methods of the cognitive process in order to form the professional competencies of future professionals.

Analysis of the scientific literature, researches on the problems of modular and heuristic learning has allowed us to clarify the essence of these concepts.

Among the personality-centered educational technologies in Ukraine, *modular learning* technologies are actively studied. Nowadays the problem of modular construction of the educational process has become quite relevant. The urgency of introducing modular technology in higher education is also due to Ukraine's entry into the single European educational space in connection with the signing of the Bologna Declaration (2005).

The concept of module (from the Latin "modulus" – measure) is interpreted differently in research and pedagogical practice. In the research of American scientists, module is completed training (15 or 20 minutes) with a holistic didactic content, organizational diversity. In the practice of the German educational system, the module is a program-content unit for the completed cycle of education, which is characterized by didactic adaptability of goals, forms, methods, teaching aids.

The main features of the training module, scientists consider relatively independent educational information and a group of fundamental concepts, combined with certain patterns. They believe that the module of the discipline is not just part of it (topic or section), but an information node, which in turn is a unit that unifies the approach to structuring the whole into parts, that is into separate modules.

There are different versions of modules: a) module as a section or topic of the course; b) a module as part of a course covering several topics or sections and the corresponding forms of control; c) module as a system that includes individual modules in natural sciences, humanities, special disciplines.

Researchers V. Khoriakov and L. Bezugla point out such features of modular technology as openness, mobility, flexibility and their variability (Khoryakov & Bezugla, 2007).

Modular learning, used in schools in England and Sweden, is based on the rules of modularity, when the design of educational material ensures for each student the achievement of didactic tasks, has the completion of the material in the module and the integration of different types and forms of learning.

The experience of foreign schools shows that the completeness of the cycles of educational activities is associated with the differentiation of the learning process, which is carried out in two directions: content and procedural.

According to M. Nikandrov, the positive effect of such training is related to its dynamism, which is manifested in the variability of the elements of the module and the content of the modules. The goals in this study are formulated in terms of methods of activity and methods of action and are divided into cycles of cognition and cycles of other activities. Modular learning marks a problem-based approach, a creative attitude to learning. Problem approach and creative attitude of students to learning are the essential factors that have been used by us in the organization of their cognitive and creative activities. P. Tretiakov, I. Sennovskyi point out that the flexibility of this technology is associated with differentiation and individualization of learning based on repeated diagnostics to determine the level of knowledge, needs, individual pace of learning activities of the learner (Tretiakov, 1997).

As stated by A. Furman, "the module is a functional unit of the educational process, a complete block of didactically adapted information". The author identifies varieties of modules:

didactic, educational, content. But he proposes to consider the training module with its "integral-functional cycle" as the basis of modular learning technology, which combines procedural and effective, substantive and formal activities and consists of completed stages (modules) in the following sequence: constituent-motivational stage, content-search, control-semantic, adaptive-transforming, system-generalizing, control-reflexive stage.

A group of scientists led by A. Furman came to important conclusions and solutions to the essence, structure, methodological support of modular development technology as the antithesis of the classroom system. Our researchers have positively assessed the versions of modular training of American, Lithuanian, Russian scientists, which are of paramount importance for the development of domestic intensive development systems in general and for the development of local ways of organizing modular development training. Important for all who study and apply innovative technologies are the conclusions made here about modular learning as a didactic system that implements a new approach to the organization of the educational process based on strengthening its focus, system, individualization and independence of students, ensuring continuous self-monitoring of academic achievement and development promotion (Furman, 1995).

Thus, all the definitions of the module have a common basis – a generic concept, which is mostly a completed part (block) of the discipline (information) or the whole educational process. The essential features of the didactic module: systematic, integrity, kinship, logical completeness of the set of elements of knowledge, as well as their adaptability to the subjects of learning and a certain time for learning.

Taking into account the essential features, we are close to I. Sikorsky's definition that the module is a logically complete, systematically ordered part of theoretical knowledge and factual skills in this discipline, adapted to the individual characteristics of the subjects of learning with a certain optimal time for the organization of their assimilation (Sikorsky, 1997).

The basic principles of modular learning act as its conceptual foundations, as the fundamental ideas of this system, reflecting its essence and at the same time act as the leading requirements for its optimal performance.

These principles reflect the general principles of personality-centered education: the principle of integrity, completeness of educational and educational activities both at the level of the whole course (maxi-module) and individual topics-modules and their elements (mini-modules); the principle of democratization and humanization of education firmly and consistently transfers the student from the position of the object to the subject of the educational process, giving him all the rights of a parity partner of the teacher; the principle of creative interaction of all participants in the educational process at all stages of modular learning (this principle defines modular technology as a mechanism that creates conditions for creative activity of the subject of personality-centered education (Lazarev, 2016) and is directly related to the subject of our study of student's competences); the principle of technologization of the educational process, which is of particular importance for our study, as it provides: a) detailed structuring of the content of education into relatively complete parts with a significant increase in logical, heuristic, associative links between them; b) a clear definition of the purpose and objectives of the training module in general and each of its educational elements (mini-module), while introducing an important psychological and pedagogical requirement for mastering the scientific system of knowledge, skills, values with strong motivational support at each stage; c) introduction of a sufficient and necessary set of methods, techniques and tools with a clear developmental setting and application of algorithms of activity – cognitive, transformative, reflective.

The real technologization of learning is impossible without the interested development of the diverse repertoire of creative methods of activity and communication, first of all, dialogical and research; the principle of objective psychological and pedagogical diagnostics provides constant scientifically provided measurement and estimation of results of training, changes in knowledge, abilities, heuristic and creative abilities, values of students; the principle of complex integration of subjects – at methodological, content and technological levels demands optimum use of interdisciplinary communications, enrichment of the given discipline with the facts, positions, ways

of activity of other subjects. We have been guided by all these scientifically based principles in creating a modified version of heuristic-modular technology and implementing its innovative capabilities in the process of forming professional and creative skills of students.

We can say that the modular approach in personality-centered education is a qualitatively new view on the construction of the educational process, the essence of which is in understanding modularity as a quality of creative self-development of the subject of technology of personality-centered education.

Thus, the modular organization of the educational process directs teachers and students to constant creative work, awakens the motivational sphere and new incentives to learn, and destroys the "inviolability" of reinforced concrete "buildings" of lecture-seminar one-dimensional for all learning system, offering instead true democracy in higher education, the right to free personal expression of the will of every student and teacher. This conclusion is of fundamental importance in the didactic support of the process of formation of professional competencies of future professionals.

Considering the specifics of the professional competences of future teachers, the best way to form them, in our view, is to fill modular technology with heuristic teaching methods.

Translated from the Greek language, "heuristics" means "discovery". Heuristics is the science of discovering something new. The term "heuristics" was introduced in the third century AD. By the ancient Greek mathematician Pappus of Alexandria, who summarized the works of ancient mathematicians. Papp combined the methods, which were different from the purely logical ones, under the conditional name "heuristics". The prototype of heuristic teaching is the method of questions and reasoning of Socrates.

Comenius also called on teachers to teach their students "so that they explore and learn about the subjects themselves, and not memorize only other people's observations and explanations".

The heuristic method is often understood as a variant of the verbal method of learning. Recently, it has been shown that this method, brought to the level of the methodological principle, is able to serve as a basis for a new type of learning – heuristic (Khutorskoi, 2001).

V. Andreiev calls heuristic methods the basis of educational and creative activities. "Heuristic methods are a system of heuristic rules of teacher's activity (teaching methods) and student's activity (learning methods), developed taking into account the laws and principles of pedagogical management and self-management in order to develop intuitive procedures for students to solve creative problems".

Theoretical prerequisites and elements of such training are contained in the works of G. Aldschuller, V. Andreiev, P. Kapterev, M. Mahmutov, A. Khutorskoi and others. Psychological problems of the student's heuristic activity have been considered by A. Brushlynskyi, P. Engelmeyer, Y. Kuliutkin, A. Luk, V. Pushkin and others.

Extraction of hidden knowledge in a person can be not only a method of teaching, but also the methodology of all education.

Didactic theory, which involves the construction of education on the basis of creative self-realization of students and teachers in the process of creating educational products in relevant fields of knowledge and activities, is called didactic heuristics.

The term "didactic heuristics" differs in meaning from the term "heuristics". Heuristics in the generally accepted sense is the science of creativity, the creative activity of people in order to obtain new results in the fields they study: cybernetics, psychology, medicine and others. Didactic heuristics has another purpose: to reveal the individual capabilities of the creators themselves – students and teachers through their activities to create educational products.

The task of heuristic educational activities is for students to design their own education through the creation of products that are part of the content of this education. The external educational product of the participant of the educational process provides him with an internal product – a change of knowledge, experience, abilities, skills and other personal qualities. The internal product of the participant of education is the qualitatively new result achieved by didactic

heuristics. To the internal product of studentsє educational activities we include the professional competences of future teachers that we study.

Thus, heuristic learning is learning that aims to construct the student's own meaning, goals and content of vocational education, as well as the process of its organization, diagnosis and awareness. Without such activities of the student it is impossible to ensure the process of formation of his professional and creative abilities and skills, which are an important component of his professional competences.

Educators distinguish two main functional characteristics of heuristic methods that provide heuristic learning: the function of "pushing" the right solution and the function of "reducing" options in determining possible ways to solve problems (Lazarev, 2016).

To determine the difference between heuristic and non-heuristic questions, the concept of "open question" is used, that is questions without a given direction of finding the answer, when the student is open to different ways and means of solving it.

It is fair to say that heuristic learning is a kind of prototype of the future of real professional adult life and therefore implies the presence of basic types of human activity and the diversity of subsequent results. Students create individual educational products of knowledge of objects, model at the level of their development similar phenomena of "great" science, the sphere of their future activities of "mature professionals". This process is a transition to the acquaintance and comparative assimilation of the cultural diversity of universal products of labor, because students learn "real" ways of doing things that will play not so much training as a real effective role in their future professional life. This fact is important in organizing the process of forming professional competencies of students.

The scientific analysis of heuristic learning conducted by M. Lazarev shows that its didactic capabilities can be integrated with the innovative capabilities of modular technology and thus ensure the formation of professional and creative abilities and skills of students, as in heuristic learning there is a stable and deep trust in the creative potential of each student, due to this setting of his cognitive and creative (search, research, constructive) activities in the first place in the whole system of education. In addition, heuristic learning involves sufficient mastery of the mechanisms, methods and techniques of creative activity, such as: "analysis through synthesis", brainstorming, a logical series of heuristic questions, methods of developing empirical knowledge to the level of theoretical, associations, comparisons, generalizations, abstractions, objective diagnosis and evaluation of their own or others' work, without which it is impossible to form professional competencies of future professionals. Heuristic methods of activity have been widely used by us in the formation of professional competencies of future teachers.

As a theoretical basis for the development of personality-centered heuristic-modular technology, we have taken the following provisions:

1. Democratization of the educational process, based on deep respect and trust in each student, focus on self-organization, self-management of the individual and the team.

2. The humanity of the pedagogical process. The basis for this has been the works of the founders of humanistic psychology and pedagogy (K. Rogers, A. Maslow, V. Sukhomlynskyi, S. Amonashvili and others). Humanization means the use of psychological and pedagogical technologies that put the teacher and student in a humanistic relationship.

3. The concept of modular learning with its innovative capabilities (A. Aleksyuk, M. Lazarev, M. Nikandrov, P. Sikorskyi, P. Tretiakov, A. Furman, M. Choshanov, P. Yutsiavichene and others).

4. Creating conditions for the developing and heuristic pedagogical process (V. Davydov, A. Matiushkin, A. Khutorskoi and others).

5. Theory of activity developed by O. Leontiev and his followers. Special emphasis is placed on the issue of awareness of student learning activities.

The heuristic-modular technology integrated by us differs from purely modular and heuristic learning in that the structure of the studied technology is based on modular learning as the main framework, and its content is filled mostly with heuristic activities, which significantly clarifies and specifies the organization of cognitive and creative activities of students and teachers within the

educational module. The purpose of this activity is to develop creative skills of students based on their previous life and educational experience, creating their own creative educational product and on this basis the continuous formation of the necessary professional and creative skills of the future specialist.

But, of course, any pedagogical technology in itself is not a guarantee of success. An organic combination of advanced technologies and the teacher's personality is needed.

Modularity in our study is implemented by organizing training in separate functional units-modules, which combine the content, forms and methods of work of teachers and students. Modularity also determines the design of educational material in such a way that it ensures that each student achieves clearly defined didactic goals. The main thing is that each student understands the perspective of learning, clearly understands why he needs the appropriate knowledge and skills in the short, medium and long term of professional activity which the student must understand the goals of three levels: subject, interdisciplinary and methodological.

These possibilities of modular technology can be realized, in our opinion, by integrating it with heuristic technology (Kryvonos, 2010).

Conclusions

Thus, the analysis of the conceptual foundations of heuristic-modular learning allowed us to make such generalizations.

Of the various technologies that belong to the personality-centered, we believe the most suitable to ensure the formation of professional competences of students of pedagogical universities integrated heuristic-modular technology, in which heuristic learning with its wide range of search, heuristic and creative activities is organically introduced into the relatively rigid organizational framework of modular technology.

The didactic possibilities of heuristic-modular technology that provide the process of formation of professional and creative skills of students include: a) increase the volume of independent creative activity in the educational process; b) sound reliance on the heuristic thinking of students and their heuristic experience in learning new things, the formation of professional abilities and skills; c) assessment of knowledge and professional competencies of students on the quality of the created creative product; e) introduction of criterion-diagnostic and level system for determining adequate, objective parameters of different types of professional and creative products in their creation, diagnosis and evaluation; g) giving increased importance to reflective activity; h) motivation of students' cognitive activity with the help of various factors, in particular the translation of the teacher's own creative experience; j) wide use of a set of methods and mechanisms of creative activity, in particular heuristics, for the formation of professional competencies of students; l) resolving the contradiction between the freedom of cognitive and creative activity of the student and the need for strict standards of their educational achievements.

The given present modernized version of the educational module with its focus on heuristic and creative activities of students both during classroom classes and in independent work strengthens the important factors of heuristic-modular learning in the process of forming professional competences of future professionals, such as: constant motivational orientation of students to cognitive and creative activities, rejection of stereotypes of the lecture-seminar system, psychological and pedagogical completeness of the educational process, independent creation of the student's own professional creative product, development of reflective abilities and skills of students.

Introduction of heuristic-modular technology in the educational process contributes to the fact that formation of professional competences of students becomes purposeful and manageable.

References

Антонюк, В.С., Полонський Л.Г., Аверченко В.І., Малахов Ю.А. (2015). *Методологія наукових досліджень*. К.: НТУУ «КПІ» (Antoniuk, V.S., Polonskyi, L.G., Averchenko, V.I., Malakhov, Y.A. (2015). *Methodology of scientific research*. K.: NTUU «KPI»).

Болонський процес у фактах і документах (Сорбона-Болонья-Саламанка-Прага-Берлін) (2005). Упорядник: Степко М.Ф., Болюбаш Я.Я., Шинкарук В.Д., Грубінко В.В., Бабин І.І. Тернопіль: Вид-во ТДПУ ім. Гнатюка (*The Bologna Process in Facts and Documents (Sorbonne-Bologna-Salamanca-Prague-Berlin)* (2005). Compiler: Stepko M.F., Boliubash Ya.Ya., Shinkaruk V.D., Grubinko V.V., Babin I.I. Ternopil: TSPU Publishing House named after Gnatiuk).

Важинський, С.Е., Щербак, Т. І. (2016). *Методика та організація наукових досліджень*. Суми: СумДПУ імені А. С. Макаренка (Vazhinsky, S.E., Scherbak, T.I. (2016). *Methods and organization of scientific research*. Sumy: Sumy State Pedagogical University named after A.S. Makarenko).

Варяниця, Л.О. (2018). Розвиток критичного мислення в умовах нової української школи. *Вісник Луганського національного університету імені Тараса Шевченка. Педагогічні науки, 1 (2),* 211-219. Режим доступу: http://nbuv.gov.ua/UJRN/vlup_2018_1(2)__31 (Varianitsa, L. O. (2018). Development of critical thinking in the conditions of the new Ukrainian school. Bulletin of Taras Shevchenko National University of Luhansk. *Pedagogical Sciences, 1 (2),* 211-219. Retrieved from: http://nbuv.gov.ua/UJRN/vlup_2018_1(2)__31).

Вознюк, Г. Ф., Мельникова, Н. Л. (2019). Організаційно-методичні умови формування інноваційної культури сучасного педагога. *Управління школою, 22-24*, 20-23 (Vozniuk, G.F., Melnikova, N.L. (2019). Organizational and methodological conditions for the formation of innovative culture of the modern teacher. *School Management, 22-24*, 20-23).

Гришин, В.Н. (2000). *Организация самостоятельной работы студентов в процессе группового взаимодействия* (автореф. дис. … канд. пед. наук: 13.00.01). Елец (Grishin, V.N. (2000). *Organization of independent work of students in the process of group interaction* (phD thesis abstract). Elets).

Голубнича, О. В. (2019). Формування готовності педагогів до інноваційної діяльності. *Управління школою, 10-12*, 29-32 (Golubnycha, O. V. (2019). Formation of readiness of teachers for innovative activity. *School Management, 10-12*, 29-32).

Дичківська, І. М**.** (2015). *Інноваційні педагогічні технології*. Київ: Академвидав (Dychkivska, I.M. (2015). *Innovative pedagogical technologies.* Kyiv: Akademvydav).

Завада, Т. О. (2018). Напрями вдосконалення змісту освіти у сучасній школі. *Вісник Чернігівського національного педагогічного університету. Серія: Педагогічні науки, 150,* 46-48. Режим доступу: http://nbuv.gov.ua/UJRN/VchdpuP_2018_150_13 (Zavada, T. O. (2018). Directions for improving the content of education in a modern school. Bulletin of Chernihiv National Pedagogical University. *Series: Pedagogical Sciences, 150,* 46-48. Retrieved from: http://nbuv.gov.ua/UJRN/VchdpuP_2018_150_13).

Закон України від «Про освіту» (2017). Режим доступу: https://zakon.rada.gov.ua/laws/show/2145-19/stru. (*Law of Ukraine on Education* (2017). Access mode: https://zakon.rada.gov.ua/laws/show/2145-19/stru).

Закон України «Про повну загальну середню освіту» (2020). Режим доступу: https://zakon.help/law/651-XIV/. (*Law of Ukraine "On Complete General Secondary Education"* (2020). Retrieved from: https://zakon.help/law/651-XIV/).

Закон України «Про вищу освіту» (2014). Режим доступу: https://zakon.rada.gov.ua/laws/show/1556-18 (*Law of Ukraine "On Higher Education"* (2014). Retrieved from: https://zakon.rada.gov.ua/laws/show/1556-18).

Зимня, І. А. (2010). *Педагогічна психологія: підручник для ВНЗ*. Воронiж: НПО «МОДЕК» (Zymnia, I. A. (2010). *Pedagogical psychology: a textbook for universities*. Voronezh: NGO «MODEK»).

Зязюн, І. А., Крамущенко, І. В., Кривонос, І. Ф. (2008). *Педагогічна майстерність*. К.: СПД Богданова А. (Ziaziun, I.A., Kramushchenko, I.V., Kryvonos, I.F. (2008). *Pedagogic mastery*. K.: SPD Bogdanova A.).

Інтерактивні технології навчання: теорія. практика, досвід (2002). Метод. посіб. авт. уклад.: О. Пометун, Л. Пироженко. К.: А.П.Н. (*Interactive learning technologies: theory, practice, experience* (2002). Method. manual. author. compiler: O. Pometun, L. Pirozhenko. K.: A.P.N.).

Кайдалова, Л.Г. (2003). *Педагогічні технології формування професійних умінь і навичок студентів вищого фармацевтичного закладу* (автореф. дис. ... канд. пед. наук: 13.00.04). Харків (Kaidalova, L. G. (2003). *Pedagogical technologies of formation of professional abilities and skills of students of higher pharmaceutical institution* (PhD thesis abstract). Kharkiv).

Концепція Нової української школи (2016). Режим доступу: https://www.kmu.gov.ua/storage/app/media/reforms/ukrainska-shkola-compressed.pdf (*The concept of the New Ukrainian School* (2016). Retrieved from: https://www.kmu.gov.ua/storage/app/media/reforms/ukrainska-shkola-compressed.pdf).

Кривонос, О.Б. (2010). *Професійно-творчі уміння педагога і шляхи їх формування: монографія.* Суми: СумДПУ імені А.С.Макаренка (Kryvonos, O. B. (2010). *Professional and creative skills of a teacher and ways of their formation: a monograph*. Sumy: Sumy State Pedagogical University named after A.S. Makarenko).

Кульневич, С.В. (2001). *Не зовсім звичайний урок: практичний посібник для вчителів, студентів ВНЗ*. Ростов н/Д.: ТУ «Учитель» (Kulnevych, S.V. (2001). *Not quite an ordinary lesson: a practical guide for teachers, university students*. Rostov n/D.: TU "Teacher").

Лазарєв, М.О. (2016). *Педагогічна творчість: Навчальний посібник для студентів, магістрантів, аспірантів педагогічного університету.* Суми: ФОП Цьома С.П. (Lazarev, M. O. (2016). *Pedagogical creativity: A textbook for students, undergraduates, graduate students of the Pedagogical University*. Sumy: FOP Tsioma S.P.).

Лобова, О., Сбруєва, А., Бойченко, М. (2020). Формування культурної компетентності школярів у процесі мистецької освіти в «Новій українській школі». *Педагогічні науки: теорія, історія, інноваційні технології, 3-4,* 266-276. Режим доступу: http://nbuv.gov.ua/UJRN/pednauk_2020_3-4_26 (Lobova, O., Sbrueva, A., Boychenko, M. (2020). Formation of cultural competence of schoolchildren in the process of art education in the "New Ukrainian School". *Pedagogical sciences: theory, history, innovative technologies, 3-4,* 266-276. Retrieved from: http://nbuv.gov.ua/UJRN/pednauk_2020_3-4_26).

Лозова, В.І., Троцко, Г.В. (2002). *Теоретичні основи виховання і навчання: Навчальний посібник.* Харків: "ОВС" (Lozova, V.I., Trotsko, H.V. (2002). *Theoretical foundations of education and training: Textbook.* Kharkiv: «OVS»).

Міськова, Н. М., Міськова, І. О. (2019). Особливості запровадження компетентнісного підходу в навчанні математики у контексті нової української школи. *Психолого-педагогічні основи гуманізації навчально-виховного процесу в школі та ВНЗ, 1,* 116-123. Режим доступу: http://nbuv.gov.ua/UJRN/Ppog_2019_1_15 (Miskova, N.M., Miskova, I.O. (2019). Peculiarities of introduction of the competence approach in teaching mathematics in the context of the new Ukrainian school. *Psychological and pedagogical foundations of humanization of the educational process in schools and universities, 1,* 116-123. Retrieved from: http://nbuv.gov.ua/UJRN/Ppog_2019_1_15).

Микитась, Т. (2018). Особистісно орієнтований підхід в організації освітнього процесу в Новій українській школі. *Директор школи, ліцею, гімназії, 4,* 96-100 (Mikitas, T. (2018). Personality-centered approach in the organization of the educational process in the New Ukrainian School. *Director of school, lyceum, gymnasium, 4,* 96-100).

Мозговий, В. (2020). Компетентності і знання учнів: взаємопідпорядкованість компонентів Нової української школи. *Імідж сучасного педагога, 5,* 5-8 (Mozhovyi, V. (2020).

Competenciesand knowledge of students: the interdependence of the components of the New Ukrainian school. *Image of a modern teacher, 5,* 5-8).

Муха, А.П. (2019). Застосування методу проектів як інструмент формування підприємницької компетентності на уроках фізики. *Наукові записки Центральноукраїнського державного педагогічного університету імені Володимира Винниченка. Сер.: Педагогічні науки, 179,* 187-194. Режим доступу: http://nbuv.gov.ua/UJRN/Nz_p_2019_179_31 (Mukha, A. P. (2019). Application of the project method as a tool for the formation of entrepreneurial competence in physics lessons. *Scientific notes of the Central Ukrainian State Pedagogical University named after Volodymyr Vynnychenko. Ser.: Pedagogical Sciences, 179,* 187-194. Retrieved from: http://nbuv.gov.ua/UJRN/Nz_p_2019_179_31).

Назарова, В. О. (2020). Інноваційні технології як засіб формування ключових компетентностей. *Англійська мова та література, 5,* 46-48 (Nazarova, V. O. (2020). Innovative technologies as a means of forming key competencies. *English Language and Literature, 5,* 46-48).

Ногас, Н. І. (2020). Державна політика у галузі освіти України: сутність та зміст. *Актуальні проблеми правознавства, 1,* 87-95. Режим доступу: http://nbuv.gov.ua/UJRN/aprpr_2020_1_16 (Nogas, N. I. (2020). State policy in the field of education of Ukraine: essence and content. *Current issues of jurisprudence, 1,* 87-95. Retrieved from: http://nbuv.gov.ua/UJRN/aprpr_2020_1_16.).

Овсієнко, Л. (2017). Компетентнісний підхід до навчання: теоретичний аналіз. *Педагогічний процес: теорія і практика, Вип. 2,* 82-87. Retrieved from: http://nbuv.gov.ua/UJRN/pptp_2017_2_16 (Ovsiienko, L. (2017). Competence approach to learning: theoretical analysis. *Pedagogical process: theory and practice, Ed. 2,* 82-87. Retrieved from: http://nbuv.gov.ua/UJRN/pptp_2017_2_16).

Підласий, І. П. (2004). *Практична педагогіка або три технології: інтерактивний підручник для педагогів ринкової системи освіти*. К.: Видавничий дім «Слово» (Pidlasyi, I. P. (2004). *Practical pedagogy or three technologies: an interactive textbook for teachers of the market education system.* K.: Publishing House "Word").

Пєхота, О.М. (2004). *Освітні технології: навчально-методичний посібник*. К.: А.С.К. (Pekhota, O. M. (2004). *Educational technologies: a textbook*. K.: A.S.K.).

Полат, Є.С., Бухаркіна, М.Ю, Моїсеєва, М. В. (2009). *Нові педагогічні та інформаційні технології в системі освіти: навч. посіб. для студентів ВНЗ*. М.: Видавничий центр «Академія» (Polat, E.S., Bukharkina, M. Yu., Moiseeva, M. V. (2009). *New pedagogical and information technologies in the education system: A textbook for university students*. M.: Publishing Center «Academy»).

Подмазін, С. (2003). Гуманізм реальний або дорогий фактор виробництва. *Управління освітою, 15-16 (63-64)* (Podmazin, S. (2003). Humanism is a real or expensive factor of production. *Education Management, 15-16 (63-64)*).

Пометун, О.І., Пироженко, Л.В. (2006). *Сучасний урок. Інтерактивні технології навчання. навч. посіб*. Київ: Видавництво А.С.К. (Pometun, O.I., Pirozhenko, L.V. (2006). *A modern lesson. Interactive learning technologies. A textbook*. Kyiv: ASK Publishing House).

Постоян, Т.Г. (2014). *Освітні технології: навчальний посібник*. Одеса: Південно-український національний педагогічний університет імені К.Д. Ушинського (Postoian, T. G. (2014). *Educational technologies: a textbook*. Odessa: South-Ukrainian National Pedagogical University named after K.D. Ushynsky).

Професійний стандарт за професіями «Вчитель початкових класів закладу загальної середньої освіти», «Вчитель загальної середньої освіти», «Вчитель з початкової освіти (з дипломом молодшого спеціаліста)» (2020). Київ: Мін-во розвитку економіки, торгівлі та сільського господарства України (*Professional standard for the professions "Primary school teacher of general secondary education", "General secondary education*

teacher", "Primary education teacher (with a diploma of junior specialist)" (2020). Kyiv: Ministry of Economic Development, Trade and Agriculture of Ukraine).

Рогова, Т.В. (2005). Педагогічні концепції особистісної орієнтації як теоретична основа персоналізованого підходу. *Педагогічні науки, 10,* 79-88 (Rogova, T.V. (2005). Pedagogical concepts of personal orientation as a theoretical basis of a personalized approach. *Pedagogical sciences, 10,* 79-88).

Рисіна, М.Ю., Сенчуріна, В.І. (2003). Групові форми роботи як засіб розвитку критичного мислення студентів. *Педагогічні науки* (Rysina, M. Yu., Senchurina, V. I. (2003). Group forms of work as a means of developing students' critical thinking. *Pedagogical sciences*).

Сікорський, П. І. (1997). Модульно-рейтингова система навчання у ліцеї. *Педагогіка і психологія, 1,* 31-32 (Sikorskyi, P.I. (1997). Modular rating system of lyceum education. *Pedagogy and Psychology, 1,* 31-32).

Сирцова, О. М., Дашко, М. В. (2018). Застосування когнітивних методів навчання в умовах інтеграції матеріалу суспільно-гуманітарних дисциплін як методична проблема. *Педагогіка формування творчої особистості у вищій і загальноосвітній школах, Вип. 58-59,* 271-281 (Syrtsova, O. M., Dashko, M. V. (2018). Application of cognitive methods training in the conditions of integration of material of social and humanitarian disciplines as a methodical problem. *Pedagogy of creative personality formation in higher and general education schools, Ed. 58-59,* 271-281).

Сластенин, В.А. (2002). *Педагогика*. М.: Изд. центр «Академия» (Slastionin, V.A. (2002). *Pedagogy*. M.: Ed. Center "Academy").

Степанов, О.М., Фіцула, М.М. (2005). *Основи психології і педагогіки*. К.: Академвидав (Stepanov, O. M., Fitsula, M. M. (2005). *Fundamentals of psychology and pedagogy*. K.: Academic Publishing).

Стрельніков, В. (2011). Проблеми вибору педагогічних технологій в аспекті особистісно-орієнтованої освіти. *Імідж сучасного педагога, 3-4,* 104-109 (Strelnikov, V. (2011). Problems of choice of pedagogical technologies in the aspect of personality-centered education. *Image of a modern teacher, 3-4,* 104-109).

Сухомлинський, В. О. (1976). *Вибрані твори. В 5-ти т. Т. 2*. К.: Рад. Школа (Sukhomlinskyi, V.O. (1976). *Selected works. In 5 volumes. Vol. 2*. K.: Rad. School).

Третьяков, П.И., Сенновский, И.Б. (1997). *Технология модульного обучения в школе: Практико-ориентированная монография*. М.: Новая школа (Tretiakov, P.I., Sennovskyi, I.B. (1997). *Technology of modular learning at school: Practice-oriented monograph*. M.: New school).

Унгурян, І. К. (2017). Формування гуманних взаємовідносин педагога та учня як складова педагогіки партнерства нової української школи. *Духовність особистості: методологія, теорія і практика, 4,* 330-335. Режим доступу: http://nbuv.gov.ua/UJRN/domtp_2017_4_37 (Ungurian, I. K. (2017). Formation of humane relations between a teacher and astudent as a component of pedagogy of partnership of the new Ukrainian school. *Spirituality of personality: methodology, theory and practice, 4,* 330-335. Retrieved from: http://nbuv.gov.ua/UJRN/domtp_2017_4_37).

Хоружа, Л. Л. (2020). Сучасні стратегії трансформації змісту педагогічної освіти. *Педагогічна освіта: теорія і практика. Психологія. Педагогіка, 33,* 8-16. Режим доступу: http://nbuv.gov.ua/UJRN/Potip_2020_33_3 (Khoruzha, L. L. (2020). Modern strategies for transforming the content of pedagogical education. Pedagogical education: theory and practice. *Psychology. Pedagogy, 33,* 8-16. Retrieved from: http://nbuv.gov.ua/UJRN/Potip_2020_33_3).

Хор'яков, В.А., Безугла, Л.І. (2007). Модульна технологія навчання з фізичного виховання студентів ВНЗ в контексті Болонського процесу. *Теорія і методика фізичного виховання, 4,* 39-42 (Khoriakov, V.A., Bezugla, L.I. (2007). Modular technology of teaching physical education to university students in the context of the Bologna process. *Theory and Methods of Physical Education, 4,* 39-420).

Хуторской, А. В. (2001). *Современная дидактика: Учебник для вузов*. СПб.: Питер (Khutorskoi, A.V. (2001). *Modern didactics: Textbook for universities*. SPb.: Peter).

Фурман, А. В. (1995). Принцип модульності в освітній практиці. *Рідна школа, 7, 8,* 20-23 (Furman, A. V. (1995). The principle of modularity in educational practice. *Native School, 7, 8,* 20-23).

Якиманская, И. С. (2000). *Технология личностсно-ориентованного обучения в современной школе.* М.: Сентябрь (Yakimanska, I. S. (2000). *Personality-centeredlearning technology in modern schools.* M.: September).

THE STATE OF DUAL EDUCATION DEVELOPMENT IN UKRAINE

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Abstract. The study characterizes state of dual education development in Ukraine in the system of vocational and higher education. The legal foundations of dual education development in Ukraine are highlighted. As a result of analysis of the regulatory framework of the implementation of the dual form of education in the domestic pre-higher and higher education institutions, reports on the results of the first and second years of implementing the pilot project in vocational and higher education institutions for training specialists in the dual form of education and study of the cases of implementing the dual form of education in Ukrainian pre-higher and higher education institutions the following expected outcomes of dual education are determined: improving the quality of education; improving the quality of training in accordance with real requirements of the labor market; ensuring training of the qualified specialists for the national economy; strengthening of the role of employers and public associations in the system of the qualified specialists training from the formation of the content of educational programs to the evaluation of learning outcomes; increasing the level of competitiveness of the education institutions graduates in the context of globalization and increasing the level of youth employment and so on.

Key words: education, dual education, higher education institution, pre-higher education institution, enterprise.

Introduction

In conditions when requirements of the modern labor market for the young specialists are becoming more and more complex, actualizes the need to revise traditional approaches in the system of professional education. The current labor market needs trained and mobile workers who are ready to independently and competently make important decisions, be responsible for their implementation, successfully involve themselves in professional activities. Nowadays employers are interested not so much in the format of graduates' "knowledge", as their readiness to carry out professional activities.

At the same time, the structure of graduates of the higher education institutions for many years does not meet the needs of the labor market in terms of the required structure of employment by educational level, by type of professional activity. These facts, as well as significant skewed wages, blurring the boundaries between formal and informal employment, between employment and unemployment, the growth of shadow employment indicate a crisis in the field of labor relations. In addition, the disparities between demand and supply of skilled labor in the labor market are also of territorial, sectoral, and socio-demographic nature. As a result of these disparities there has been formed a critical situation, when, on the one hand, it is impossible to meet the needs of society, industry, organizations, enterprises in workers of certain professions and specialties, which, in turn, reduces the competitiveness of the enterprise as a whole, and on the other hand, there are stable groups of the population who are experiencing difficulties in employment, who are in need of social assistance from the state.

Recognizing the need to change the system of specialists training, at the national level was made the decision to introduce dual form of education. In particular, the need to create favorable conditions for training at the appropriate level of competitive workers who are able to meet the requirements of the modern labor market, and ensuring equal access to vocational education was formulated in the Section III, subsection 8 "Modernization of vocational education" of the Government's medium-term priority action plan until 2020 and the Government's priority action

plan for 2017 (*Order of the Cabinet of Ministers of Ukraine of April 3, 2017 № 275-r "On approval of the medium-term plan of priority actions of the Government until 2020 and the plan of priority actions of the Government for 2017",* 2017).

In the Law of Ukraine "On Education" (2017) there first appeared the definition of dual form of education as "a way of obtaining education, which involves combining training of persons in education institutions (in other subjects of educational activities) with training in the workplace at enterprises, institutions and organizations to acquire a certain qualification, usually on a contractual basis" (*Law of Ukraine "On Education",* 2017).

The issue of dual education development in accordance with the requirements of the changing labor market has recently gained more and more attention of both scientists, policy-makers and education managers. Problems of training highly qualified specialists, interaction of educational services and labor markets are analyzed in the works of such Ukrainian researchers as D. Bohynia, N. Chernysh, V. Daniuk, M. Dolishnyi, Ye. Holovakha, L. Koleshnia, A. Kolot, E. Libanova, O. Martiakova, S. Melnyk, S. Oksamytna, V. Petiukh, V. Savchenko, E. Suimenko, V. Vasilchenko, H. Yaroshenko. T. Zaiats. The essence and specifics of dual education are considered by A. Anikeiev, Ye. Arturov, V. Kutumov, V. Kovtunets, H. Yarkov, K. Yesenin and others. European experience in the implementation of dual education is covered in the publications of S. Amelina, I. Boichevska, M. Drozach, N. Kudeli, U. Milla, V. Tesheva. Methodological approaches and organizational features of training qualified personnel in the dual system of vocational education analyze O. Glaisner, O. Davlikanova, M. Drozach, M. Lilyk, O. Kupenko and others.

At the same time, the studies of the peculiarities of dual education development in the system of Ukrainian education, is quite limited. Therefore, the aim of the present study is to characterize the state of dual education development in Ukraine in the system of vocational and higher education.

Research results

Legal foundations of dual education development in Ukraine

Recognizing the need for creating conditions for combining work with education both in the format of evening or distance learning, and in the format of practical training of full-time students of higher education institutions and vocational education institutions at workplaces, the Cabinet of Ministers of Ukraine issued on September 19, 2018 the Order № 660-r "On approval of the Concept of training specialists in the dual form of education" (*Order of the Cabinet of Ministers of Ukraine of September 19, 2018 № 660-r "On approval of the Concept of training specialists in the dual form of education",* 2018).

In the Concept it is stated that it is based on the German experience of the dual education and is aimed at overcoming the problem of the insufficient level of readiness of many graduates of the institutions of higher, pre-higher and vocational education for independent professional activity in the first jobs corresponding to the acquired education. The manifestations of the outlined problem are: unwillingness of graduates to work in the specialty; dissatisfaction of the labor market with the quality of education, which leads to the need for additional training in the workplace, expanding the training system in enterprises; low level of work of education institutions, including inefficient use of budget funds, as evidenced by the excessive proportion of graduates of the education institutions who do not work (often do not plan to work at all) in the acquired professions; inefficient use of the best time for students to acquire professional competences; establishing requirements for the availability of experience of independent professional activity (work experience) for graduates of the education institutions who are employed for the first time (*Order of the Cabinet of Ministers of Ukraine of September 19, 2018 № 660-r "On approval of the Concept of training specialists in the dual form of education"*, 2018).

The Concept explains that the above mentioned problem arose as a result of the long-term influence of the following factors: formal education is not focused on the development of

competences demanded by employers; limited opportunities for training outside education institutions; insufficient amount of funding for education institutions to create a modern material and technical base and formation of practical skills of the participants in the educational process; lack in the research and teaching staff of the competences necessary for the formation of relevant practical skills in students; lack of reliable information on current and future needs of employers in the competences of employees; insufficiency or complete absence of modern equipment and technologies in education institutions for the use of which it is necessary to train specialists; difficulties in attracting to teaching in higher education institutions of professionals with practical experience, with a salary that corresponds to their qualifications, due to the fact that staffing requirements in the field of higher education provide benefits for teachers with degrees; non-involvement of most education institutions (mostly with the status of budgetary institutions) in modern market relations and uncertainty of the mechanism of cooperation in the field of public-private partnership, which affects preparation of students for independent professional activity in a market environment (*Order of the Cabinet of Ministers of Ukraine of September 19, 2018 № 660-r "On approval of the Concept of training specialists in the dual form of education",* 2018).

Consequently, the aim of the analyzed Concept is to develop the principles of state policy to improve the quality of professional training based on the dual form of education.

The policymakers have determined the stages for implementing the Concept, namely:

Stage I – development of the regulatory framework for the introduction of the dual form of education (2018–2019);

Stage II – development of standard models of dual forms of education in the education institutions, implementation of pilot projects of models of dual forms of education, performance evaluation (2019–2020);

Stage III – creation of clusters of dual education based on competitive education institutions and interested employers – enterprises, institutions, organizations, including those belonging to the sphere of government (2020–2023) (*ibid.*).

The expected results of implementing the dual form of education in the system of higher, pre-higher and vocational education include:

- expansion and improvement of the practical part of the program while maintaining a sufficient level of theoretical training;
- ensuring interconnection and interaction of different systems (education and production, education and science, science and production) to implement important changes aimed at improving the quality of education;
- improving the quality of training in accordance with real requirements of the labor market and ensuring training of qualified specialists for the national economy;
- strengthening of the role of employers and public associations in the system of the qualified specialists training from the formation of the content of educational programs to the evaluation of learning outcomes;
- modernization of the content of education in order to bring it in line with the modern content of professional activity;
- increasing the level of competitiveness of graduates of the education institutions in the context of globalization and increasing the level of youth employment;
- reduction of the period of adaptation of the graduates of the education institutions to professional activity;
- development (updating) of qualification characteristics/professional standards;
- increasing the motivation of students to learn (*Order of the Cabinet of Ministers of Ukraine of September 19, 2018 № 660-r "On approval of the Concept of training specialists in the dual form of education",* 2018).

The document also defines the criteria for achieving the above expected results by education institutions, students and employers:

- *for education institutions:* increasing the competitiveness of the education institutions in the market of educational services; availability of the up-to-date information on the current state

of development of professions and types of economic activity for which the education institution trains specialists; improving the quality of education by adapting educational programs to the requirements of employers; expanding opportunities for applied research; expanding opportunities for professional development of the teaching staff;

- *for students:* combination of theoretical knowledge with practical experience at one or more enterprises, institutions or organizations; increasing the chances of getting a permanent job immediately after the graduation; availability of the work experience necessary for further professional growth before graduation, as well as a realistic vision of one's own career path; gaining practical experience during training and the opportunity to receive a monetary reward in the learning process;
- *for employers:* influence on the process of training a specialist with the necessary knowledge, skills and competences; obtaining qualified specialists who are ready to work at the appropriate level without additional costs for the initial acquaintance with the work processes at the enterprise, institution or organization or for retraining; selection (during training) of the most talented applicants for an invitation to work after graduation (*Order of the Cabinet of Ministers of Ukraine of September 19, 2018 № 660-r "On approval of the Concept of training specialists in the dual form of education",* 2018).

The Order of the Ministry of Education and Science of Ukraine "Regarding introduction of a pilot project in institutions of pre-higher and higher education for the training of specialists in the dual form of education" (2019) launched the experiment on introduction of the dual form of education at the level of pre-higher and higher education (*Order of the Ministry of Education and Science of Ukraine "On the introduction of a pilot project in institutions of professional pre-higher and higher education in training specialists in the dual form of obtaining education",* 2019).

The Order of the Ministry of Education and Science of Ukraine "On approval of the Regulations on the dual form of professional (vocational) education" (2019) defines grounds, conditions and procedure for obtaining professional (vocational) education in dual form in the institutions of professional (vocational) education (*Order of the Ministry of Education and Science of Ukraine "On approval of the Regulations on the dual form of professional (vocational) education" of 12.12.2019 № 1551,* 2019).

Pilot projects on implementing dual education in Ukraine

As it has been mentioned above, in the fall of 2019 the Ministry of Education and Science of Ukraine issued a relevant order on a large-scale pilot project on dual education. At the beginning of the experiment, it involved 44 institutions of pre-higher and higher education, and at the end of 2021 – 79 institutions, more than 300 employers, including representatives of large, medium and small business. The task of the experiment was to work out different models of dual education in Ukraine within four years and development of dual form of education, which will be useful for both education and business, will provide better prospects and opportunities for students.

At the end of the first year, in 2020, three reports (Davlikanova et al., 2020; Buchynska et al., 2020a; Buchynska et al., 2020b) were published on the results of this year of implementation of the pilot project of the Ministry of Education and Science of Ukraine. The reports provided data on the status of the introduction of the dual form of education; highlighted the problems faced by stakeholders during implementation and organization of training in dual form; recommendations on how to solve them were given and further steps to promote the dual form of education were proposed. The results of the first year allowed to conduct benchmarking to evaluate the results of the pilot project.

The second year of the experiment, which was affected by the quarantine restrictions imposed by the COVID-19 pandemic, led to significant changes in the usual mode of educational process and work of enterprises. However, the dual form of education has not lost its relevance, and employers are trying to resume cooperation with education institutions and education applicants.

The results of the second, 2021, year of implementing pilot project on dual education were presented in the analytical report (Buchynska et al., 2021).

The authors of the "Analytical report on the results of the second year of the pilot project, implemented in accordance with the Order of the Ministry of Education and Science of 15.10.2019 № 1296 'On the introduction of a pilot project in institutions of pre-higher and higher education for training specialists in dual form of obtaining education'" (Buchynska et al., 2021) note that due to the instability of the philosophy of dual education in Ukraine in some employers who do not participate in the pilot project, it seems that dual education represents a format, in which the applicant receives neither sound theoretical knowledge nor relevant practical experience. In addition, they do not see the difference between correspondence and dual forms of obtaining education. Therefore, it is necessary to strengthen information work and prevent the transformation of training in a dual form, which has proven itself in European countries, in Germany in particular, into "ineffective dual education", which could become a "national fault" (Buchynska et al., 2021, p.7).

The researchers explain this situation by the violation of the basic principles of dual education, in particular ensuring a balance between theoretical and practical components of applicants training, between the interests of the education institution and the employer. They warn that dual education should be focused on the interests of students and their quality training. They also note that discussions and updates on the content of education are often purely declarative, partly due to the fact that some partner employers are not willing to spend time on these and other formalities, on the one hand, and teachers do not receive sufficient support from the education institution or do not want to perform additional loads, on the other. Dual form of obtaining education for groups of applicants remains rather exceptional. This does not allow to create a training schedule that would provide real opportunities for the distribution of time between the places of study – education institution and the company. In some cases, as a violation of the law, education institutions agree that students attend classes in their free time or approve schedules that make the burden on students unbearable. These are just some of the issues that need to be addressed urgently. Although such cases are not ubiquitous, they cannot be ignored, as after two years of the national experiment, they will affect formation of the "image" of the dual form of obtaining education and the attitude of key stakeholders to it (Buchynska et al., 2021, p. 7-8).

According to the data, presented in the above-mentioned analytical report, one of the results of the experiment was developing of the general algorithm of actions for implementing dual form of obtaining education. This algorithm included the following stages:

- making a joint decision with the relevant employer about introduction of dual form of obtaining education in a certain specialty;
- identification of coordinators from the parties and preparation of a package of documents;
- signing of a bilateral agreement on the introduction of dual form of obtaining education;
- approval by the coordinators of the goals and training programs of the dual form of obtaining education;
- selection of students;
- additional on-the-job training for admission to the workplace (not applicable to all);
- signing an employment agreement with the applicant;
- signing a tripartite agreement on specialists training;
- order for referral to training in the dual form of obtaining education (Buchynska et al., 2021, p. 9).

The Analytical report contains data on the number of students who studied in the dual form of obtaining education in Ukrainian pre-higher and higher education institutions in the 2020-2021 academic year. The list of the higher education institutions includes:

1. Bila Tserkva National Agrarian University – 9 students;
2. SHEI "Donetsk National Technical University" – 7 students;
3. State Higher Education Institution "Azov State Technical University" – 28 students;
4. Zaporizhzhia National University – 4 students;

5. Ivano-Frankivsk National Technical University of Oil and Gas – 38 students;
6. Kryvyi Rih National University – 11 students;
7. Luhansk National Agrarian University – 3 students;
8. Lviv National Agrarian University – 11 students;
9. National Aerospace University named after M. Ye. Zhukovskyi "Kharkiv Aviation Institute" – 108 students;
10. National Technical University "Kharkiv Polytechnic Institute" – 137 students;
11. National University of Water Management and Environmental Sciences – 18 students;
12. Polissia National University – 10 students;
13. Yurii Kondratiuk Poltava National Technical University – 1 student;
14. Sumy National Agrarian University – 32;
15. Volodymyr Dahl East Ukrainian National University – 9 students;
16. Tavriia State Agrotechnological University named after Dmytro Motornyi – 17 students;
17. Ukrainian State University of Railway Transport – 48;
18. Kharkiv State University of Nutrition and Trade – 6;
19. Kharkiv National University of Municipal Economy named after O. M. Beketov – 25 students (Buchynska et al., 2021, p. 17-23).

Among the pre-higher education institutions, the dual form of education implemented:

1. Illinetsky State Agrarian College – 16 students;
2. Dnieper State Technical School of Energy and Information Technologies – 1 student;
3. Kamianka State Energy Technical School – 26 students;
4. Berdiansk College of the Tavriia State Agrotechnological University named after Dmytro Motornyi – 5 students;
5. Rohatyn Agrarian Vocational College – 20 students;
6. Polytechnic College of Kremenchug National University named after Mykhailo Ostrohradskyi – 28 students;
7. Myrogoshchany Agrarian College – 3 students;
8. SU NUBiP Ukraine "Bobrovytsia College of Economics and Management named after O. Mainova" – 4 students (Buchynska et al., 2021, p. 24-25).

Therefore, according to the data, provided in the Analytical report on the results of the second year of the pilot project, implemented in accordance with the Order of the Ministry of Education and Science of 15.10.2019 № 1296 "On the introduction of a pilot project in institutions of pre-higher and higher education for training specialists in dual form of obtaining education", the above mentioned higher education institutions involved 522 students while pre-higher education institutions involved only 103 students.

These institutions implemented dual form of education in the following specialties:

- Social and behavioral sciences (051 Economics);
- Management and Administration (071 Accounting and Taxation; 072 Finance, Banking Business and Insurance; 073 Management; 075 Marketing; 076 Entrepreneurship, Trade and Exchange Activities);
- Information technology (121 Software Engineering; 122 Computer Science; 126 Information Systems and Technologies);
- Mechanical Engineering (131 Applied Mechanics; 133 Industries Mechanical Engineering; 134 Aviation and rocket and space technology; 136 Metallurgy);
- Electric Engineering (141 Electricity, Electrical Engineering and Electromechanics);
- Automation and Instrument Making (151 Automation and Computer-Integrated Technologies);
- Chemically and Bioengineering (161 Chemical Technology and Engineering);
- Electronics and Telecommunications (172 Telecommunications and Radio Engineering; 173 Avionics);
- Production and Technology (181 Food Technology; 184 Mining; 185 Oil and Gas Engineering and Technologies);

- Architecture and Construction (192 Construction and Civil Engineering; 193 Geodesy and Land Management);
- Agricultural Sciences and Food (201 Agronomy; 203 Gardening and Viticulture; 204 Production Technology and Livestock Product Processing; 208 Agroengineering);
- Veterinary Medicine (211 Veterinary medicine);
- Civil Security (263 Civil Security);
- Transport (272 Air Transport; 273 Railway Transport; 274 Automotive Transport; 275 Transport Technologies (Buchynska et al., 2021, p. 24-25).

In order to understand the motives of implementing the dual form of education in the pre-higher and higher education institutions the researchers asked these institutions about the main reasons that had prompted this step. According to the received answers, there is a number of reasons to implement the dual form of education:

- modernization of the content of education in order to bring it in line with modern content of professions and strengthening the practical component of education applicants training;
- improving the quality of future specialists' training, in particular, acquisition of competences by education applicants in accordance with the real requirements of the labor market;
- increasing the competitiveness and employment rates of graduates;
- creation of optimal conditions for the development of the potential of the young people who have decided on a professional trajectory;
- use of modern material and technical base of enterprises for training education applicants and providing opportunities for internships in scientific-pedagogical and pedagogical-production personnel;
- historical traditions of cooperation between the employer and the employer (Buchynska et al., 2021, p. 29).

It should be mentioned that in order to coordinate the process of implementing dual education in the domestic higher education institutions some HEIs created a separate structural unit, while in other institutions the functions related to the organization of dual education have been redistributed among other structural subdivisions. Thus, separate structural units are created in:

- State Higher Education Institution "Azov State Technical University";
- Ivano-Frankivsk National Technical University of Oil and Gas;
- National Technical University "Dnieper Polytechnic";
- Polissia National University;
- Ukrainian State University of Railway Transport.

Let's consider the functions of these units in more detail. One of such units is the Coordination Center for Dual Education of Ivano-Frankivsk National Technical University of Oil and Gas, which was established in February 2020 according to the order of the Rector № 19 of February 4, 2020.

The Coordination Center for Dual Education performs organizational and coordination functions to intensify partnership, cooperation between the university, the higher education applicant and business organization, stimulating the competitiveness of higher education applicants in the labor market by implementing training in the higher education institution and enterprise.

In its activities, the Coordination Center for Dual Education is guided by the Laws of Ukraine "On Education", "On Higher Education", the order of the Cabinet of Ministers of Ukraine from 19.01.2018 № 660-r "On approval of the Concept of training specialists in the dual form of education", the order of the Ministry of Education and Science of Ukraine dated 15.10.2019 № 1296 "On introduction of a pilot project in institutions of professional pre-higher and higher education for training specialists in dual form of obtaining education", other orders and directives of the Ministry of Education and Science of Ukraine, legislative and regulatory acts and orders on higher education, University Charter, orders and normative acts of the Rector, First Vice-Rector and other Vice-Rectors of the University, as well as the Regulations on the Coordination Center for Dual Education of Ivano-Frankivsk National University of Oil and Gas.

The Coordination Center for Dual Education functions as a structural unit of the university, reporting directly to the rector. The first vice-rector coordinates the work of the center.

The Coordination Center for Dual Education performs the following tasks:

- participation in the process of implementation and realization of the model of dual education at the university;
- meeting the needs of the region in qualified personnel based on the implementation of the model of dual education with involvement of the public-private partnership;
- participation in the career guidance aimed at meaningful choice by future students of the specialties, the most promising in terms of regional development;
- approbation and modernization of the educational programs, bringing the structure, content and technologies of educational programs in line with the requirements of employers, professional standards and forecast of socio-economic development of the region;
- introduction of the mechanisms of professional and public accreditation of educational programs with the direct participation of employers;
- organization and holding of conferences, webinars, seminars, round tables on dual education, etc. (*Ivano-Frankivsk National Technical University of Oil and Gas. Coordination Center for Dual Education*).

Somewhat different is the model of the structural unit which coordinates dual education in the State Higher Education Institution "Azov State Technical University", where dual education is coordinated by the Educational-Scientific Center "Lifelong Learning Academy" which implements continuing education aimed at mastering new knowledge and modern technologies throughout life, improving the quality and level of higher education competitiveness, providing, improving conditions for self-realization and development of citizens in the region in order to educate professionals who can successfully work in a competitive environment in Ukraine and abroad.

The Educational-Scientific Center "Lifelong Learning Academy" conducts activities in several directions, namely:

- scientific and scientific-technical activities aimed at studying the sciences, mastering technical specialties required in the labor market of Donetsk region (STEM-education);
- carrying out scientific and educational activity on pre-university preparation with the use of objects of intellectual property (Know-How):
  - EIT preparation courses;
  - English language courses for children;
  - computer literacy (robotics) courses for children.
- implementation of the project "Introductory career guidance practice for students";
- organization of open lessons at the enterprises of the city;
- introduction of the dual form of education;
- implementation of the scholarship program of Metinvest Holding LLC;
- English language courses for adults;
- IT courses for adults (*Azov State Technical University. Lifelong learning*).

As it can be seen from the above list, one of the directions of the center's activity is introduction of dual education at the University. As it is stated on the webpage of the corresponding structural unit (https://pstu.edu/uk/novyny/dualna-forma-zdobuttya-vyshhoyi-osvity/), the dual form of higher education at the State Higher Education Institution "Azov State Technical University" involves obtaining education by combining theoretical training of students at the university with practical training in the workplace at enterprises to obtain a certain qualification.

Since December 2019, the dual form of higher education has been introduced at the Azov State Technical University, the purpose of which is to improve the quality of professional training of students, by:

- strengthening and improving the practical component of the educational process while ensuring achievement of learning outcomes defined by the relevant educational standard and educational program;

- ensuring interconnection, interpenetration and interaction of different systems (science and education, science and industry or the public sector) to implement important changes aimed at improving the quality of education;
- improving the quality of training in accordance with real requirements of the labor market and providing the national economy with qualified specialists;
- strengthening the role of employers and professional associations in the system of training qualified personnel from the formation of the content of educational programs to the evaluation of learning outcomes;
- modernization of the content of education in order to bring it in line with the requirements of the labor market;
- increasing the competitiveness of graduates of the education institutions in the context of globalization and promoting the growth of youth employment;
- reduction of the period of adaptation of graduates to professional activity;
- increasing the motivation of students to learn (*Azov State Technical University. Dual form of higher education*).

The Center for Dual Education in Polissia National University was established on September 25, 2019 (Order № 175) to neutralize the main shortcomings of traditional forms and methods of training future professionals, reduce the gap between theory and practice, education and industry, and improve the quality of training according to the requirements of the employers in the framework of new organizationally different forms of education. The regulatory basis for the establishment of the Center were the Laws of Ukraine "On Education", "On Higher Education", Order of the Cabinet of Ministers of Ukraine dated 19.09.2018 № 660-r "On approval of the Concept of training specialists in the dual form of education".

Polissia National University, approving the Regulations on the dual form of education in 2018, showed the first initiatives and tried to use the dual form in the educational process. Thus, at the beginning of 2019, 22 students of various specialties "Economics", "Entrepreneurship, Trade and Exchange", "Marketing", "Accounting and Taxation", "Veterinary Medicine", "Agronomy", "Agroengineering", "Electricity, electrical engineering and electromechanics", "Technology of production and processing of livestock products") carried out dual training at the enterprises of Zhytomyr region, namely PE "Galex Agro", LLC "Organic Milk", LLC "AgroVest Group" and PE "Furniture Factory Myrtle" (*Polissia National University. Center for Dual Education*).

The Center developed the "Roadmap for the implementation of the dual form of education in Polissia National University" (*Roadmap for the implementation of the dual form of education in Polissia National University*).

In the Ukrainian State University of Railway Transport the structural unit for coordination of dual education was established on the basis of the Center for Educational and Practical Training created in 2007 and renamed in 2014 into the Center for Educational and Practical Training and Employment Promotion of Students and Alumni of Ukrainian State University of Railway Transport. At the end of 2019, due to the significant changes in the legislation of Ukraine in the field of higher and vocational education, in particular – introduction of a new paradigm for quality assurance in higher education, implementation of dual education, increasing requirements for systematic interaction with employers and other stakeholders it was restructured into the Center for Educational and Practical Training, Vocational and Dual Education.

In its work, the Center is guided by the current legislation of Ukraine, in accordance with its specifics, the University Charter, decisions of the Academic Council, regulations, orders and directives of the university management.

The purpose of the Center is to improve the quality of practical training of students to meet the needs of the railway transport and other sectors of the economy of Ukraine in highly qualified professionals, as well as to promote employment of students and graduates of the University, accelerate adaptation of graduates.

Employees of the Center establish and maintain contacts with potential employers. The Center is constantly working to accumulate a bank of potential employers (enterprises, institutions and organizations of various forms of ownership).

On the issues of practical training and employment of students and graduates the University closely cooperates with JSC Ukrainian Railway ("Ukrzaliznytsia") (including its regional branches), as well as with such enterprises as CE "Kharkiv Heat Networks", JSC "Giprozavodtrans", SE "Ukrzaliznychproekt", Kharkiv Metro, OJSC Turboatom, CJSC Transmost (Chernivtsi), PJSC Kharkiv Machine-Building Plant Svitlo Shakhtar, SE Electrovazhmash, OJSC Teplovozoremontny Zavod (Poltava), OJSC Kryukivsky Car-Building plant, Stakhanov car-building plant, Malyshev plant.

Special attention is paid to the interaction with the central executive bodies of Ukraine, state and municipal institutions and their regional subdivisions that implement regulatory policy in the field of training specialists with higher and professional education, employment of freelance graduates, their social and labor adaptation, including the Minnistry of Education and Science of Ukraine, the Ministry of Social Policy of Ukraine, the National Agency for Quality Assurance in Higher Education, etc.

An important activity of the Center for Educational and Practical Training, Vocational and Dual Education is cooperation with stakeholders in the direction of tracking the career path of university graduates, collecting information on employers' satisfaction with the quality of training (together with the Center for Quality Assurance in Higher Education) in order to properly adjust educational programs in all specialties. To this end, the Center has established regular contacts with the Department of Personnel Development and Card Policy of JSC "Ukrzaliznytsia" and its functional units at regional branches of the company, the Employers' Organization Branch Association of the Railway Transport Enterprises "Federation of Railwaymen of Ukraine" and other relevant institutions.

The management and specialists of the Center for Educational and Practical Training, Vocational and Dual Education regularly take part in working meetings of JSC "Ukrzaliznytsia" and "Federation of Railwaymen of Ukraine" on the development of dual education, other forms of joint activities to train personnel for the transport industry and develop professional standards.

The Center provides an opportunity for each student of the university to get a working profession in the profile of study at the university. At the request of students, they can get another job. Training is carried out on the principle of course preparation 2-3 days a week for 2-3 pairs after the main classes on the university schedule.

Currently, the university has licenses from the Ministry of Education and Science of Ukraine for course training in 15 working professions (four of them provide the right to advanced training). At the end of theoretical training students in each discipline take exams, after passing the internship and report on it there is a final exam in the working profession. During their studies at the Center, students get acquainted with the modern equipment of the enterprises of the Regional Branch of the Southern Railway, automated workplaces of railway transport workers. After obtaining a working profession, students have the opportunity to do internships in paid jobs, work in summer student labor groups and receive education in the dual form of education (*Center for educational and practical training, vocational and dual education*).

Implementing dual education at Sumy State Pedagogical University named after A.S. Makarenko

In order to implement dual form of education at Sumy State Pedagogical University named after A.S. Makarenko, the Order of the Rector of November 29, 2021, approved Regulations on the dual form of higher education in Sumy State Pedagogical University named after A. S. Makarenko.

According to the Regulations, the dual form of obtaining higher education at the University provides for obtaining higher education by full-time students by combining training in University with on-the-job training at enterprises, institutions, and organizations to acquire certain

qualifications ranging from 25 to 60 percent of the total educational volume of the contract-based educational program.

The purpose of introducing the dual form of higher education is improving the quality of preparation of higher education applicants for professional activities.

The main tasks of training in dual form are also defined in the Regulations:

- strengthening and improving the practical component of educational process with ensuring achievement of learning outcomes, defined in the relevant standard of higher education and educational program;
- ensuring interconnection, interpenetration and interaction of different systems: science and education, science and production or the public sector to implement important changes, aimed at improving the quality of higher education;
- improving the quality of training specialists with higher education in accordance with real requirements of the labor market and providing the education sector and the national economy with qualified specialists;
- strengthening the role of stakeholders and professional associations in the system training of the qualified personnel from the formation of the content of the educational programs to assessing learning outcomes;
- modernization of the content of higher education in order to bring it to compliance with labor market requirements;
- increasing the level of competitiveness of the University graduates in the context of globalization and promoting growth of youth employment;
- reduction of the period of adaptation of graduates to professional activity;
- increasing the motivation of higher education applicants to study (*Sumy State Pedagogical University named after A.S. Makarenko. Regulations on the dual form of higher education at Sumy State Pedagogical University named after A.S. Makarenko*).

Special emphasis should be placed at the models of higher education organization in the dual form. The models are based on the division of workload and study load of the higher education applicant and the way they are distributed between the University and the workplace at the enterprise/institution/organization depending on the specifics of the educational program.

The specified models include, but are not limited to the following:

- split day model: a few hours during the day the study takes place at the University, a few hours – at the workplace at the enterprise/institution/organization;
- split week model: several days during the week the study takes place at the University, and during the rest of the week – at the workplace;
- block model: the study at the University and at the workplace takes place in blocks (one block lasts one or more weeks, months, semester);
- partial model: part of theoretical training is covered by training in institutions, establishments, organizations, enterprises;
- mixed model: several models of division of educational load can be applied during the whole period of study;
- other models (*Sumy State Pedagogical University named after A.S. Makarenko. Regulations on the dual form of higher education at Sumy State Pedagogical University named after A.S. Makarenko*).

Conclusions

The results of the analysis of the regulatory framework of the implementation of the dual form of education in the domestic pre-higher and higher education institutions, reports on the results of the first and second years of implementing the pilot project in vocational and higher education institutions for training specialists in dual form of education and study of the cases of implementing

the dual form of education in Ukrainian pre-higher and higher education institutions have allowed to make the following conclusions.

Dual form of education is a way of obtaining education by combining training of persons in education institutions (in other subjects of educational activities) with training in the workplace at enterprises, institutions and organizations to acquire a certain qualification.

Implementation of the dual form of education in Ukraine is regulated by a number of acts: Law of Ukraine "On Education", Order of the Ministry of Education and Science of Ukraine "On approval of the Regulations on the dual form of professional (vocational) education" of 12.12.2019 № 1551, Order of the Ministry of Education and Science of Ukraine "On the introduction of a pilot project in institutions of professional pre-higher and higher education in training specialists in the dual form of obtaining education" of October 15, 2019 № 1296, Order of the Cabinet of Ministers of Ukraine of September 19, 2018 № 660-r "On approval of the Concept of training specialists in the dual form of education" and others.

The results of the introduction of a pilot project in institutions of professional pre-higher and higher education in training specialists in the dual form of obtaining education show that at the beginning of the experiment it involved 44 institutions of pre-higher and higher education, and at the end of 2021 – 79 institutions, more than 300 employers, including representatives of large, medium and small business. The task of the experiment was to work out different models of dual education in Ukraine within four years and development of dual form of education, which will be useful for both education and business, will provide better prospects and opportunities for students.

The expected outcomes of implementing dual form of education include: expansion and improvement of the practical part of the program while maintaining a sufficient level of theoretical training; ensuring interconnection and interaction of different systems (education and production, education and science, science and production) to implement important changes aimed at improving the quality of education; improving the quality of training in accordance with real requirements of the labor market and ensuring training of qualified specialists for the national economy; strengthening of the role of employers and public associations in the system of the qualified specialists training from the formation of the content of educational programs to the evaluation of learning outcomes; modernization of the content of education in order to bring it in line with the modern content of professional activity; increasing the level of competitiveness of graduates of the education institutions in the context of globalization and increasing the level of youth employment; reduction of the period of adaptation of the graduates of the education institutions to professional activity; development (updating) of the qualification characteristics/professional standards; increasing the motivation of students to learn and so on.

References

Давліканова, О. Б., Іщенко, Т. Д., Чайковська, А. Б. (2020). *Аналітичний звіт за результатами першого року проведення експерименту із запровадження пілотного проєкту в закладах фахової передвищої та вищої освіти з підготовки фахівців за дуальною формою здобуття освіти відповідно до Наказу МОНУ від 15.10.2019 № 1296 «Щодо запровадження пілотного проєкту в закладах фахової передвищої та вищої освіти з підготовки фахівців за дуальною формою здобуття освіти».* Київ: Представництво Фонду ім. Фрідріха Еберта в Україні. Режим доступу: https://mon.gov.ua/storage/app/media/rizne/2020/09/28/zvitza20192020nrshchodorealizatsiyidualnohonavchannya.pdf (Davlikanova, O. B., Ishchenko, T. D., Tchaikovskyi, A. B. (2020). *Analytical report on the results of the first year of the pilot project in vocational and higher education institutions for training specialists in dual form of education in accordance with the Order of the Ministry of Education and Science of 15.10.2019 № 1296 "On the introduction of a pilot project in pre-higher and higher education institutions of training specialists in the dual form of education"*. Kyiv: Representation of the Foundation named after Friedrich Ebert in Ukraine. Retrieved from:

https://mon.gov.ua/storage/app/media/rizne/2020/09/28/zvitza20192020nrshchodorealizatsiyi dualnohonavchannya.pdf).

Бучинська, О. В., Давліканова, О. Б., Лилик, І. В., Чайковська, А. Б. (2020). *Аналітичний звіт «Думки роботодавців про дуальну освіту» за результатами дослідження обізнаності роботодавців про дуальну форму здобуття освіти та досвіду участі в пілотному проєкті з її запровадження на рівні фахової передвищої та вищої освіти України».* Київ: Представництво Фонду ім. Фрідріха Еберта в Україні Режим доступу: https://mon.gov.ua/storage/app/media/rizne/2020/11/10/Dualna_2_2%20edit%206-11.pdf (Buchynska, O. V., Davlikanova, O. B., Lilyk, I. V., Tchaikovsky, A. B. (2020). *Analytical report "Employers' Opinions on Dual Education" based on the results of a survey of employers' awareness of the dual form of education and experience in participating in a pilot project for its implementation at the level of professional higher and higher education in Ukraine*. Kyiv: Representation of the Foundation named after Friedrich Ebert in Ukraine. Retrieved from: https://mon.gov.ua/storage/app/media/rizne/2020/11/10/Dualna_2_2% 20edit% 206-11.pdf).

Бучинська, О. В., Давліканова, О. Б., Лилик, І. В., Яшкіна, О. І. (2020). *Аналітичний звіт «Думки здобувачів про дуальну освіту» за результатами дослідження обізнаності здобувачів про дуальну форму здобуття освіти та досвіду учасників пілотного проєкту з її запровадження на рівні фахової передвищої та вищої освіти України. Київ: Представництво Фонду ім. Фрідріха Еберта в Україні.* Режим доступу: http://library.fes.de/pdf-files/bueros/ukraine/17747.pdf (Buchynska, O. V., Davlikanova, O. B., Lilyk, I. V., Yashkina, O. I. (2020). *Analytical report "Opinions of applicants of dual education" based on the results of the study of applicants' awareness of the dual form of education and the experience of pilot project participants in its implementation at the level of pre-higher and higher education in Ukraine.* Kyiv: Representation of the Foundation named after Friedrich Ebert in Ukraine. Retrieved from: http://library.fes.de/pdf-files/bueros/ukraine/17747.pdf).

Бучинська, О., Давліканова, О., Іщенко, Т., Лилик, І., Чайковська, А., Яшкіна, О. (2021). *Аналітичний звіт за результатами другого року пілотного проєкту, що реалізується відповідно до Наказу МОНУ від 15.10.2019 № 1296 «Щодо запровадження пілотного проєкту в закладах фахової передвищої та вищої освіти з підготовки фахівців за дуальною формою здобуття освіти»*. Київ. Режим доступу: https://mon.gov.ua/storage/app/media/news/2021/12/08/Zvit.za.2.rik.Pilot.proyekt.Dual.osv.2020-2021.pdf (Buchynska, O., Davlikanova, O., Ishchenko, T., Lilyk, I., Tchaikovskуш, A., Yashkina, O. (2021). *Analytical report on the results of the second year of the pilot project, implemented in accordance with the Order of the Ministry of Education and Science of 15.10.2019 № 1296 "On the introduction of a pilot project in institutions of pre-higher and higher education for training specialists in dual form of obtaining education"*. Kyiv. Retrieved from: https://mon.gov.ua/storage/app/media/news/2021/12/08/Zvit.za.2.rik.Pilot.proyekt.Dual.osv.2020-2021.pdf).

Дорожня карта впровадження дуальної форми здобуття освіти у Поліському національному університеті. Режим доступу: https://nmc-vfpo.com/wp-content/uploads/2021/10/dorozhnya-karta-realizacziyi-dfzo_compressed-1-szhat%D1%8Bj.pdf (*Roadmap for the implementation of the dual form of education in Polissia National University*. Retrieved from: https://nmc-vfpo.com/wp-content/uploads/2021/10/dorozhnya-karta-realizacziyi-dfzo_compressed-1-szhat%D1%8Bj.pdf).

Закон України «Про освіту» (2017). *Відомості Верховної Ради (ВВР), 38-39,* 380. Режим доступу: http://zakon.rada.gov.ua/laws/show/2145-19 (Law of Ukraine "On Education" (2017). *Information of the Verkhovna Rada (VVR), 38-39,* 380. Retrieved from: http://zakon.rada.gov.ua/laws/show/2145-19).

Івано-Франківський національний технічний університет нафти і газу. Координаційний центр дуальної освіти. Режим доступа: https://nung.edu.ua/department/kcdo (*Ivano-Frankivsk National Technical University of Oil and Gas. Coordination Center for Dual Education*. Retrieved from: https://nung.edu.ua/department/kcdo).

Наказ МОН України «Про затвердження Положення про дуальну форму здобуття професійної (професійно-технічної) освіти» від 12.12.2019 № 1551 (2019). Режим доступу: https://zakon.rada.gov.ua/laws/show/z0193-20#Text (*Order of the Ministry of Education and Science of Ukraine "On approval of the Regulations on the dual form of professional (vocational) education" of 12.12.2019 № 1551* (2019). Retrieved from: https://zakon.rada.gov.ua/laws/show/z0193-20#Text).

Наказ МОН України «Щодо запровадження пілотного проекту у закладах фахової передвищої та вищої освіти з підготовки фахівців за дуальною формою здобуття освіти» від 15 жовтня 2019 р. № 1296 (2019). Режим доступу: https://mon.gov.ua/ua/npa/shodo-zaprovadzhennya-pilotnogo-proektu-u-zakladah-fahovoyi-peredvishoyi-ta-vishoyi-osviti-z-pidgotovki-fahivciv-za-dualnoyu-formoyu-zdobuttya-osviti (*Order of the Ministry of Education and Science of Ukraine "On the introduction of a pilot project in institutions of professional pre-higher and higher education in training specialists in the dual form of obtaining education" of October 15, 2019 № 1296* (2019). Retrieved from: *https://mon.gov.ua/ua/npa/shodo-zaprovadzhennya-pilotnogo-proektu-u-zakladah-fahovoyi-peredvishoyi-ta-vishoyi-osviti-z-pidgotovki-fahivciv-za-dualnoyu-formoyu-zdobuttya-osviti*).

Поліський національний університет. Центр дуальної освіти. Режим доступу: https://polissiauniver.edu.ua/%D1%86%D0%B5%D0%BD%D1%82%D1%80-%D0%B4%D1%83%D0%B0%D0%BB%D1%8C%D0%BD%D0%BE%D1%97-%D0%BE%D1%81%D0%B2%D1%96%D1%82%D0%B8/ (*Polissia National University. Center for Dual Education.* Retrieved from: https://polissiauniver.edu.ua/%D1%86%D0%B5%D0%BD%D1%82%D1%80-%D0%B4%D1%83%D0%B0%D0%BB%D1%8C%D0%BD%D0%BE%D1%97-%D0%BE%D1%81%D0%B2%D1%96%D1%82%D0%B8/).

Приазовський державний технічний університет. Дуальна форма здобуття вищої освіти. Режим доступу: https://pstu.edu/uk/novyny/dualna-forma-zdobuttya-vyshhoyi-osvity/ (*Azov State Technical University. Dual form of higher education*. Retrieved from: https://pstu.edu/uk/novyny/dualna-forma-zdobuttya-vyshhoyi-osvity/).

Приазовський державний технічний університет. Lifelong learning. Режим доступу: https://pstu.edu/uk/university/departments/lifelong-learning/ *(Azov State Technical University. Lifelong learning.* Retrieved from: https://pstu.edu/uk/university/departments/lifelong-learning/).

Розпорядження Кабінету міністрів України від 3 квітня 2017 р. № 275-р «Про затвердження середньострокового плану пріоритетних дій Уряду до 2020 року та плану пріоритетних дій Уряду на 2017 рік» (2017). Режим доступу: https://zakon.rada.gov.ua/laws/show/275-2017-%D1%80#Text (*Order of the Cabinet of Ministers of Ukraine of April 3, 2017 № 275-r "On approval of the medium-term plan of priority actions of the Government until 2020 and the plan of priority actions of the Government for 2017"* (2017). Retrieved from: https://zakon.rada.gov.ua/laws/show/275-2017-%D1%80#Text).

Розпорядження Кабінету міністрів України від 19 вересня 2018 р. № 660-р «Про схвалення Концепції підготовки фахівців за дуальною формою здобуття освіти» (2018). Режим доступу: https://zakon.rada.gov.ua/laws/show/660-2018-%D1%80#Text (*Order of the Cabinet of Ministers of Ukraine of September 19, 2018 № 660-r "On approval of the Concept of training specialists in the dual form of education"* (2018). Retrieved from: https://zakon.rada.gov.ua/laws/show/660-2018-%D1%80#Text).

Сумський державний педагогічний університет імені А.С. Макаренка. Положення про дуальну форму здобуття вищої освіти у Сумському державному педагогічному університеті імені А. С. Макаренка. Режим доступу: https://sspu.edu.ua/images/2021/docs/11/pro_dualnu_formu_zdobuttya_vischoyi_osviti_37099.pdf (*Sumy State Pedagogical University named after A.S. Makarenko. Regulations on the dual form of higher education at Sumy State Pedagogical University named after A.S. Makarenko*. Retrieved from: https://sspu.edu.ua/images/2021/docs/11/pro_dualnu_formu_zdobuttya_vischoyi_osviti_37099.pdf).

УкрДУЗТ. Центр навчально-практичної підготовки, професійної та дуальної освіти. Режим доступу: https://kart.edu.ua/unit/cpp (UkrSURT. *Center for educational and practical training, vocational and dual education.* Retrieved from: https://kart.edu.ua/unit/cpp).

INNOVATION SCIENTIFIC ACTIVITY OF MEDICAL COLLEGES AT U.S. UNIVERSITIES

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Abstract. The chapter covers the innovation scientific activity of medical colleges at U.S. Universities within engineering, design, and transfer of innovation products. Biomedical engineering deals with applying engineering principles and design concepts in the medical or biological field in the health care system for diagnostic, therapeutic, rehabilitation, and other purposes. Note that the transfer of innovative products of medical colleges at U.S. Universities is carried out within the implementation of the Bayh-Dole Act (1980) and amendments to it, adopted in the late 20th – early 21st centuries. Moreover, the problem of increasing the efficiency of transfer of products of innovation activity by developing innovation methods of assessing the commercial success of the proposed products has become relevant in current conditions.

Key words: innovation scientific activity, medical colleges, U.S. Universities, engineering, design, transfer.

Introduction

Medicine is clinical work and relationship building, teamwork, communication skills, research, innovation, publishing, and critical evaluation. Medical specialists are more likely to discover new clinical associations and syndromes and solve problems that medicine has never done before (Anand, 2014). So, the USA knows what innovations require: a continuous commitment to scientific research, a world-class workforce, and an economic environment. This rewards entrepreneurship and innovations. As the most dynamic and prosperous country globally, the United States has long benefited from policies and investments that promote innovation and, in turn, stimulate productivity and economic growth, foster U.S. trade, protect health and national security and defend the American dream (*Innovation: an American Imperative*, June 23, 2015).

Medical education as a whole and innovation activity of medical colleges at U.S. Universities, in particular, has become the issue of special interest of such foreign researchers as R. Asera, N. Al-Wardy, R. Atkinson, B. Barzansky, H. Beecher, F. Billings, F. Blaisdell, H. Weiskotten, N. Gevitz, K. DeZee, J. Dienstag, P. Jolly, R. Drake, E. Cordell, S. Lamb, K. Ludmerer, B. Murphy, A. Mortimer, B. Ogur, C. Pfeifer, S. Seifer, Ch. Smith, S. Smithson, T. Snyder, J. Takeuchi, C. Chapman, A. Chesney, P. Fallavollita, E. Fee, A. Flexner and others.

The Ukrainian scientific community has significant work on the development of higher education in the United States, including medical one: activity of adult education centres in the United States and Japan (N. Avsheniuk); development of the adult education system in the USA

(N. Bidiuk); training future teachers to work with gifted students in higher education institutions in the United States, Canada and the United Kingdom (M. Boichenko); alternative education in the USA (O. Zabolotna); use of U.S. experience in the organization of distance and blended learning in domestic universities (I. Zadorozhna); training of masters in higher education establishments of the USA (T. Kuchai); two-year nursing education in the USA (N. Lishchenko); theory and practice of corporate education in the United States (I. Lytovchenko); public administration of education in the United States (V. Luniachek); use of distance learning during the training of nurses-masters in the USA (I. Melnychuk); professional development of secondary school teachers in the systems of continuing pedagogical education in Great Britain, Canada, USA (N. Mukan); international activity as a factor of innovation development of U.S. Universities (O. Ogienko); management of scientific work in U.S. state universities (A. Sbruieva, M. Sbruiev, K. Shykhnenko); trends in the development of adult education in the United States and Canada (O. Terenko) and others. However, the innovation scientific activity of medical colleges at U.S. Universities still needs detailed study.

The research focuses on the innovation scientific activity of medical colleges at U.S. Universities within engineering, design, and transfer of innovation products.

Research results

Innovation scientific activity of medical colleges at U.S. Universities as a research problem

'A Strategy for American Innovation: Driving towards Sustainable Growth and Quality Jobs', published in 2009, identified promising areas for U.S. innovation activity in the nearest future.

According to the document, the increase in costs and the decrease in the quality of medical care were due to the inefficiency of the health care system. Using the latest information technologies in healthcare can increase efficiency, while broad reforms may involve businesses and individuals in innovation activity (*Executive office of…,* 2009).

The following promising areas of innovation activity were also identified:

- increase the use of advanced information technologies in the field of health care (mobile medical programs, electronic medical records, sensors for monitoring chronic diseases, etc.) to prevent medical errors, improve the quality of health care, modernize the health care system and reduce costs;
- renewing interest in biomedical research, in particular through targeted funding for research to detect genetic changes in various cancers, clinical trials of drugs to combat HIV/AIDS, identifying causes and treatments for autism, using DNA sequences to prevent and treat heart disease, lungs and blood;
- slowing the growth of health care expenditures through comprehensive health care reform and improving the quality of health care (*Executive office of…,* 2009).

In 2015, 'A Strategy for American Innovation reported that the Presidential Administration' was pursuing an additional policy to support an innovation ecosystem that benefits all Americans. In particular, thanks to it, American innovators have successfully implemented a project to create white blood cells that help kill cancers without damaging healthy cells (*National Economic…,* 2015).

The document identified the following prospects for U.S. innovation activity development:

- intellectual support for the regulation of innovation processes;
- service to the people;
- use of financial innovations following national priorities;
- strengthening the demand for American innovation strategy (*National Economic…,* 2015).

Also, according to the document 'Innovation: an American Imperative' (2015), the representatives of different fields declared their intention to act decisively and to urge Congress to renew the federal commitment to scientific discovery; make federal R&D tax credits permanent; reform the U.S. visa policy; take steps to simplify or eliminate costly and inefficient regulations;

stimulate further improvements in advanced manufacturing, etc. (*Innovation: an American Imperative*, June 23, 2015).

M. Sbruiev (Sbruiev, 2012a; 2012b; 2015) addressed the issue of development of scientific work in American Universities. Ukrainian researcher notes that 'the effectiveness of the management system of scientific work of a modern American public Universities is a complex, multifaceted function that depends on many external and internal variables' (Sbruiev, 2012b, p. 136). It can be considered as a matrix, which presents the areas of cooperation between the University and industry, society, and the state, which determine the economic and social components of efficiency, as well as the competencies of research administrators needed for the successful collaboration of scientists, administrators, politicians, educators and others (Sbruiev, 2012b, p. 136).

L. Fedulova focuses on the innovation University as an agent of change, which is 'an academic complex of collective entrepreneurship that dynamically and quickly adapts to the requirements of the external environment and operates in a competitive environment' (Fedulova, 2016, p. 163). This competitive environment includes domestic and foreign educational establishments that provide training and professional development of intellectuals; research centres that produce knowledge-intensive products; organizations providing educational and consulting services. Together, the outlined organizations also actively shape the structure and needs of the markets in which they operate (Fedulova, 2016, p. 163).

L. Fedulova emphasizes that in current conditions, the need to intensify innovation activity is relevant, which should cover two areas that complement each other: 1) implementation of innovative methods of managing higher education establishments, among which the top place is occupied by scientific management; 2) establishing partnerships with all actors not only in the national innovation system but also in the international innovation space, which includes such components as education, science and industry (Fedulova, 2016, p. 166).

The implementation of innovations requires companies to invest heavily in research, development, production and marketing and undergo a rigorous approval process through the FDA. The price of innovation is vast for those who invest in advanced technologies to develop medicine (Fargen et al., 2013).

As R. Atkinson and W. Blanpied rightly point out, the very emergence of research universities in the United States was once an innovation. Johns Hopkins University became the first American higher education establishment founded as a research university. After Johns Hopkins University, Clark University (1889), Stanford University (1891), and the University of Chicago (1892) began to consider themselves research establishments. At the turn of the 19th and 20th centuries, several public universities, including the Universities of California, Michigan, Wisconsin, Minnesota, and Illinois, also began to position themselves as leading research establishments (Atkinson, Blanpied, 2008).

The activities of American research universities were based on the following principles:

- meritocracy. It means management of persons with unique abilities and virtues, high intellectual abilities and qualifications, which meets the requirements of the scientific and technological revolution (Marutian, 2005, p. 335);
- organized scepticism. It deals with a willingness to take into account the most radical ideas, preferring the truth to the statement and inquisitive study - to the fact;
- creation of new knowledge; adherence to the principle that discoveries should be available to everyone, that those who make discoveries should not receive from this profit;
- system of expert assessment of the quality of the proposed research that needs funding;
- academic freedom and free research (Cole, 2016).

The mission of educational research universities 'involves a combination of three components of its activities: academic, scientific and social: the university must teach students, conduct research, serve society' (Sbruieva, 2010).

The development of medical education is due to the production of new knowledge and clinical approaches resulting from research. On the other hand, new research is driven by human

diseases and medical problems, while the level of education and medical care is increasing through the involvement of students and trainees in the invention. The source of rapid discoveries and continuous improvement of medical education, which has led to significant medical progress, is the positive synergistic relationship between the main missions (Kerschner et al., 2018, p. 985) implemented by research universities.

The Ukrainian scientific and pedagogical discourse forms the idea of a research university as a higher education establishment 'with a high level of research activity, which has sufficient technological, resource base and intellectual potential for basic and applied research' (Sbruieva, 2021, p. 57).

Many of them have venture funds that complement external research funding with internal grants with the far-reaching goal of supporting promising young researchers (Sbruieva, 2010).

Necessary structural units within the medical colleges at U.S. universities are research centres and institutes. They were actively created at the beginning of the 21st century. According to W. Mallon and S. Bunton, research centres and institutes are organizational units with many goals, forms, sizes and characteristics (Mallon, Bunton, 2005, p. 1010).

Researchers distinguish two types of the following structural units:

- *the first type*, which accounts for about 85–90% of centres and institutions, is too simple. These structures play a limited but essential role in biomedical research enterprises. They must work with departments and other centres to achieve goals and missions successfully. They cannot independently control the teaching staff or have significant resources;
- *the second type*, 10–15% of the total, can be independent and play an essential role in the organization and management of the medical college and University. Such research centres and institutes are authoritative centres within the University, can influence scientists, report directly to the president of the University, have a large number. Directors of this type of centre can turn to important decision-makers who oversee financial matters and research policies (Mallon, Bunton, 2005, p. 1010).

W. Mellon and S. Bunton also note that these research centres and institutes make a vital contribution to the research mission of Universities. As researchers increasingly work to advance science and improve human health, medical colleges and Universities need to support the work of such units (Mallon, Bunton, 2005, p. 1010).

Moreover, W. Mellon adds that medical colleges differ in four aspects regarding the management of financial needs of research centres and institutes:

- *funding time.* The 'first dollar' is the initial funding, the allocation of small financial resources for a quick start to implementing innovative scientific ideas. The 'last dollar' is the search for external funding by research centres before the medical college considers financial investment;
- *funding request process.* It deals with the successive steps by which the academic staff submits an application for funds for the implementation of a project to the administration of the medical college;
- *decision-making structure.* It is related to official agreements, where funds are distributed not only between research centres and institutes but also other structural units;
- *funding culture.* It concerns common assumptions, professional values, and implicit rules related to organizational behaviour (Mallon, 2006).

We need to mention that a medical college is a kind of a business centre, as it aims to produce new knowledge and human resources for the health care industry. Therefore, the successful and productive activity of a modern medical college, which by its nature is innovative, largely depends on well-organized management. Governance, in turn, depends on economic, political, social factors and trends both in a given country and in the world.

O. Marmaza points out that 'innovation management arose based on achievements of various sciences (management, economics, psychology, pedagogy, sociology), which formed theories and accumulated positive experience of creative activity, scientific and technological progress, methods

of improvement, activities. It is designed to ensure the implementation of strategic goals of the organization through innovation processes' (Marmaza, 2014, p. 311).

Innovation management belongs to the innovations of scientific and technological progress (Romanovskyi, 2010, p. 18). It deals with implementing management methods and techniques to create the most favourable conditions for the development of practical innovations. In addition, innovation management allows the educational establishment to adequately respond to external or internal challenges and attract employees at every level who are creatively involved in the development, creation of a new educational product and study the demand of the target audience (Andolfi, 2016, p. 65-67).

According to O. Romanovskyi, innovation management in education is a system of strategic management of innovation processes to study the main directions of educational, scientific, technical and industrial activities and justify a set of measures to implement innovation strategy. The tasks of innovation management include:

- development of plans and programs of innovation activity in the field of education;
- development and implementation of a unified innovation policy in the field of education;
- training of scientific and pedagogical specialists and providing all areas of educational activity;
- providing educational activity with the necessary resources (material, labour, financial, information);
- planning and selection of the best projects of educational innovations and control over its development;
- creation of particular groups of management and control over innovation activity in the field of education at all its stages (Romanovskyi, 2010, p.17).

According to the tasks, the main functions of innovation management are analytical and forecasting, planning, organization, control, regulation (Marmaza, 2014, p. 311).

The result of innovation management can be considered the expansion of innovation opportunities and strengthening the competitiveness of higher education. Such Universities, medical colleges attract creative personalities; they positively perceive creative ideas, accumulate innovation potential and develop innovation culture; support the image of organizations that constantly implement innovations, form the spirit of innovation activity (Marmaza, 2014, p. 315).

At the present stage of social development, no medical college can be developed without innovation management. Therefore, an important task is to monitor global educational and scientific innovations, society challenges, and cooperation with staff ready to innovate.

Another critical question for innovation scientific development is marketing. It is valuable for service or product providers in creating, communicating, and responding to the target market's challenges. Modern marketers start with customers, not products or services. They are more interested in building sustainable relationships than ensuring a single transaction. Their goal is to create a high level of customer satisfaction to return to the same supplier. Marketers have used many traditional methods, including marketing research, product or service design, distribution, pricing, advertising, promotional sales, and sales management. There is a need to add to these methods new ones related to innovative technologies and concepts to attract customers through messages and suggestions (Purcarea, 2019, p. 93-94). We believe that these principles and methods are also applied in the market of educational services, where, in our case, the suppliers are medical colleges.

Note that innovation is vital to ensure a modern, flexible education system that can stimulate innovation activity in the economy and society (OECD, 2016, p. 116).

The authors of the collective monograph 'Marketing Policy of Higher Education Establishments' believe that 'trends of globalization, intellectualization and informatization in the educational services market make adjustments to educational entities' behaviour, which raises the problem of theoretical understanding different levels. The development of competition in the provision of educational services actualizes the study of the processes of adaptation of higher education institutions to more stringent economic conditions, as well as issues of improving its

competitiveness and quality of educational services as demand and viability' (Savytska et al., 2018, p. 6).

Medical Colleges and Universities have turned to market, hoping that by selling their services, student visits will increase. Moreover, fierce competition Universities encourages specific marketing strategies (Rudd, Mills, 2008, p. 43).

The Scrip website (https://thescript.zocdoc.com/) lists the main points to keep in mind when planning successful marketing strategies:

- marketing is not advertising, although advertising can play a significant role in a particular marketing strategy;
- marketing is an ongoing process. The strategy needs to be adapted to changes in the industry and the challenges of society;
- marketing is an investment. Not only should one plan to spend time and money on a particular marketing strategy, but one should also monitor the results to determine the return on investment and ensure a successful outcome;
- marketing is the relationship between a service provider or product and customers;
- marketing will be futile if one does not maintain the requirements (*12 Best Marketing*…, n.d.).

It is worth noting that these features of planning marketing strategies are practical not only for medical services or goods but also for medical education.

V. Purcarea emphasizes that the consumer usually receives certain information about the product through commercials in the media. However, important information still comes from recommendations or independent peer reviews (Purcarea, 2019, p. 94). For example, a potential student watches advertising videos on television, the Internet, social networks, but takes into account the feedback of graduates of the future place of medical education, especially if they are relatives and acquaintances, and appeals to the official rating of the educational establishments, specific expert assessments.

Analyzing marketing strategies, we state that the following are successful for medical colleges:

- creation and maintenance of an informative official website;
- creating and maintaining blogs;
- creation of the official page of a medical school in social networks, popular among potential students;
- involvement of mass media for comprehensive coverage of activities;
- electronic distribution of relevant information;
- creating an online profile on different platforms;
- use feedback from graduates of different years (*12 Best Marketing*…, n.d.).

In our research, it is also essential to turn to the model of the 'triple helix' of innovations, which deals with the relationship between university, industry and government, proposed by American scientist H. Etzkowitz and his colleague L. Leydesdorff from the University of Amsterdam, which focused on the networking of communications and expectations that changed the institutional arrangements between universities, industry and government (Etzkowitz, Leydesdorff, 2000) and applied this model to the study of knowledge-based economies (Cai, Etzkowitz, 2020).

H. Etzkowitz, analyzing the epistolary legacy by K. Compton, president of the Massachusetts Institute of Technology (1930–1948), found a positive interaction between the university, industry, and government to solve problems in the declining region. As a result, the 'triple helix' of innovations was created based on the observation, analysis and designation of specific innovation achievements (successful practices of regional innovations until the 1990s), in which economic growth was increasingly based on science and technology (Cai, Etzkowitz, 2020). The validity of this model was proven during the observation of the joint development of Stanford University and Silicon Valley (Zhou, Etzkowitz, 2021).

Thus, H. Etzkowitz and L. Leydesdorff note that, historically, the national organization of the innovation system has become necessary in determining competition. However, the reorganization of industrial sectors and nation states is due to new technologies (biotechnology, ICT, etc.). Further transformations can be analyzed from (neo)evolutionary mechanisms. University research will gradually occur in the 'laboratory' of such science-intensive network transitions (Etzkowitz, Leydesdorff, 2000).

According to researchers, in a knowledge-based society, the boundaries between public and private sectors, science and technology, universities and industry should gradually disappear, resulting in a system of interaction with planes of intersection, i.e. each industry, retaining its primary role and identity, can play the role of another in certain situations. So, the university plays an industry's role, supporting the creation of startups in incubation and acceleration projects (Leydesdorff, Etzkowitz, 1996).

This model implies that the university has the same status as the other two agents, i.e., an equal innovation participant. The 'triple helix' model of innovations identified three types: statist, laissez-faire, and balanced (Etzkowitz, Leydesdorff, 2000) – see table 1.1.

Table 1

Types of the models of the 'triple helix' of innovations

Type of the model of the 'triple helix' of innovations	Features	Stage in the U.S. history
Statist	The government controls the university and industry (even when university and industry representatives are part of the government); it plays a leading role in project development and providing resources for new initiatives	World War II
Laissez-faire	The university, industry and government are separate and independent of each other. Each participant in the relationship interacts with the other to a lesser extent through firm boundaries	The first postwar years
Balanced	It results from a dialectic between the laissez-faire model and practical needs. It creates an infrastructure of knowledge with interrelated institutional areas, each of which plays the role of the other and interacts with hybrid organizations that arise at the intersection	'Cold War'. The end of the 20th century – the beginning of the 21st century

Systematized by the authors based on (Etzkowitz, Leydesdorff, 2000; Cai, Etzkowitz, 2020)

Currently, the balanced type of the 'triple helix' of innovations applies to regional economic growth and entrepreneurship by understanding the interaction dynamics between university, industry, and government (Cai, Etzkowitz, 2020).

However, Y. Cai and H. Etzkowitz note that a pure model with a balanced interaction between the three spirals is unlikely to exist. At the same time, a muscular imbalance between spirals can deplete even the most successful innovation system (Cai, Etzkowitz, 2020).

As for Silicon Valley, J. Pique, J. Berbegal-Mirabent, and H. Etzkowitz argue that its' innovation ecosystem, as well as the role of the agents of the Triple helix, has changed over the last decade (from 2008 to 2018. – A. K. and M. B.)' (Pique et al., 2018).

The researchers have concluded that such changes are related to:

- launching acceleration programs as new participants in the ecosystem;
- cooperation of corporations with startups at an early stage;
- geographical expansion of Silicon Valley, which includes San Francisco;
- strengthening the interaction of universities with investment funds;
- growth of microcorporations due to lack of staff and fierce competition in the region (Pique et al., 2018).

Thus, the innovation scientific activity of medical colleges at U.S. Universities is satisfying but at the same time complex because it deals with strict government regulatory mechanisms, the peculiarities of funding and the specifics of innovations.

Engineering and design as types of innovation scientific activity of medical colleges at U. S. Universities

Considering engineering and design as types of innovation activity of medical colleges at U. S. Universities, we note that in this context, we will talk primarily about biomedical engineering that deals with applying engineering principles and design concepts in the medical or biological field in the health care system for diagnostic, therapeutic, rehabilitation, and other purposes.

It is indisputable that in the current conditions in the U.S. health care system and, consequently, medical education, the research area of innovations is actively developing. Because biomedical engineering involves the application of concepts, knowledge, and scientific approaches from a wide range of engineering disciplines to address specific health issues, the possibilities for collaboration between engineers and physicians are vast and diverse.

Before proceeding directly to consider biomedical engineering as a type of innovation activity of medical colleges at U. S. Universities, we consider clarifying the essence of this phenomenon. While A. Pacela defines bioengineering as a broad general term for the field as a whole (Pacela, 1990), most researchers believe that bioengineering is an activity related to biotechnology and genetic engineering, that is, the modification of animal or plant cells or parts of cells to improve plants or animals, or the development of new microorganisms for beneficial purposes (Bronzino, 2005; Enderle, Bronzino, 2012).

J. Enderle and J. Bronzino define the typical tasks of biomedical engineering:

- development of improved plant and animal species for food production;
- invention of new medical diagnostic tests for different diseases;
- production of synthetic vaccines from clone cells;
- bioecological engineering to protect people, animals, and plants from toxic substances and pollutants;
- study of protein-surface interaction;
- modelling the growth kinetics of yeast cells and hybridomas;
- research of the technology of immobilised enzymes;
- development of therapeutic proteins and monoclonal antibodies (Enderle, Bronzino, 2012).

Thus, the term 'biomedical engineering' is general. Biomedical engineers in their work apply the principles of electrical, chemical, optical, mechanical, and other types of engineering to understand, modify or control biological systems (humans and animals).

The field of biomedical engineering in modern conditions covers such areas as biomechanics; prosthetic devices and artificial organs; medical imaging; biomaterials; biotechnology; fabric engineering; neural engineering; biomedical instrumentation; bionanotechnology; physiological modelling; rehabilitation engineering; clinical engineering; biosensors; medical and bioinformatics; medical and biological analysis.

The main types of innovation activity of biomedical engineers include:

- research of new materials for implanted artificial organs;
- development of new diagnostic tools for blood analysis;
- creation of software for analysis of medical research data;
- analysis of the danger and effectiveness of medical devices;
- creation of new diagnostic imaging systems;
- design of telemetry systems for patient monitoring;
- design of biomedical sensors;
- creation of expert systems for diagnosis and treatment of diseases;
- design of closed control systems for drug administration;
- design of devices for sports medicine;
- development of new dental materials;
- development of means of communication for disabled people;
- study of the dynamics of pulmonary fluid;
- study of the biomechanics of the human body;
- creation of material for human skin replacement, etc. (Enderle, Bronzino, 2012).

This list is not exhaustive and depends primarily on the clinical/research environment in which the innovation activity occurs. At the same time, we will dwell on certain types of biomedical engineering in more detail.

One of the oldest innovations in biomedical engineering is prosthetics. It began to flourish after World War II when an unprecedented number of veterans returned home alive but disabled.

Prosthetics refers to any internal or external device that replaces lost parts or functions of the nervous system and can be orthopaedic or external controlled. Externally controlled devices can be powered from the body via myoelectricity or a separate power supply. The most innovative today is neural prosthetics.

Neural devices can be powered from the human body by electrical signals with the help of electrodes from an external source to peripheral muscle neurons and an external power source. Neural prostheses use functional electrical stimulation to restore sensory or motor functions. These prostheses can help people with the spinal cord or cervical injuries restore muscle and lower extremity function. Electrode stimulation should reach a threshold frequency to achieve tetany or smooth movement of muscle contraction. Stimulation below this frequency results in isolated twitching and muscle fatigue.

Note that neural prosthetics is a relatively common area of innovation in medical colleges at American Universities. In this context, the scientific article-review of neural prosthetic strategies, used in these establishments, was published by G. Loeb, Professor of Biomedical Engineering at the University of Southern California (Loeb, 2018).

The scientist considers a wide range of innovations in the field of neural prosthetics, namely:

- devices to control pain (transcutaneous electrical nerve stimulators, spinal cord stimulators, and other devices);
- Deep Brain Stimulation devices;
- cochlear implants;
- artificial eyes;
- devices that perform neuromuscular stimulation;
- devices that improve the function of the urinary system;
- devices that improve the function of the gastrointestinal tract;
- electrical drugs for autonomous modulation;
- devices to control epileptic strokes;
- devices that connect the brain to the computer;
- devices aimed at improving mental state (Loeb, 2018).

The next innovation of medical colleges at U.S. Universities is tissue engineering. It is a relatively new branch of biomedical engineering that produces biological tissue ex vivo or in vitro

or introduces new advances to restore and grow existing tissues in vivo. In the case of ex vivo, bio-artificial tissues (consisting of both synthetic and natural materials) are used as an alternative to organ transplantation or are designed to study tissue behaviour in vitro. Some crucial issues in this area include cell isolation, cell organisation and function control, scaling up to full-fledged bio-artificial tissues, and biomaterial production.

Although the most well-known advances in tissue engineering have been made in epithelial tissues, researchers from medical colleges at U.S. Universities are currently conducting clinical trials to reconstruct cartilage, bone, nerve, and liver tissue. Transplants are used to treat all types of skin damage, including burns, bedsores, and diabetic ulcers. In addition, polymer tubes are implanted to promote nerve regeneration due to damage or disruption of the central and peripheral nervous system (Enderle, Bronzino, 2012).

Tissue engineering also involves the replacement of joints, including connective tissue repair and bone grafts. A bioreactor model is used within pancreatic and liver tissue. Bioreactors consist of many cells that receive reagents at the inlet and release a set of products at the outlet. Bioreactors are also used to produce blood cells from hematopoietic tissue. There are two types of bioreactor systems – hollow fibres and microcarrier-based systems.

An illustrative example of innovations in the field of tissue engineering is the activity of the Medical College of Wisconsin, which has many laboratories of tissue engineering, including:

- *Cardiovascular Regenerative Engineering Laboratory.* It develops substitutes for living tissues using regenerative engineering and biomedical nanotechnology approaches. The laboratory specialises in the development of living blood vessels, heart valves, vascular and cardiac patches, which can reconstruct, self-repair, and grow;
- *Computational Systems Biology Laboratory* uses an integrated experimental, computational approach to modelling to identify kinetic and molecular mechanisms and related biochemical drivers that regulate the functions of mitochondria, cells, and healthy tissues/organs, as well as to find out how failures in mitochondrial and cellular mechanisms leading to tissue/organ dysfunction and pathogenesis of various diseases;
- *OREC's Biomaterials & Histology Laboratory* assesses bone fillers and bone transplant substitutes, mechanisms and clinical applications of osteoinductive materials, and assesses materials for orthopaedic and vertebral devices;
- *Tissue Regenerative Engineering Laboratory* develops biofunctional tissues, providing advanced therapeutic opportunities for patients suffering from diseases such as the cleft palate and vascular disease (Medical College of Wisconsin. *Molecular & Cellular. Tissue Engineering Laboratories,* n.d.).

The following topical area of innovations in medical colleges at U.S. Universities is the study of stem cells. It has a powerful potential for radical changes in understanding and treating human diseases. For example, activating stem cells for tissue repair or direct isolation and transplantation is the basis of regenerative medicine.

Researchers use two different types of stem cells in their experimental work – embryonic and induced pluripotent ones. Embryonic stem cells come from embryos, mainly delivered by in vitro fertilisation clinics four to five days after fertilisation. At this point, the stem cells are either self-healing or fixed and differentiated. Self-healing or regeneration means that the stem cell will proliferate without commitment to development. In essence, the stem cell remains the stem cell. Differentiation is the expression of tissue or cell-specific genes. For most tissues of the human body, cells will be differentiated. However, in some cases, dynamic surgery is required, and, thus, the adult stem cell population is maintained for regeneration (Enderle, Bronzino, 2012).

In this context, the interdisciplinary doctoral program in Stem Cell Biology and Regenerative Medicine, launched by Stanford University School of Medicine and the world's first PhD program, deserves attention. It offers specialised training at the intersection of basic and clinical sciences, emphasising stem cell biology and regenerative medicine.

Within this program, third-level higher education students, under the guidance of experienced scientists, carry out a wide range of research to identify mechanisms that allow cells to transmit

signals to each other (e.g., the relationship between stem cells and their niches). The identity of different cell types is established during development, from stem cells or by induced cell reprogramming, and how animals-model age. Educators also develop effective therapeutically relevant genome editing strategies, develop next-generation stem cell therapies, and direct stem cell differentiation into in vitro stem cell therapies. Educators use innovative technologies, including genome editing, single-cell transcription, chromatin analysis, microscopy, and advanced stem cell culture systems (Stanford Medicine. *About the Stanford Interdisciplinary PhD Program in Stem Cell and Regenerative Medicine,* n.d.).

In this aspect of innovations, Stanford University School of Medicine researches in the following main areas:

- *study of mature stem cells of tissues or organs.* Scientists expand their understanding of known stem cells that continue to function throughout life, so-called 'adult' stem cells, mature tissues or cells of organs that include hematopoietic, nervous, skin, and skeletal muscle stem cells. Research in this area also aims to understand the clinical application of these stem cells in areas such as regeneration of diseased or damaged organs and tissues;
- *studies of human embryonic and induced pluripotent stem cells.* Scientists study how embryonic cells are formed and how they differentiate to become different tissues in the body. Researchers have also been able to produce embryonic cells from mature cells;
- *research on new stem cell lines.* Scientists are studying how to create stem cells from specialised cells grown from the stem cell stage. This study includes the use of nuclear transfer technology and induced pluripotent stem cell technology to create new stem cell lines that serve as models for the study and treatment of diseases such as cancer, diabetes, cardiovascular disease, autoimmune diseases, and neurodegenerative disorders such as Alzheimer's, Parkinson's and Lou Gehrig's disease;
- *cancer stem cell research.* The scientists of this medical school have played a vital role in detecting and studying cancer stem cells, which are believed to underlie the destructive potential of cancer. Stanford University School of Medicine continues to be the global epicentre of cancer stem cell research. Scientists aim to conduct preclinical research to develop new therapeutic approaches to the destruction of cancer stem cells by transferring these results into clinical trials (Stanford Medicine. *Research*, n.d.).

Experienced and young scientists from the Keck Medical School of the University of Southern California are not left out of the study of stem cells. According to the website (https://keck.usc.edu/research/about-keck-school-of-medicine-research/), their findings represent fundamentally new knowledge in stem cell research and have led to crucial technological innovations. According to the journal Science, they entered the top 10 leading world achievements in 2010. In addition, two projects at the Keck Medical School of the University of Southern California – the California Project to Cure Blindness and Stem Cell Therapy for AIDS - received two prestigious awards from the Keck School of California's Institute of Regenerative Medicine (USC. *About Our Research,* n.d.).Genetic engineering is a powerful area of innovations for medical colleges at U.S. Universities. Along with the term 'genetic engineering' to denote the phenomenon of direct manipulation of body genes, scientists use the terms recombinant DNA, genetic modification/manipulation (G.M.), and more. Unlike traditional breeding, an indirect method of genetic manipulation, genetic engineering uses modern tools.

In particular, a team of scientists from the University of Illinois at the University of Chicago (Sh. Gao, J. Dai, D. Rehman) has developed software that allows researchers to more effectively identify gene regulators. The system uses a machine-learning algorithm to predict which transcription factors are likely to be active in individual cells.

Transcription factors refer to proteins that bind to DNA and control which genes are 'turned on' or 'turned off' inside a cell. These proteins are essential to biomedical researchers because understanding and manipulating these signals in the cell can effectively discover new treatments for many diseases. However, hundreds of transcription factors within human cells make it difficult to find the most active ones in different cell types that could be used as drug targets.

According to J. Rehman, a Professor of Medicine at the University Of Illinois School Of Medicine in Chicago, one of the problems in this area is that the same genes can be ‘turned on’ in one group of cells but ‘turned off’ in another group of cells within single organ. Understanding the activity of transcription factors in individual cells would allow researchers to study activity profiles in all major cell types of major organs, such as the heart, brain, or lungs (loc. cit. Carey, 2021).

Scientists have built the Bayesian inference transcription factor activity model based on the fundamental biological principle that differences in single-cell DNA sequencing profiles reflect the underlying states of transcription factor activity. This model has been tested in lung, heart, and brain tissue cells (Gao, Dai, Rehman, 2021).

According to Sh. Gao and others, the proposed approach identifies not only significant actions of transcription factors but also provides valuable information on critical mechanisms for regulating transcription factors. Furthermore, by providing such data for each transcription factor in a cell, the model can give researchers a good idea of which ones to look for when studying new drug targets to work on this cell type (Gao, Dai, Rehman, 2021).

Note that among the current areas of bioengineering research for employees and students of the University of Illinois at Chicago, a special place is occupied by scientific research on COVID-19.

Under the guidance of Associate Professor Zh. Peng, students T. Leong and Ch. Voletti created ‘coarse-grained’ models of two essential types of proteins: thorn proteins, which characterise the appearance of SARS-CoV-2 virus, and ACE2 receptor proteins in human cells, which allow attachment of coronavirus spikes. The proposed models provide a simplified idea of how molecules behave and interact and will be helpful to researchers in studying the complex processes that occur in the body when the coronavirus enters cells.

The researchers note that the developed models have helped confirm the scientific community’s belief that the binding of thorn protein to the ACE2 receptor plays a critical role when the virus first enters human cells. The researchers added that they also have found that thorn protein is flexible and able to bend in a way that optimises its chances of breaking the ACE2 receptor (University of Illinois Chicago. *Bioengineers design coronavirus model*, n.d.).

To experiment, the researchers used molecular dynamics software called NAMD and VMD to simulate the physical motions of atoms and molecules that simulate both the ACE2 receptor, and the SARS-CoV-2 virus based on actual data to illustrate the process of endocytosis by which substances, such as a virus, get inside the cells.

Ch. Peng said it was difficult to simulate the process because it involved millions of atoms. However, the team solved the problem using the Theta supercomputer at the Argonne National Laboratory.

Although work on models of proteins, viruses, and cell membranes is still ongoing, the intermediate results of the study determine which part of the spike protein and which part of the ACE2 receptor bind to each other. Detection of these parts can help scientists develop antiviral drugs that would prevent the penetration of this thorn into human cells (University of Illinois Chicago. *Bioengineers design coronavirus model*, n.d.).

An important area of biomedical engineering in medical colleges at U.S. Universities is medical imaging. Medical imaging refers to methods and procedures to obtain reproductions of human body parts in the treatment and diagnostic process.

According to experts from the National Electrical Manufacturers Association, medical imaging has changed health care science. Innovation activities in medical imaging have led to faster and more accurate images, the procedures for which have become less invasive. If previously imaging was considered a tool for diagnosing diseases, it is also used to treat, control, and predict diseases in modern conditions. As a result, the use of medical imaging has become a necessity for almost all primary medical conditions and diseases. In addition, it is one of the standards of new medical care for diseases such as cancer, cardiovascular, trauma, neurological conditions, and more.

The concept of ‘medical imaging’ covers a wide range of methods of radiological imaging, such as radiography; photofluoroscopy; magnetic resonance imaging; ultrasound; endoscopy;

elastography; tactile image; thermography; functional imaging technologies for medical photography and nuclear medicine, such as positron emission tomography (PET). In addition, medical imaging is magnetoencephalography (MEG), electrocardiography (ECG), and electroencephalography (EEG) (*Medical Imaging*, n.d.).

Medical imaging also includes measurement and recording techniques that do not create 'images' but produce data often expressed in graphs or maps. These include electroencephalography (EEG), magnetoencephalography (MEG) and electrocardiography (ECG).

In current conditions, such methods of medical imaging are actively used as:

- *projection radiographs* – to detect bone fractures, pathological changes in the lungs and the diagnosis of certain types of colon cancer;
- *fluoroscopy* – to obtain real-time images of various internal parts and structures of the human body;
- *MRI* – to create two-dimensional images of the body and brain;
- *scintigraphy* – to capture two-dimensional images from the radiation released by the introduced radioisotopes, to identify areas of biological activity that may be associated with the disease;
- *positron emission tomography (PET)* – for the diagnosis or treatment of various pathologies using specific properties of isotopes and energy particles emitted from radioactive materials;
- *ultrasound* – to obtain images of the fetus, abdominal organs, heart, chest, muscles, tendons, arteries and veins for diagnostic purposes;
- *elastography* – to reflect the elastic properties of soft tissues in the body;
- *tactile imaging* – to create images of the prostate, chest, vagina, pelvic floor support structures and myofascial trigger points in the muscles by converting the sense of touch into digital images;
- *photoacoustic imaging* – to monitor tumour angiogenesis in vivo, blood oxygenation maps, functional brain imaging and skin melanoma detection;
- thermography methods – to detect breast tumours using programs such as telethermography, contact thermography and dynamic angiothermography;
- *tomography methods* – to obtain images of structures of thin areas of the body (CT, PET scan);
- *echocardiography* – to see the detailed structure of the heart, including chamber size, heart function, heart valves and pericardium (*Medical Imaging*, n.d.).

Note that such institutions carry out the innovative activities and training of specialists in medical imaging as J. Roy College and Lucille A. Carver University of Iowa, Medical College of the University of Arkansas, San Diego School of Medicine, and others.

In particular, Eric A. Hoffman, Professor of Radiology, Medicine and Biomedical Engineering at J. Roy College of Medicine and Lucille A. Carver of the University of Iowa created and headed the Advanced Laboratory of Pulmonary Physiological Imaging and the Iowa Comprehensive Center for Lung Imaging at Iowa University (University of Iowa Health Care. *Eric Hoffman, PhD*, n.d.).

Together with a group of researchers, he developed a dynamic spatial reconstructor. This one-of-a-kind C.T. scanner could collect up to 240 contiguous C.T. areas of the body every 1/60 second. He used advanced imaging techniques to study the basic physiology of respiration, focusing primarily on ventilation mechanisms, perfusion heterogeneity, and regional lung mechanics.

More recently, besides continuing basic physiological studies of the lungs, he created a combination of single- and multispectral multidetector line spiral C.T. imaging to objectively track human lung pathology and pathophysiology, focusing on inflammatory lung disease. The central element of APPIL is the Siemens SOMATOM Force computer scanner.

In 2018, Professor Hoffman received the Honored Researcher of the Academy of Radiology and Biomedical Imaging. He also received the 2013 John West Award for Outstanding Contribution to Functional Pulmonary Imaging from the International Seminar on Pulmonary Functional Imaging, the Joseph R. Rodarte Award for Scientific Achievement from the 2018 Alumni

Respiratory Structure and Functions Assembly of the American Thoracic Society and the Thoracic Society. The innovation activity of Professor E.A. Hoffman's Laboratory at the University of Iowa Medical College uses advanced imaging techniques to study normal and pathological lung physiology with specific areas of interest in inflammatory lung diseases, including asthma and environmental pathologies. In addition, APPIL serves as a radiological centre for numerous large-scale studies that use imaging to determine lung phenotype as part of research (University of Iowa Health Care. *Eric Hoffman, PhD*, n.d.).

Most of the innovative products in biomedical instrument engineering were created during the last 15-20 years. The introduction of biomedical devices revolutionised medicine and greatly facilitated the treatment of patients. The main principle of operation of biomedical devices is the conversion of signals found inside the body into electrical ones.

In current conditions, the main areas of research in the field of biomedical instrument engineering in medical colleges at U.S. Universities are:

- miniaturisation of traditional biomedical devices for the examination of individual cells or microscale tissues;
- adaptation of traditional biomedical devices for distribution and deployment outside the traditional care environment, such as at home and in resource-poor conditions (Berkeley Bioengineering. *Research. Bioinstrumentation*, n.d.).

Note that one of the leaders in biomedical engineering and design among medical colleges at U.S. Universities, which presents almost all of the areas outlined in this section, is Johns Hopkins University School of Medicine.

Next, we characterise the main areas of innovation activity of Johns Hopkins University School of Medicine, which serve as an illustrative example of a holistic system of innovation of research Universities in the field of bioengineering and design.

Biomedical Data Science includes the analysis of biomedical data arrays to identify features of the functioning of living systems. Academic and research programs in this area are focused on developing new data analysis technologies to clarify disease peculiarities and provide improved health care at a lower cost. For example, Johns Hopkins University School of Medicine students work with faculty to develop new cloud technologies and data analysis techniques to improve disease diagnosis and treatment. Moreover, students and teachers are developing innovative methods for analysing arrays of biomedical data that provide new knowledge about the functioning of living systems.

There are the following main areas of research:

- *computer science* (establishing interaction between computer science, mathematics, and biomedical engineering to improve computer technology to address a wide range of issues of personalised medicine);
- *machine learning and data science* (creation of high-performance software for extracting symbolic and ontological information from data sets using machine learning);
- *biomedical data* (integration of biomedical data with high-performance computing tools to analyse several terabytes of data used in modern tools of machine learning and artificial intelligence);
- *science as a service* (search for scientific solutions integrated into the software, development of new cloud technologies for the exchange of data sets and tools);
- *biomedical clouds* (creating essential resources to improve the quality of care) (Johns Hopkins School of Medicine. *Biomedical Data Science*, n.d.).

Computational medicine aims to improve healthcare by developing digital models of diseases, of the disease, personalisation of these models using patient data, and their use to improve the diagnosis and treatment of the disease. Specialists use these patient models to identify new risk biomarkers, predict disease progression, develop optimal treatments, and identify new drug targets. Students of the Medical School under study are developing new solutions in personalised medicine, building computational models in molecular biology, physiology, and anatomy of human health and

diseases. Students and faculty are also innovators in developing and applying patient-specific quantitative models used in the clinic to understand, diagnose, and treat disease.

The main areas of research:

- *computational molecular medicine* means studying molecular networks, possible and impossible concentrations of biomolecules and their changes over time to make more informed clinical decisions;
- *computational physiological medicine* implies the development of disease models that combine information at different levels of biological organisation – from molecules and cells to tissues and organ systems – and the application of these models for patient care;
- *computational anatomical medicine* denotes the application of mathematical theory to model anatomical structures and their changes in health and disease, for example, identifying differences in brain shape and connections during neuropsychiatric diseases and neurodevelopmental disorders or classification of changes in heart shape and movement, characterising heart disease;
- *computational health* is the integration of biomedical signal processing, computational modelling, machine learning, and medical informatics to develop new approaches in personalised medicine using electronic medical records, physiological time series data, and genomics (Johns Hopkins School of Medicine. *Computational Medicine,* n.d.).

Genomics and systems biology focuses on making connections between information in the genome and the epigenome with the functions of biological systems, from cells to tissues and organs. At Johns Hopkins University School of Medicine, students and staff develop new computational and experimental methods for systematic genome analysis, building models with time and time scales, and using synthetic biology to develop new biomedical systems for human health. Students and teachers are also introducing new technologies to understand how interactions between molecules, cells, tissues, and organs support health and provoke disease.

The main areas of research in the field of genomics and systems biology include:

- *genome collection* develops new methods of assembling genomes that can reproduce genomes of any size using the latest sequencing technologies;
- *RNA transcriptomics and sequencing* means the development of computational methods for converting data into accurate indicators of gene activity and comparing gene expression in different conditions;
- *personal genomics and data modeling* indicates the development of new methods of large-scale integrated analysis of genomic, epigenomic, and transcriptomic data better to predict the impact of genetic variants on human health;
- *genomic and epigenomic engineering* means the use of new tools to edit the genome and epigenome and identify the links between the environment and genetics for the prevention and treatment of disease;
- *nanopore sequence* deals with the development of new technologies for determining the sequence and epigenetic modifications of individual DNA molecules for personalised medicine;
- *cell fate engineering* controls cell fate transitions by studying how genomes provide spatio-temporal control of gene expression;
- *synthetic biology* is the development, manufacture, and integration of new biological components, from individual genes to whole chromosomes and genomes (Johns Hopkins School of Medicine. *Genomics & Systems Biology,* n.d.).

Imaging & Medical Devices measure spatial and temporal distributions and signals at various scales (from molecules and cells to organs and entire populations). Combining mathematics, physics, and biological systems with the development of new devices and computational algorithms, the medical school academic and research programs focus on new technologies and intensive data analysis, including imaging technologies: optical, X-ray, CT, MRI, ultrasound, and molecular imaging; image analysis – image registration and reconstruction; gaining knowledge from image data; new medical devices – a wide range of diagnostic and therapeutic devices, due to

clinical needs. The educational program covers mathematical foundations, physics of imaging technologies, design and development of devices based on clinical needs, and computational methods of image processing and analysis. In addition to knowledge of natural clinical systems and data, students study data analysis, modelling, and computer simulation techniques. Classroom experience classroom, research laboratory, and clinical settings connect education with practical, real-life cases.

Students and academic staff are introducing new imaging technologies to improve disease diagnosis and management of clinical procedures, researching the following main areas:

- *advanced biophotonics* means the use of innovative optical imaging technologies, including fluorescence and tomography microscopy and endoscopy, for early detection of the disease;
- *image analysis and registration* denote the use of mathematical models for strain alignment of multimodal images and information analysis to understand responses to the disease and treatment of Alzheimer's disease and other neurological disorders;
- *imaging algorithms* use high-precision physical models, reliable statistical methods, and machine learning to develop imaging algorithms, computational imaging and advanced image reconstruction and apply them during MRI, CT, and nuclear imaging;
- *new imaging systems* mean the development of new imaging technologies for optical endoscopy, molecular imaging, ultrasound, C.T., and MRI;
- *imaging-driven interventions* create new platforms and methods for image processing, such as cone-beam C.T., image recording, navigation, and robotics to use visualisation in high-precision interventions (Johns Hopkins School of Medicine. *Imaging & Medical Devices*, n.d.).

Immunoengineering uses the forces of the immune system to treat diseases such as cancer and promotes tissue regeneration and healing. The educational program involves the study of the studied phenomenon at the molecular, cellular, and systemic levels. Particular emphasis is placed on innovative materials and methods to engage the immune system to fight disease and promote tissue repair and healing. Students develop new biomaterials, vaccines, therapeutics, and systems to understand the function of immune cells and control their behaviour.

Students and academic staff research many areas, namely:

- *biomimetic materials* deal with the control of signals that regulate the reactions of immune cells on a macro-and nanoscale through biomimicry and improved design of materials;
- *regenerative immunology and ageing* means the creation of innovative platforms that modulate the innate and adaptive immune response to promote tissue regeneration and wound healing; study of the effects of ageing on the immune system and its functions in recovery and disease;
- *immuno-oncology* introduces innovative platforms that modulate immune responses to increase the effectiveness of vaccines, improve the delivery of drugs, and increase the effectiveness of cancer treatment;
- *Host Defense* denotes the development of new material and cellular therapy to correct the wrong immune response in case of autoimmune attacks and disorders or for augmentation – in case of liberation from foreign invaders;
- *system immunology and computational immunology* is the study of ways in which immune cells communicate with each other and tissues to perform their functions; creation of system models of cell and tissue functions to be used in experimental and translational studies; and the use of bioinformatics to improve the discovery of neoantigens;
- *molecular engineering* is the processing of natural proteins and creation of entirely new proteins as tools for understanding and manipulating the immune response; search for biotechnology to control the functions of immune cells (Johns Hopkins School of Medicine. *Immunoengineering*, n.d.).

Neuroengineering includes basic, experimental, computational, theoretical, and quantitative research to understand and strengthen the brain functions in health and disease on several spatio-temporal scales. The educational program aims to teach students to develop and apply new

technologies to understand and treat neurological disorders. Students create tools to identify, control, improve, or block neural networks in specific spatial and temporal domains.

In addition to the academic component, students together with teachers introduce new technologies to modulate the functions of the nervous system to improve screening, diagnosis, prognosis, rehabilitation, and recovery and conduct research in the following main areas:

- *NeuroExperiments* mean development and use of experimental methods for measuring and manipulating the cognitive functions of the brain, including new methods in the system of neuroscience and brain mapping;
- *NeuroTech* is the development and implementation of tools for detection and control of the human brain and behaviour (neuromorphic engineering, intelligent agents, prosthetic devices, and robots);
- *NeuroData* imply the creation of intensive scientific opportunities for the brain, integrating neuroinformatics, computational neuroscience, and machine learning systems for analysis and modelling of neuroscience data sets of any size;
- *NeuroDiscovery* means discovering the basic principles of neural and connective coding, studying the internal coordinate system of the brain, and trying to decipher the unsurpassed ability of the brain to understand complex phenomena;
- *NeuroHealth* deals with improving, restoring, and increasing normal and impaired nerve function, focusing on diagnosing, diagnosing, and treating nervous system disorders (Johns Hopkins School of Medicine. *Neuroengineering*, n.d.).

Translational Cell & Tissue Engineering denotes the development and translation of innovation technologies to enhance or restore molecular, cellular, and tissue functions. According to the website of the educational establishment (https://www.bme.jhu.edu/research/research-areas/translational-cell-and-tissue-engineering/), Johns Hopkins University School of Medicine is a leader in translational cell and tissue engineering, which combines discovery, innovations, and translation through basic scientific, technical and clinical research. As a part of the educational program in translational cell and tissue engineering, students develop new techniques and biomaterials to guide cell behaviour and repair damaged tissues and organs.

The main areas of research in this area include:

- *molecular and cellular biotechnology* deals with the invention of new biological technologies to create new cellular microenvironments, targeted drug delivery platforms, and cell engineering both ex vivo and in vivo;
- *training materials* control signals that regulate cellular responses at the macro and nanoscale using high-performance platforms for synthesis and screening, tools for three-dimensional printing and design of functional materials;
- *cell therapy* means cell reprogramming as a living therapy for targeted treatment of diseases;
- *bioproduction* creates opportunities for the transmission of biological and cellular technologies for the new world bioeconomy;
- *computational regenerative engineering* denotes elucidation of the dynamic behaviour of cells integrated at different length scales, from molecules to tissues (Johns Hopkins School of Medicine. *Translational Cell & Tissue Engineering,* n.d.).

Thus, we can state that engineering and design are significant for the innovation scientific activity of medical colleges at U.S. Universities. According to the analysis of scientific references and websites of numerous medical colleges at U.S. Universities, as a rule, establishments focus on several areas of bioengineering due to the availability of appropriate logistical, laboratory, and clinical facilities. However, some establishments, such as Johns Hopkins University School of Medicine, are developing a wide range of areas in biomedical engineering. An essential feature of the innovation activity of the studied medical colleges is the combination of academic and research components in educational programs of all three levels (bachelor's, master's, and doctoral). These components provide simultaneous acquaintance with innovation achievements in biomedical engineering at medical colleges under the guidance of experienced academic staff.

Transfer of products of innovation scientific activity of medical colleges at U.S. Universities

The transfer of innovation products is carried out within the framework of implementing the provisions of the Bayh-Dole Act (1980) and its amendments adopted over the next forty years. According to the Report of General Accounting Office (*General Accounting Office*…, 1998), the first higher education establishments to form specialised units authorised to report and license inventions under the Bayh-Dole Act. At the end of the 20th century, the top ten research Universities in the United States had technology licensing offices or technology transfer offices.

As noted in the Report, the study identified the state of implementation of the Bayh-Dole Act among the U.S. research Universities, which included medical colleges, and found out the following four types of departments responsible for the transfer of innovation products:

- *centralised licensing office.* All activities are concentrated in one centralised unit. An example of such a unit is the Massachusetts Institute of Technology's licensing office, which coordinates innovations throughout the establishment, including the innovation developments of the Lincoln Laboratory, the Whitehead Biomedical Research Institute, and others;
- *decentralised licensing office.* Reporting and licensing activities are carried out by separate departments in different schools, departments, and other structural units of the University. For example, Johns Hopkins University has three licensing offices: one is for the School of Medicine, one is for the Applied Physics Laboratory, and another is for the rest of the University;
- *foundation.* An independent foundation conducts licensing activities established explicitly by the University for this purpose. The University may also have an office responsible for processing reports on implementing the Bayh-Dole Act. This scenario is most common among public Universities. An example of such an independent foundation is the Wisconsin Alumni Research Foundation;
- *contractor organisation.* Some universities enter into partial or complete licensing agreements. One of the largest contractors is the Research Corporation Technologies, Tucson, Arizona. However, this licensing management is gradually losing its popularity. In particular, many Michigan Universities with medical colleges initially used RCT services but later established centralised offices (*General Accounting Office*…, 1998).

In the context of technology transfer offices, there is a study by D. Weckowska on approaches to the commercialisation of products of innovation, namely: transaction-focused commercialisation practice and relations-focused commercialisation practice. According to the researcher, the proposed approaches to the commercialisation of innovation products are associated with different 'competence regimes', i.e. differences in understanding of a competent action and different 'worldviews', particularly, views on the innovation process (Weckowska, 2015).

The relations-focused approach to commercialisation practice focuses on building relationships between research, business, and University Technology Transfer Office managers. At the heart of this practice, there is the belief that a competent pursuit of commercialisation involves building and managing complex relationships between stakeholders in all commercialisation activities. Through relationships with researchers, technology transfer offices are aware of current research that can lead to commercial results. Potential licensees and investors are approached at an early stage. It is the opportunity to work with researchers on new technologies that stand out in marketing rather than the technology itself. Relationships with researchers and potential licensees become sources of information for technology transfer offices when deciding on a patent. For example, the information gathered in the process of interacting with potential licensees is used to manage patent claims in terms of what is the real value of what people want (Callon, 1998, p. 19), and, accordingly, the subjects involved in these processes shape the nature of the product and its value. Licenses or documents certifying intellectual property rights are seen as potential 'hooks for joint research', i.e. this is a starting point for complex long-term relationships between researchers and commercial organisations to create new knowledge jointly. The protection of intellectual

property, the assessment of the invention's commercial potential, and the identification of licensees occur almost simultaneously. According to D. Weckowska, the relations-focused commercialisation practice is supported by implicit assumptions that the innovation process is an interactive one, that scientific discoveries must meet the needs and capabilities of the industry, and that bilateral communication between University and industry and the collaboration of market experts and research and development are crucial (Weckowska, 2015). The same assumptions underlie the interactive or 'coherent' innovation model described by R. Rothwell (Rothwell, 1994).

The transaction-focused approach to commercialisation is characterised by interpreting research results as marketable products and focuses on implementing such intellectual property transactions as sales and licensing. This approach is concentrated on the belief that a competent study of commercialisation entails commodifying scientific knowledge and the successful sale and licensing of intellectual property. According to D. Weckowska, managers of technology transfer offices who follow this practice emphasise the importance of skills to sell the idea to the outside world. As soon as a researcher discloses research results that can be commercialised, the technology transfer office 'produces' it, securing intellectual property rights. The product (e.g. patented technology) is then sold to potential licensees and investors. Commercial organisations are perceived as 'buyers' and are not approached until the product is considered 'ready', as it is believed that the technology transfer office must fully understand the economics of the new product and its scalability to be able to give potential licensees complete picture so that they have fewer questions and fewer reasons to say no. Licensing or resale of innovation products is considered an end in itself. This approach is linear because specific measures for commercialisation (patenting, marketing, negotiations, concluding agreements) are performed consistently. This position is characteristic of an early innovation model or scientific impetus by B. Godin (Godin, 2006). Thus, the transaction-focused approach to commercialisation is based on a linear understanding of the innovation process.

The researcher emphasises that the transaction-focused commercialisation practice is limited, so managers of technology transfer offices who use this approach should know this fact and invest in developing different ways to identify opportunities for commercialisation, intellectual property management and cooperation with commercial organisations and researchers (Weckowska, 2015).

Thus, we can state that the approach to commercialising innovation products, focused on relationships, is more effective. After all, technology transfer offices manage the use of university research results for for-profit and public benefit, providing support in patenting, licensing, and other aspects of innovation commercialisation.

In order to reflect the activity features of these structural units, we consider it appropriate to refer to the experience of organising technology transfer in some establishments of higher medical education. Therefore, both decentralised technology transfer offices regulate this process, not in the whole University, but directly in the medical colleges at U.S. Universities, and centralised ones were selected for the case analysis.

An example of a decentralised office is the Office of Technological Development of the Medical College of Wisconsin. Its mission is to support and train medical college faculty, doctoral students, interns, students and staff. Moreover, the Office of Technology Development focuses on the transfer of technology from research and clinical practice to commercial products that benefit the Medical College of Wisconsin, the local community and the general public. The Office of Technological Development is a division of the Office of Research and reports to the Deputy Dean for Research at the Medical College of Wisconsin. In addition, the Office of Technology Development engages inventors and internal and external stakeholders to 'bring patents to patients' (*Medical College of Wisconsin. Office of Technology Development,* n.d.).

The Office of Technological Development is responsible for managing and commercialising inventions, newly developed software, and other intellectual property assets of the Medical College of Wisconsin and promoting these assets from patents to patients. Employees of the specified structural unit identify, assess and protect intellectual property and then license it to well-known

companies or startups, which then develop these new technologies into commercial products (*Medical College of Wisconsin. Office of Technology Development*, n.d.).

The Medical College of Wisconsin is a corporation that specialises in patient care, education, research, and community engagement, and where new knowledge is constantly generated, developed, or otherwise put into practice, the institution maintains best research practices, encouraging the expression of knowledge in the form of patented inventions, new research tools, copyrighted documents, books and software, as well as other work related to educational activities. Besides, the Medical College of Wisconsin seeks to translate and transfer this knowledge in forms that may be useful to the public (*Medical College of Wisconsin. Office of Technology Development*, n.d.).

Technology development and commercialisation priorities correspond to the mission of the researched establishment of higher medical education, support entrepreneurship, and promote research cooperation with other academic establishments and industries. The description of the corporate establishment policy, in the section 'Patent and Copyright', contains instructions on the process of technology transfer and related rights and responsibilities.

Note that the process of bringing technologies to market is often repetitive, but for many health technologies that need significant investment and regulatory approval, the timing is usually generalised.

Starting with the invention submitted to the Office of Technological Development by the inventors, the unit assesses the market potential of products and services using its internal experience and seeking confidential feedback from external experts with experience in intellectual property law, business and product development in the field of medical technology. The staff of the Technology Development Office then submits the results of the technical analysis together with their decision to preserve intellectual property rights and invest resources in protection and licensing, return rights to inventors or report that the discovered technology does not provide enough data to assess market prospects adequately.

Considering the activities of the Office of Technology Transfer and Intellectual Property Development of Tulane University, we note that this structural unit is an example of a centralised office that transfers products of innovation not only to the Medical School, which is part of it but also the School of Science and Technology, the School of Public Health and Tropical Medicine and the School of Law.

According to Tulane University Office of Technology Transfer and Intellectual Property, its main functions include:

- promoting cutting-edge research to the broader community;
- informing external users about the development and implications of research;
- tracking how the Tulane University innovation products are used for the most significant public benefit.

Unlike other higher education research institutions, where technology transfer is seen simply as a potential source of income, Tulane University considers the transfer to be a means of achieving significant challenges in education, research and services *(Office of Technology Transfer and Intellectual Property Development. Technology Transfer at Tulane University: History and Mission*, n.d.).

The office website (https://ott.tulane.edu/home/about-us/) contains information on the crucial achievements in transferring innovation products at Tulane University.

Peptide chemistry. Research in peptide chemistry has proven its effectiveness: three pharmaceutical peptides discovered by researchers have been approved by regulatory authorities and are used to treat patients for various indications.

Triptorelin is used to treat hormone-responsive cancers, such as prostate or breast cancer, and assisted reproduction. As of 2007, triptorelin was registered in more than 60 countries, including 25 in Europe. Triptorelin was first developed in the laboratory of Dr A. Shelley of Tulane University School of Medicine. Dr A. Shelley currently works at the University of Miami (Florida) and the South Florida Foundation for Research and Education.

Lanreotide is a drug used to treat acromegaly and symptoms caused by neuroendocrine tumours, especially carcinoid syndrome. It is a long-acting analogue of somatostatin. It was developed by Dr D. Coy, a researcher at Tulane University School of Medicine.

Cetrorelix acetate is a synthetic decapeptide used to treat hormone-sensitive prostate and breast cancer in pre-/perimenopausal women and treat some benign gynaecological diseases. Cetrorelix is also used in ancillary reproduction. Cetrorelix was launched in Europe in 1999, in the United States in 2001 and in Japan in 2006 and approved in more than 90 countries. The drug was developed in the laboratory of Dr A. Shelley.

Tulane University School of Medicine researchers found that many peptides are currently undergoing clinical trials. The first, for the treatment of ovarian and endometrial cancer, was developed by Dr A. Shelley. The second, for pain control, was developed by Dr J. Zadina. The third peptide is clinically tested as an anti-influenza drug. This compound and many other promising related peptides were developed by Dr R. Harry (*Office of Technology Transfer and Intellectual Property Development. Technology Transfer at Tulane University: History and Mission*, n.d.).

Diagnosis of infectious diseases. Tulane University has made significant progress in diagnosis by developing a high-precision test for Lyme disease. The veterinary version of this diagnostic technology is included in one of the most widely used animal tests in the United States.

Vaccines against infectious diseases. The International Non-Profit Organization PATH continues to study a vaccine adjuvant developed in the laboratory of Dr J. Clements of Tulane University School of Medicine for use in children health in developing countries (*PATH. Development and Relief Services*, n.d.). If successful, this vaccine will play an essential role in reducing diarrheal diseases caused by enterotoxigenic Escherichia coli, a major cause of disease and death in developing countries. Another charity organisation assesses the use of this adjuvant in the polio vaccine and for use in children in developing countries.

Medical products. Essential innovation products at Tulane University in this area are a catheter to improve the placement of ventricular pacemakers, invented by Dr J. Pigott from the School of Medicine, and an obstetric device that clamps and cuts the umbilical cord in a motion. The device was developed to improve health in developing countries, where traditional childbirth procedures often involve unsanitary conditions that lead to frequent illness and death among infants and mothers. Undergraduate students developed the obstetric device under W. Ketman in cooperation with Dr D. Rice (*Office of Technology Transfer and Intellectual Property Development. Technology Transfer at Tulane University: History and Mission*, n.d.).

Columbia Transfer Ventures (CTV) is a higher education division that supports many initiatives in technology development, entrepreneurship, external collaboration, and commercially-oriented multidisciplinary technology innovations. CTV primary mission is to facilitate the transfer of inventions from academic research laboratories to the market for the benefit of society at the local, national and global levels. According to the Columbia Technology Ventures website (https://techventures.columbia.edu/about-ctv/technology-transfer-columbia), it manages more than 400 disclosures, 100 licensing agreements and 20-30 new startups each year with support for innovation products, attracting more than 750 inventors on the campuses of Columbia University. CTV currently has more than 1,500 patented assets available for licensing in research areas such as biotechnology, IT, devices, big data, nanotechnology etc. (*Columbia Technology Ventures. Technology Transfer at Columbia*, n.d.).

Columbia University Technology Transfer Office has extensive experience creating and supporting technology initiatives that enable promising technologies to quickly overcome the 'valley of death' and enter the market as quickly and successfully as possible. Many of these initiatives are multi-institutional and require broad collaboration with partner universities and their technology transfer offices. Several CTV organisations have played essential roles in building partnerships, including the PowerBridgeNY clean energy proof-of-concept centre, the NYC Media Lab, and Columbia Biomedical Technology Accelerator. In addition, the Resource Translational Therapeutics (TRx) was established in 2016 in collaboration with the Irving Institute for Clinical and Translational Research and the Clinical Trials Office to promote new medicines from the

laboratory through commercialisation to clinical implementation (*Columbia Technology Ventures. Technology Transfer at Columbia*, n.d.).

Columbia University Technology Transfer Office is supported by 45 full-time staff and more than 30 CTV fellows, providing broad support to the Columbia community and other stakeholders in marketing, law (patents, contracts, etc.), business, and administration. The CTV Executive-in-Residence program also attracts experienced industry leaders, serial producers, and investors to the Columbia University campus to support academic staff and students *(Columbia Technology Ventures. Technology Transfer at Columbia*, n.d.).

CTV offers a range of services to faculty, students and staff at Columbia University:

- filing a patent application and managing innovation products;
- marketing of innovation technologies;
- concluding license agreements on innovation technologies;
- concluding agreements on the transfer of materials and data;
- concluding confidentiality agreements;
- express licensing' of software;
- inter-institutional cooperation;
- opportunity to participate in the Columbia Women Inventor Network (Columbia WIN), etc.

Columbia University Technology Transfer Office attracts industry and investors to:

- concluding license agreements;
- concluding sponsored research agreements;
- concluding agreements on the transfer of materials and data;
- concluding confidentiality agreements;
- meetings with scientists on campus;
- expanding investment opportunities;
- empowerment of mentoring;
- presentation of innovation products to potential investors (pitch events);
- publishing newsletters on available innovative technologies, etc. *(Columbia Technology Ventures. Technology Transfer at Columbia*, n.d.).

The Nova Southeastern University Technology Transfer Office reports to the Office of Research and Technology Transfer, which reports to the Department of Translational Research and Economic Development, which supports the research infrastructure of the South-Eastern University of Nova. In addition to the Technology Transfer Office, the Office of Research and Technology Transfer oversees the Office of Sponsored Programs, Clinical Research, and the Grant Writing Laboratory.

The purpose of the technology transfer office is to transfer research from academic laboratories to society. The above-mentioned structural subdivision of the Nova Southeastern University seeks to commercialise the University innovations for the outside world to maximise the positive social impact and strengthen the economy. Among many existing commercialisation options, the technology transfer office helps choose the one that will help achieve the best results that benefit the inventor, investor and university (*NSU Florida. Office of technology transfer. About us*, n.d.).

The scope of the technology transfer office includes the protection and management of intellectual property, compliance with federal regulations, assistance in filling out application forms and contracts, assessment and marketing of inventions, commercialisation of innovations and management of revenues from this commercialisation activity. Moreover, this office also promotes the formation of subsidiary enterprises of the University, promotes cooperation with strategic corporate partners, increases the efficiency of innovative educational activities and creates economic value for the benefit of society (*NSU Florida. Office of technology transfer. About us*, n.d.).

The Technology Transfer Office of the Nova Southeastern University (https://www.nova.edu/ott/researchers-inventors/process.html) in the section 'Technology Transfer

Process' provides a detailed description of it, covering many stages, to be completed, which takes several years.

1. *Research and invention.* The first step in commercialising any University invention is research and discoveries made by the inventor (inventors). This crucial initial step is carried out by teachers, staff and students in research laboratories in a wide range of disciplines.

2. *Disclosure of inventions.* Suppose faculty, staff, or students believe that their research has led to an invention and potential commercial value. In that case, they must complete the invention and disclosure form at the Technology Transfer Office. This form is a confidential internal document for declaring an invention, which allows the Technology Transfer Office to initiate the appropriate process. The Technology Transfer Office cannot initiate an assessment of any invention and take the next necessary steps related to the technology transfer process until the inventors have received a standard form of invention and disclosure. However, the technology transfer office managers warn the inventors that the proposed form is only an internal document and does not offer legal protection for intellectual property (*NSU Florida. Office of technology transfer. Process of Technology Transfer*, n.d.).

3. *Assessment of the product of innovation activity by the Technology Transfer Office.* Office staff assess the invention using the information provided by the inventors through the invention and disclosure. Moreover, such criteria as novelty, patentability, and competitive advantage over similar existing technologies, future commercial value and various other factors based on which office managers decide whether the invention of the Nova Southeastern University is suitable for the protection of intellectual property and future development is considered.

4. *Protection of intellectual property rights.* After the invention is initially assessed and a decision is made to invest the resources of the Nova Southeastern University to protect its intellectual property, the staff of the technology transfer office begins to work with an external patent attorney to submit the relevant documents. The first step is to file a preliminary application with the U.S. Patent and Trademark Office. The next step is to apply for a Patent Cooperation Treaty application within 12 months of the previous application. Finally, the Technology Transfer Office staff advises and informs the inventors about all steps to protect intellectual property rights.

5. *Commercialisation.* After protecting intellectual property rights, the staff of the Technology Transfer Office develops a plan for marketing and the commercialisation of technology. The Technology Transfer Office is working with external corporate partners and inventors at Nova Southeastern University to determine the path of commercialisation that is ideal for each technology, as there are several ways to commercialise, and which path is most appropriate will depend on many factors, such as stage development of the invention, plans of the inventors and commercial demand for the technology. The final decision on commercialisation and identification of corporate co-authors can be made only after consultation with the inventors.

6. *Income management.* Once the external corporate partner starts making a profit by commercialising the technology acquired at Nova Southeastern University, a predetermined portion will be distributed to the designated higher education establishment. Unless all parties agree to another income distribution plan in the written agreement, the inventors and the University receive 50% of the 'net income'. In the Employee Policy Manual, one can find detailed information on income distribution in the Important Documents section of the above-mentioned Technology Transfer Office website (*NSU Florida. Office of technology transfer. Process of Technology Transfer*, n.d.).

According to the analysis of the Technology Transfer Office of Nova Southeastern University, cooperation with potential partners in the field of transfer of innovation products can be structured in different ways. Each invention/technology is unique; transfer agreements are developed on a case-by-case basis. The types of agreements used by the Technology Transfer Office of Nova Southeastern University are listed below.

License Agreement. It gives the company the right to commercialise intellectual property. In addition, the license agreement outlines revenue sharing plans, legal details, and product development deadlines.

Optional agreement. It allows the industry partner to assess the technology and its cost before finally licensing and paying the license fee. Its signing does not provide the right to commercialise the technology. Such an agreement provides only a limited time to develop innovation technology further and ultimately make a more informed decision to enter into a license agreement. After internal research and assessment, the company can use the option and sign a license agreement.

Sponsored research agreements. The industry can sponsor all or part of Nova Southeastern University research project relevant to their specific area of interest. So, the company can participate in the project early and prioritise licensing the inventions that may arise within this sponsored research project. The agreement sets out details such as intellectual property rights, the scope of work, the duration of the project and the amount of financial support from the company.

Alliance for Industrial and Academic Research. This agreement will be implemented if the researchers hired by the the company are interested in collaborating with one of the researchers from Nova Southeastern University. Before initiating such a joint research project between industry and University, it is necessary to agree on research cooperation, which will contain information on the legal conditions, each participant contribution, intellectual property rights and other relevant details. The most apparent difference between this type of agreement and the sponsored research agreement is the company significant intellectual and scientific contribution (*NSU Florida. Office of technology transfer. Types of Agreements*, n.d.).

Note that the Technology Transfer Office makes requirements not only for products of innovation activity that may be subject to commercialisation but also for partner organisations that must meet many criteria:

- the management team must have previous experience in the relevant field(s);
- before the conclusion of the agreement, the partner the organisation must submit a business plan that defines the development strategy of the invention;
- the partner organisation must provide some evidence of its ability to provide adequate financial support and employ the skilled labour needed to develop, manufacture and commercialise the technology;

The partner organisation must demonstrate its ability to achieve short-term and long-term development goals (*NSU Florida. Office of technology transfer. Criteria for Licensing NSU Technologies*, n.d.).

However, as mentioned above, only an invention that has proven its patentability will be commercialised: it must be new, unique and valuable. At the stage of disclosure of the invention, managers of the Technology Transfer Office pay attention to the following characteristics: the invention meets the need or solves an existing problem; the inventor has good scientific data or a the working prototype of the device, etc. (*NSU Florida. Office of technology transfer. For Researchers and Inventors*, n.d.).

In this context, we emphasise that deciding on the appropriateness of the transfer of an innovative product is a responsible step that requires employees of the Technology Transfer Office to have innovative methods of assessing the commercial success of the proposed products. Furthermore, it is undeniable that the use of effective mechanisms for assessing the products of innovation of University staff helps increase the rate of disclosure of inventions, reduce staff dissatisfaction and minimises time for discussions on the feasibility of selecting a product of innovation.

One such tool is the Invention Assessment Tool, which is used in business and can be adapted to the conditions of the educational establishment. Indicative in this context is the experience of the University of Kansas Medical Center Technology Transfer Office, whose staff began assessing various diagnostic tools in the fall of 2005 to improve licensing and commercialization procedures and speed up the verification process of inventions and discoveries that had commercial potential. This search resulted in the adaptation of the VentureQuest assessment tool uses a simple assessment scale that minimises ambiguous responses. Thus, the Innovation Assessment Tool, adapted by the University of Kansas Technology Transfer Office, provides objective, pragmatic feedback, identifying strengths and weaknesses of the proposed invention to reduce risk and achieve

tremendous success in commercialisation. The specified assessment tool contains 31 parameters by which the development is assessed, grouped into the following sections:

- *assessment of an inventor*. The researcher supports commercialisation; the researcher has previous patents/copyrights; the researcher has published numerous peer-reviewed articles; the researcher has experience working with commercial partners; the a researcher has experience in the field of technology transfer; the inventor has constant funding for research;
- *protection of intellectual property rights*. It includes a high probability of obtaining international intellectual property rights; the number of barriers to the development of the invention; 100 per cent ownership; absence of legal obstacles; limited existing intellectual property competition rights; probability of protection of intellectual property rights (patents); probability of protection of intellectual property rights (copyright);
- *characteristics of a product/service*. It includes invention implementation; strong technical differentiation; lack of apparent technical obsolescence; several separate products/services; lack of state regulation; lack of additional research and development;
- *market characteristics*. It deals with recognised, established market; active growth potential of the target market; lack of competition; offer high value for customers; stable competitive advantage;
- *commercialization strategy*. It includes many ways to commercialise; continuity of income flow; potential for high gross profit at a competitive price;
- importance for the University of Kansas Medical Center is high potential for research funding; high potential for licensing; it improves the image/impact of the University of Kansas Medical Center; well-known potential employees or license.

According to K. Price, R. Houston, and A. Meyers, this assessment methodology helped increase the efficiency and objectivity of the process of commercialising innovation products at the University of Kansas by assessing only those characteristics that are critical to the achievement of strategic goals and objectives; faster and earlier assessments of commercialisation, which document the reasons that hinder the advancement of technology; reduction of the assessment time of each technology to 80%; conducting interactive discussions with business-oriented researchers; focusing on communities/differences in ratings with an emphasis on strengths, weaknesses and potential aspects of technology; reduction of subjectivity in assessment; allocating resources to support the most promising technologies (Price et al., 2008).

So, we can state that the technology transfer offices of U.S. Universities, including medical colleges, license, patent, and commercialise the results of innovation scientific activity of medical colleges based on modern innovative methods of selecting patentable innovative products and careful selection of partner organisations for promotion.

Conclusions

So, the research highlights the areas of innovation scientific activity of medical colleges at U.S. Universities, particularly engineering and design, technology transfer.

Medical or biomedical engineering, which involves the application of medical and biological engineering principles and concepts in the health care system for diagnostic, therapeutic, rehabilitation and other purposes, is considered in the context of the characterization of innovation in medical colleges.

There are the following products of innovation scientific activity: biomechanics; prosthetic devices and artificial organs; medical imaging; biomaterials; biotechnology; fabric engineering; neural engineering; biomedical instrumentation; bionanotechnology; physiological modelling; rehabilitation engineering; clinical engineering; biosensors; medical and bioinformatics; medical and biological analysis.

The paper presents an example of innovation activity in tissue engineering of the Medical College of Wisconsin, which has many tissue engineering laboratories, including Cardiovascular Regenerative Engineering Laboratory, Computational Systems Biology Laboratory, OREC's

Biomaterials & Histology Laboratory, and Tissue Regenerative Engineering Laboratory. The products of such innovation activity have become substitutes for living tissues (blood vessels, heart valves, vascular and cardiac patches that can reconstruct, self-healing and growth), bone fillers and bone graft substitutes, etc.

Moreover, there is the focus on the world first interdisciplinary doctoral program in stem cell biology and regenerative medicine, introduced by Stanford University School of Medicine. Under this program, third-level higher education students carry out a wide range of research under the guidance of experienced scientists: develop next-generation stem cell therapy, investigate the inherited basis of complex human diseases by introducing genetic variants into cultured stem cells, and direct differentiation valuable cell types.

The directions of stem cell research at Stanford University School of Medicine are covered: research of mature stem cells of tissues or organs; study of human embryonic and induced pluripotent stem cells; research of new stem cell lines; study of cancer stem cells, etc.

An important area of biomedical engineering in medical colleges at U.S. Universities is medical imaging, namely methods and procedures aimed at obtaining reproductions of parts of the human body in the treatment and diagnostic process.

An example of a holistic system of innovation scientific activity in the field of bioengineering and design is the activity of Johns Hopkins University School of Medicine, which includes components such as biomedical data (computational science, machine learning and data science, biomedical data, science as a service, biomedical clouds); computational medicine (computational molecular medicine, computational physiological medicine, computational anatomical medicine, computational health care); genomics and systems biology (genome collection, transcriptomics and RNA sequencing, personal genomics and data modeling, genomic and epigenomic engineering, nanopore sequence, cell fate engineering, synthetic biology); visualization and medical devices (advanced biophotonics, image analysis and registration, imaging algorithms, new imaging systems, imaging-controlled interventions); immune engineering (biomimetic materials, regenerative immunology and aging, immuno-oncology, host protection, system immunology and computational immunology, molecular engineering); neuroengineering (neuroexperiments, neurodata, neurodiscovery, neurohealth); translational cell and tissue engineering (molecular and cellular biotechnology, cell therapy, bioproduction, computational regenerative engineering).

The transfer of innovation products of medical colleges at U.S. Universities is carried out within the implementation of the Bayh-Dole Act (1980) and amendments to it, adopted in the late 20^{th} – early 21^{st} centuries. The main types of structural units responsible for the transfer of innovation products are centralized office (responsible for technology transfer throughout the University, e.g. Massachusetts Institute of Technology Technology Licensing Office); decentralized office (responsible for technology transfer within a separate structural unit, e.g. Johns Hopkins University has three technology transfer offices: for School of Medicine, applied physics laboratory and the rest of the University); foundation (an independent agency created explicitly by the University to conduct licensing activities, e.g. Wisconsin Alumni Research Foundation); contractor organization (provides for the conclusion of agreements on partial or complete licensing activities, e.g. one of the largest contractors is the Technology Research Corporation, Tucson, Arizona). At the present stage of the development of innovation activity of medical colleges at U.S. Universities, the most common are the first two types – centralized and decentralized offices.

It is determined that in current conditions, the issue of increasing the efficiency of transfer of products of innovation activity by developing innovative methods of assessing the commercial success of the proposed products has become relevant. Examples of implementation of these techniques are analyzed, the most illustrative of which is the tool for assessing inventions 'VentureQuest', adapted by the Technology Transfer Office of Kansas University Medical Center to the needs of the relevant medical college, which provides objective, pragmatic feedback, identifying strengths and weaknesses to reduce risk and achieve tremendous success in commercialization.

The study does not cover all aspects of the outlined problem. As for further research, there will be a comparison of the innovation scientific activity of medical colleges at U.S. Universities and medical education establishments of the European Union.

References

Мармаза, О. І. (2014). Інноваційний менеджмент в освіті: сутність, функції, засоби. *Педагогіка формування творчої особистості у вищій і загальноосвітній школах, 36,* 309-316 (Marmaza, O. I. (2014). Innovative management in education: essence, functions, means. *Pedagogy of formation of creative personality in higher and secondary schools, 36,* 309-316).

Марутян, Р. (2005). Меритократія. У М. Ф. Головатий, О. В. Антонюк. *Політологічний словник* (с. 467). Київ: МАУП (Marutian, R. (2005). Meritocracy. In M. F. Golovatyi, O.V.Antoniuk. *Political Science Dictionary* (p. 467). Kyiv: IAPM.).

Романовський, О. О. (2010). *Шляхи впровадження інновацій, підприємництва та підприємницької освіти в системі національної освіти України*: монографія. Вінниця: Нова книга (Romanovskyi, O.O. (2010). *Ways of introduction of innovations, entrepreneurship and entrepreneurial education in the system of national education of Ukraine*: monograph. Vinnytsia: Nova Kniga).

Савицька, Н. Л., Ушакова, Н. Г., Помінова, І. І. (2018). Освітня послуга та освітній продукт: взаємозв'язок категорій. У Н. Л. Савицька, *Маркетингова політика закладу вищої освіти:* колективна монографія (сс. 6-14). Х.: ХДУХТ (Savytska, N.L., Ushakova, N.H., Pominova, I. I. (2018). Educational service and educational product: the relationship of categories. In N.L. Savytska, *Marketing policy of higher education:* a collective monograph (pp. 6-14). Kh.: KhSUFTT).

Сбруєва, А. А. (2010). Управління науковою роботою в державних університетах США: структурно-функціональні аспекти. *Порівняльно-педагогічні студії, 1-2*, 68-76 (Sbruieva, A. A. (2010). Management of research at U.S. public universities: structural and functional aspects. *Comparative and Pedagogical Studies, 1-2*, 68-76).

Сбруєва, А. А. (2021). *Порівняльна педагогіка вищої школи: національний, європейський та глобальний контексти.* Суми: СумДПУ імені А. С. Макаренка (Sbruieva, A. A. (2021). *Comparative higher education pedagogy: National, European and global contexts.* Sumy: Sumy State Pedagogical University named after A.S. Makarenko).

Сбруєв, М. Г. (2012а). Управління науковою роботою в університетах США: характеристика стану розроблення проблеми. *Педагогічні науки: теорія, історія, інноваційні технології, 8 (26), 121-131* (Sbruiev, M. G. (2012a). Scientific research management in the U.S. universities: overview of the studied and developed issues. *Pedagogical sciences: theory, history, innovative technologies, 8 (26),* 121-131).

Сбруєв, М. Г. (2012б). Теоретичні засади управління науковою роботою в державних університетах США. *Теоретичні питання культури, освіти та виховання, (46),* 135-140 (Sbruiev, M. G. (2012b). Theoretical principles of research management in U.S. public universities. *Theoretical issues of culture, education and upbringing, (46),* 135-140).

Сбруєв, М. Г. (2015). Технології грантового супроводу науково-дослідних проектів в університетах США. *Педагогічні науки: теорія, історія, інноваційні технології, 3* (47), 139-153 (Sbruiev, M. G. (2015). Grant support technologies for research projects at US universities. *Pedagogical sciences: theory, history, innovative technologies, 3 (47),* 139-153).

Федулова, Л. (2016). Інноваційна екосистема університету. *Вісник Київського національного торговельно-економічного університету, 4*, 162-177 (Fedulova, L. (2016). Innovative ecosystem of the university. *Bulletin of the Kyiv National University of Trade and Economics, 4,* 162-177).

Anand, A. (2014). Need for innovation in medical institutions. *Annals of neurosciences, 21*(1), 1-2. https://doi.org/10.5214/ans.0972.7531.210101

Andolfi, G. (2016). Development and innovation management on higher education institutions. *European Journal of Social Sciences Studies, 1 (1),* 65-70.

Atkinson, R. C., Blanpied, W. A. (2008). Research Universities: Core of the US science and technology system. *Technology in Society, 30*, 30-48.

Berkeley Bioengineering. *Research. Bioinstrumentation*. Retrieved from: https://bioeng.berkeley.edu/research/bioinstrumentation.

Bronzino, J. (2005). Biomedical Engineering: A Historical Perspective, In J. D. Enderle, S. M. Blanchard, J. D. Bronzino (Eds), *Biomedical Engineering, Introduction to Biomedical Engineering* (pp. 1-29). Academic Press. https://doi.org/10.1016/B978-0-12-238662-6.50003-3.

Callon, M. (1998). *The Laws of the Markets.* London: Blackwell Publishers.

Carey, J. (2021). Machine learning algorithm predicts how genes are regulated in individual cells. Retrieved from: https://bme.uic.edu/news-stories/machine-learning-algorithm-predicts-how-genes-are-regulated-in-individual-cells/.

Cai, Y., Etzkowitz, H. (2020). Theorizing the Triple Helix model: Past, present, and future. *Triple Helix, 7*(2-3), 189-226. doi: https://doi.org/10.1163/21971927-bja10003.

Cole, J. R. (2016, September 20). *The Triumph of America's Research University The Atlantic.* Retrieved from: https://www.theatlantic.com/education/archive/2016/09/the-triumph-of-americas-research-university/500798.

Columbia Technology Ventures. Technology Transfer at Columbia. Retrieved from: https://techventures.columbia.edu/about-ctv/technology-transfer-columbia.

Enderle, J., Bronzino, J. (Eds.) (2012). *Introduction to biomedical engineering*.

Etzkowitz, H., Leydesdorff, L. (2000). The Dynamics of Innovation: From National Systems and 'Mode 2' to a Triple Helix of University-Industry-Government Relations. *Research Policy, 29*(2), 109-123.

Executive office of the President national economic council office of science and technology policy. (2009). *A Strategy for American Innovation: Driving Towards Sustainable Growth And Quality Jobs.* Retrieved from: https://files.eric.ed.gov/fulltext/ED511653.pdf.

Fargen, K. M., Frei, D., Fiorella, D., McDougall, C. G., Myers, P. M., Hirsch, J. A., Mocco, J. (2013). The FDA approval process for medical devices: an inherently flawed system or a valuable pathway for innovation? *Journal of neurointerventional surgery, 5(4),* 269-275. Retrieved from: https://doi.org/10.1136/neurintsurg-2012-010400.

Gao, Sh., Dai, Y., Rehman, J. (2021). A Bayesian inference transcription factor activity model for the analysis of single-cell transcriptomes. *Genome Research.* Retrieved from: https://genome.cshlp.org/content/early/2021/06/23/gr.265595.120.full.pdf+html.

General Accounting Office, Washington, DC. Resources, Community, and Economic Development Div. (1998). *GAO/RCED-98-126 – Technology Transfer: Administration of the Bayh-Dole Act by Research Universities. Report to Congressional Committees*. Retrieved from: https://www.gao.gov/assets/rced-98-126.pdf

Godin, B. (2006). The linear model of Innovation the historical construction of an analytical framework. *Sci. Tech. Hum. Values, 31,* 639-667.

Innovation: an American Imperative. (June 23, 2015). Retrieved from: http://www.amacad.org/sites/default/files/academy/pdfs/InnovationAmericanImperativeCalltoAction.pdf

Johns Hopkins School of Medicine. *Biomedical Data Science*. Retrieved from: https://www.bme.jhu.edu/research/research-areas/biomedical-data-science/.

Johns Hopkins School of Medicine. *Computational Medicine*. Retrieved from: https://www.bme.jhu.edu/research/research-areas/computational-medicine//.

Johns Hopkins School of Medicine. *Genomics & Systems Biology*. Retrieved from: https://www.bme.jhu.edu/research/research-areas/genomics-and-systems-biology/.

Johns Hopkins School of Medicine. *Imaging & Medical Devices*. Retrieved from: https://www.bme.jhu.edu/research/research-areas/imaging-and-medical-devices/.

Johns Hopkins School of Medicine. *Immunoengineering.* Retrieved from: https://www.bme.jhu.edu/research/research-areas/immunoengineering/.

Johns Hopkins School of Medicine. *Neuroengineering*. Retrieved from: https://www.bme.jhu.edu/research/research-areas/neuroengineering/.

Johns Hopkins School of Medicine. *Translational Cell & Tissue Engineering*. Retrieved from: https://www.hopkinsmedicine.org/institute_basic_biomedical_sciences/our_work/biomedical_engineering/.

Keck School of Medicine of USC. *About Our Research*. Retrieved from: https://keck.usc.edu/research/about-keck-school-of-medicine-research/.

Kerschner, J. E., Hedges, J. R., Antman, K., Abraham, E., Colón Negrón, E., Jameson, J. L. (2018). Recommendations to Sustain the Academic Mission Ecosystem at U.S. Medical Schools. *Academic medicine : journal of the Association of American Medical Colleges*, *93*(7), 985-989. *https://doi.org/10.1097/ACM.0000000000002212.*

Leydesdorff, L., Etzkowitz, H. (1996). Emergence of a triple Helix of university – industry – government relations. *Sci Public Policy, 23*(5), 279-286.

Loeb, G. E. (2018). Neural Prosthetics: A Review of Empirical vs. Systems Engineering Strategies. *Applied Bionics and Biomechanics, 6,* 1-17.

Mallon, W. T., Bunton, S. A. (2005). Research centers and institutes in U.S. medical schools: a descriptive analysis. *Academic medicine: journal of the Association of American Medical Colleges*, *80*(11), 1005–1011. https://doi.org/10.1097/00001888-200511000-00007

Mallon, W. T. (2006). The Financial Management of Research Centers and Institutes at U.S. Medical Schools. *Analysis in Brief, 6* (3). Retrieved from: https://www.aamc.org/media/10031/download?attachment

Medical College of Wisconsin. *Office of Technology Development*. Retrieved from: https://www.mcw.edu/departments/technology-development/about-us.

Medical College of Wisconsin. *Molecular, Cellular & Tissue Engineering Laboratories*. Retrieved from: https://mcw.marquette.edu/biomedical-engineering/molecular-cellular-and-tissue-engineering.php.

Medical Imaging. Retrieved from: https://innovatemedtec.com/digital-health/medical-imaging.

National Economic Council and Office of Science and Technology Policy (2015). *A Strategy for American Innovation.* Retrieved from: https://obamawhitehouse.archives.gov/sites/default/files/strategy_for_american_innovation_october_2015.pdf.

Office of Technology Transfer and Intellectual Property Development. Technology Transfer at Tulane University: History and Mission. Retrieved from: https://ott.tulane.edu/home/about-us/.

NSU Florida. *Office of technology transfer. About us.* Retrieved from: https://www.nova.edu/ott/index.html.

NSU Florida. *Office of technology transfer. Criteria for Licensing NSU Technologies.* Retrieved from: https://www.nova.edu/ott/industry-partners/criteria.html.

NSU Florida. Office of technology transfer. For Researchers and Inventors. Retrieved from: https://www.nova.edu/ott/researchers-inventors/index.html.

NSU Florida. *Office of technology transfer. Process of Technology Transfer*. Retrieved from: https://www.nova.edu/ott/researchers-inventors/process.html.

NSU Florida. *Office of technology transfer. Types of Agreements.* Retrieved from: https://www.nova.edu/ott/industry-partners/agreements.html.

OECD. (2016). *Innovating Education and Educating for Innovation: The Power of Digital Technologies and Skills.* Paris: OECD Publishing. http://dx.doi.org/10.1787/9789264265097-en.

Pacela, A. (1990). *Bioengineering Education Directory*. Quest Publishing Co., Brea, CA.

PATH. Development and Relief Services. Retrieved from: https://www.charitynavigator.org/ein/911157127.

Pique, J. M., Berbegal-Mirabent, J., Etzkowitz, H. (2018). Triple Helix and the evolution of ecosystems of innovation: the case of Silicon Valley. *Triple Helix 5*, 11. https://doi.org/10.1186/s40604-018-0060-x

Price, C., Huston, R., Meyers, A. D. (2008). A new approach to improve technology commercialisation in university medical schools. *Journal of Commercial Biotechnology, 14 (2),* 96-102.

Purcarea, V. L. (2019). The Impact of Marketing Strategies in Healthcare Systems. *Journal of medicine and life, 12(2),* 93-96. https://doi.org/10.25122/jml-2019-1003.

Rothwell, R. (1994). Towards the fifth-generation innovation process. *Int. Market. Rev., 11,* 7-31.

Rudd, D., Mills, R. (2008). Expanding Marketing Principles for the Sale of Higher Education. *Contemporary Issues in Education Research, 1(3),* 41-52.

Stanford Medicine. *About the Stanford Interdisciplinary PhD Program in Stem Cell and Regenerative Medicine.* Retrieved from: https://med.stanford.edu/stemcell/phd/about.html.

Stanford Medicine. *Research*. Retrieved from: https://med.stanford.edu/stemcell/research.html.

University of Columbia. *Irving Institute for Clinical and Translational Research.* Retrieved from: https://www.irvinginstitute.columbia.edu/.

University of Illinois Chicago. *Bioengineers design coronavirus model*. Retrieved from: https://bme.uic.edu/news-stories/bioengineers-design-coronavirus-model/.

University of Iowa Health Care. *Eric Hoffman, PhD.* Retrieved from: https://medicine.uiowa.edu/radiology/profile/eric-hoffman.

Weckowska, D. M. (2015). Learning in university technology transfer offices: transactions-focused and relations-focused approaches to commercialization of academic research. *Technovation, Vol. 41-42*, 62-74.

Zhou, C., Etzkowitz, H. (2021). Triple Helix Twins: A Framework for Achieving Innovation and UN Sustainable Development Goals. *Sustainability, 13,* 6535. https://doi.org/10.3390/su13126535.

12 Best Marketing Strategies for Medical Practices. Retrieved from: https://thescript.zocdoc.com/best-marketing-strategies-for-medical-practices/.

NEW EUROPEAN RESEARCH AREA AND GLOBAL APPROACH TO R&I: ANALYSIS OF EU STRATEGIES AND RECOMMENDATIONS OF THE EUROPEAN UNIVERSITY ASSOCIATION

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Abstract. The study reveals the goals, factors, and organizational approaches to the renewal of the European Research Area (ERA) and development of global cooperation of the European Union in research and innovation (R&I), which became the basis for developing European Union strategies announced in 2020-2021 in the context of implementation of the Horizon Europe program. The current geopolitical, geoeconomic and geotechnological factors that influenced formation of the new European strategies in the field of R&I and international cooperation in this field are identified. The vision of the European University Association of the priorities for building a new ERA and participation of universities in further development of EU global cooperation in the field of R&I is highlighted.

Key words: European Research Area (ERA), Research and Innovation (R&I), European University Association (EUA), university, European Union, strategy.

Introduction

The beginning of the twenties of the 21st century became a period of unprecedented global challenges in the recent history of mankind, due to the devastating effects of climate change, the COVID-19 pandemic, energy, and financial and economic crisis, escalating political and military-political confrontations in different parts of the world.

Research and innovation (R&I), which have become one of the priority factors of economic growth, international cooperation, and global competition, play an important role in finding ways to solve these and many other vital problems of mankind. Individual countries and geopolitical regions develop and implement new strategies of R&D cooperation, R&D rivalry, R&D leadership, which often coexist in solving the most important problems and challenges of mankind. The subject of our consideration in this context were the EU strategies in the field of ERA renewal, development of global cooperation in the field of R&I, formulated in the EC Communication "A new ERA for Research and Innovation" (2020), "The Global Approach to Research and Innovation". Europe's strategy for international cooperation in a changing world" (EU, 2021), and the proposals of the European academic community on the implementation of EU policy initiatives in this area, are formulated in a number of documents of European professional organizations and networks. We believe that a clear understanding by the Ukrainian academic community of EU requirements for R&D partners will contribute to a better understanding of EU R&I priorities and values, better participation of Ukrainian educators and researchers in Horizon Europe and Erasmus+ projects for 2020-2027.

The source base of the study included EU policy documents in the research area and analytical documents, which analyze the EU strategy for updating the ERA and international cooperation in the field of R&I:

- policy documents of the European Union structures: communiqué (EC, 2012; EC, 2020a; EC, 2021); conclusions (*Council of the European Union*, 2013); reports (EC, 2016); decisions (EC, 2019)), etc.;
- analytical publications of EU experts on the development of R&I in the region, including the report "SRIP 2020" (EC, 2020e), ESPAS (ESPAS, 2019);
- analytical papers of international professional organizations (European University Association (EUA, 2021a; EUA, 2021b), European Innovation Council (EIC, 2021), European Institute of Innovation and Technology (EIT, 2021));
- Internet websites of European network structures for R&I support and dissemination of innovations (European Strategy Forum on Research Infrastructures (ESFRI, 2021), European Cluster Collaboration platform) (ECCP, 2021); Start-up Europe (*Start-up Europe*, 2021); EU Digital Innovation Hubs (EU, 2021);
- analytical documents of the European University Networks (Aurora Universities Network AUN, 2021).

The aim of the article is to clarify the current approaches to the renewal of the European Research Area (ERA) and development of EU international cooperation in R&I, used in the strategies ERA-2020 and R&I-2021, characterizing the role of universities in the processes under study.

In the context of the research goal, the following methods were used: genetic and causal analysis, which allowed to trace the origins of the analyzed Strategies and approaches used in them in connection with current changes in geopolitical, geoeconomic and geotechnological spheres; structural-logical analysis, which made it possible to determine the content of the EU's global cooperation in the field of R&I.

Research results

Strategic priorities for the renewal of the European Research Area and recommendations of the European academic community on the participation of universities in this process

Analysis of the R&I cooperation development in the EU shows that creation of the European Research Area (ERA) was launched in 2000 as part of the EU Lisbon Strategy. The text of the Strategy identified a number of tasks in the specified field which included: developing of the appropriate mechanisms for networking of the national and joint research programs on a voluntary basis around freely chosen objectives; identification of the best practices in research and development in all Member States to facilitate their dissemination; improvement of the environment for private investment in research, R&D partnerships and high-tech startups, using tax policy, venture capital and EIB support; encouraging of development of an open method of coordination for the comparative analysis of national research and development policy; taking measures to remove obstacles to the mobility of researchers in Europe and to attract and retain high-quality research talent in Europe (ER, 2000).

In general, the idea of creating the ERA was to build a common science and technology space, a single market for research and innovation, which will facilitate the free movement of researchers, scientific knowledge and innovation, and stimulate a more competitive European industry.

Implementation of this idea involved restructuring of the European research landscape in the direction of greater cross-border cooperation, increasing the competitiveness of the European science across the continent, increasing the critical mass of intellectual capital to ensure such competitiveness, improving national policies and research systems as well as development of joint R&I policy on a regional scale.

As early as 2007, the task of building the ERA was included in the text of the Treaty on the Functioning of the European Union (TFEU), which states in Article 179 that the Union aims to strengthen its scientific and technological base by creating the European Research Area, where

researchers, scientific knowledge and technology circulate freely. To this end, the Union encourages enterprises, including small and medium-sized research centers and universities, to engage in high-quality research and technological activities; the Union supports their efforts to cooperate with each other, in particular by allowing researchers to cooperate freely across borders and enabling enterprises to fully exploit the potential of the internal market, in particular by signing national government contracts, setting common standards and removing legal and fiscal barriers to cooperation (TFEU, 2007).

Over the past twenty years, the European Research Area has seen major achievements. An important organizational basis of the ERA functioning has become the European Strategy Forum on Research Infrastructures (ESFRI), a strategic instrument to develop the scientific integration of Europe and to strengthen its international outreach. The competitive and open access to high quality Research Infrastructures supports and benchmarks the quality of the activities of European scientists, and attracts the best researchers from around the world. Within the framework of ESFRI and the ESFRI Roadmap process, national governments have worked in close partnership with the European Commission and the scientific community to catalyse the establishment of over 50 European Research Infrastructures, mobilising investments of approximately €20 billion across the EU (ESFRI, 2020).

The European academic and scientific community considers elimination of the organizational barriers to researchers' mobility and fragmentation of research careers in Europe, driven by the European Charter for Researchers and a Code of Conduct for the Recruitment of Researchers (EC, 2005) to be a significant result of the ERA. In addition, the EURAXESS initiative supports researcher mobility and career development by delivering information and support services to professional researchers (EURAXESS, 2021)

Among the most important achievements of the ERA are enhanced access to open, free of charge, re-usable scientific information through the Open Science initiative and European Open Science Cloud (EOSC) creating a cloud area for research data in Europe allowing for better science through open and collaborative knowledge sharing.

At the same time, experts-authors of the EU policy documents in the analyzed field provide numerous evidence of slowing down progress in achieving the key objectives of the ERA, emphasizing the following facts and giving the following objective arguments:

- stagnation of public funding of the R&D sector since 2010. The EU R&D investment is at 2.19 % of GDP (2018), still far from its 3 % target. EU business R&D investment (1.45 % of GDP) remains significantly lower than that of our main competitors 6. In South Korea it stands at 3.64 %, in Japan at 2.59 %, in the United States at 2.05 % and in China at 1.69 % (EC, 2020a);
- while participation of the less performing Member States in the Framework Programme is now on the rise (it has increased from 4.4 % under FP7 to recently 5.6 % under Horizon 2020), indicators regarding science quality or innovation activity show significant discrepancies within the Union.
- EU is also lagging behind in translating R&I results into the economy. Although the Union is a world leader in some high tech sectors such as green technology, with the growing importance and diffusion of ICT, efforts need to be channelled towards strengthening industrial innovation, technology transfer and fostering the uptake of R&I solutions and the diffusion of innovation through knowledge transfer and public-private cooperation. The proof of the EU lagging behind is the fact that the share of innovative firms cooperating with knowledge institutes is only 15 % (2016). The share of public research financed by the private sector is only 7.2 % (2017) and has been slowly declining since 2007;
- Europe is a leader in science quality, including in international scientific collaboration. However, in relative terms the EU scores below the US on number of high impact publications and has not seen progress since 2012, while China is rising (EC, 2020a).

In developing the goals of further development of R&I-policy, experts emphasize the need to take into account the current social, environmental and economic situation in which the Union is:

Europe is currently facing deep societal, ecological and economic challenges, aggravated by the coronavirus crisis. Delivering on Europe's recovery is a pressing priority, while the green and digital transitions (twin transition) are more important than ever (EC, 2020a).

Thus, in such a complex and contradictory context, the EU has set itself ambitious goals and put in place instruments to achieve competitive sustainability. It committed to climate neutrality by 2050 (UN, 2015). Accelerating R&I and improving the collaboration between private and public research and innovation in the Member States towards early market deployment of clean technology solutions is vital for reaching these targets and provides an economic opportunity for the EU. It is also important to develop strategic supply chains of industrial capabilities in clean technologies.

Significant interest in understanding the challenges of further development of the ERA, are the documents of the ESFRI, namely White Paper "Making science happen. A new ambition for Research Infrastructures in the European Research Area" (ESFRI,2020), which states that the comprehensive Research Infrastructures landscape needs optimisation to address the overall objectives of the new European Research Area. To this end, ESFRI aims to optimise the organisation of the Research Infrastructure landscape:

- to facilitate the cross disciplinary research and the exploitation of data interoperability to produce new science to tackle new societal challenges and contribute to the Sustainable Development Goals (SDGs);
- to create more efficient synergies and direction between various European and national sources of funding;
- to enable the stronger integration of Research Infrastructures into their host societies;
- to continually modernise their services in support of European priorities;
- to strengthen the European leadership in the construction of global endeavours (ESFRI, 2020).

Deserve attention the key messages, formulated in the ESFRI White Paper, which concern the overall objectives of the new European Research Area. ESFRI considers that the following are needed for a stronger Europe:

- reinforce the position of Research Infrastructures as an essential pillar of the European Research Area, forming a healthy, sustainable and integrated Research Infrastructure ecosystem that strives for scientific excellence with impact, and provides transnational services, supporting education and skills development;
- enhance the role of Research Infrastructures as truly strategic investments across borders of sectoral domains, contributing to European strategic agendas and enabling European research and innovation to address pressing and complex societal challenges;
- develop and exploit the potential of the European Research Infrastructures as knowledge and innovation hubs, integrated into local communities, forming the basis of European competitiveness, with regional impact and global outreach;
- further strengthen the coherence between European, national and regional priorities and policies for Research Infrastructure development and funding;
- exploit the potential of Research Infrastructures as major promoters of Open Science providing FAIR (data which meet principles of findability, accessibility, interoperability, and reusability) and quality certified Open Data, supporting their contribution to the success and impact of the European Open Science Cloud and so strengthening their capacity to serve their users;
- better use the potential of the ESFRI to contribute to the development of coherent Research Infrastructure policy and investment in Europe, ensuring its appropriate capacity to that end (ESFRI, 2020).

Summing up the numerous judgments on the target priorities and strategies for further development of the ERA and R&I-policy, the experts concluded that the next ten years are Europe's Digital Decade. The COVID-19 pandemic has shown the importance of state-of-art digital technologies, based on European values, for the resilience of the economy and the society. Digital transformation is also a key enabler of the Green Deal. The Industrial Strategy, the European Skills

Agenda for Sustainable Competitiveness, Social Fairness and Resilience, the Digital Education Action Plan and the new European Education Area, are strategies that will guide the development and roll-out of digital technologies as well as the take up of digital skills in the EU. Europe must also focus on enhancing its model of open strategic autonomy, economic security and potential for job creation (EC, 2020a).

In the analyzed document titled "A new ERA for Research and Innovation" it is emphasized that in order to increase the excellence and efficiency of the European R&I system, all the traditional 'single market' elements of the ERA (building of critical mass, mobility, open science, etc.) continue to be highly relevant, but implementation needs to progress in a more ambitious manner. Four basic tasks have been formulated, which, according to the EU political and scientific community, should ensure the desired progress in a more ambitious manner. Let us provide a definition of these tasks in the wording given in this document. Therefore, development of a stronger European Research Area for the Future requires fulfillment of the following tasks:

I. "Prioritising investments and reforms: to accelerate the green and digital transformation and to increase competitiveness as well as the speed and depth of the recovery. This requires better analysis and evidence and includes simplifying and facilitating the inter-play between national and European R&I systems. The principle of excellence, meaning that the best researchers with the best ideas obtain funding, remain the cornerstone for all investments under the ERA.

II. Improving access to excellence: towards more excellence and stronger R&I systems across the whole of the EU where best practice is disseminated faster across Europe. Member States willing to increase the performance of their R&I system towards excellence should be encouraged and supported, building on dedicated Horizon Europe measures and complementarities with smart specialisation strategies under Cohesion Policy.

III. Translating R&I results into the economy: R&I policies should aim at boosting the resilience and competitiveness of our economies and societies. This means ensuring Europe's competitive leadership in the global race for technology while improving the environment for business R&I investment, deployment of new technologies and enhancing the take up and visibility of research results in the economy and society as a whole.

IV. Deepening the ERA: to further progress on the free circulation of knowledge in an upgraded, efficient and effective R&I system, in particular by moving from an approach of coordination towards deeper integration between national policies. The ERA will continue to promote adequate framework conditions and inclusiveness, help develop the skills that researchers need for excellent science, and connect all actors across Europe, including in education, training and the labour market" (EC, 2020a).

The subject of our review were documents of international professional organizations and networks of the European universities, which proposed mechanisms for updating the ERA by actively involving universities in this process and developing synergies between the ERA, EHEA and EEA. Of particular interest in this context are the EUA documents, which systematize and summarize proposals of the European academic community. In particular, the EUA report "Perspectives on the new European Research Area from the university sector" (EUA, 2020) formulates a holistic and logically consistent set of thematic recommendations that address both content and organizational aspects of the issue and are addressed to the European Commission, Parliament and the EU member states. Among the most important, in our opinion, thematic recommendations, formulated in the EUA document, are the following:

- *"Build an inclusive governance system* in order to build a comprehensive dialogue with the representative bodies of universities and other R&I stakeholders, both within the ERAC and the ERA Forum for Transition. Equally important, the ERA governance should enable dialogue and synergies with the European Education Area;
- *Provide sustainable funding to meet collective ambitions of the European R&I agenda*. Better synergies and strategic alignment among funders and funding programmes will equally contribute to a more efficient funding landscape, paving the way for a successful new ERA;

- *Emphasise academic freedom and institutional autonomy* as the underlying principles of the new ERA : to make institutional autonomy and academic freedom integral to every stage of the renewed ERA process. It is important that the common values and principles they articulate are effectively realised and actively promoted in the new ERA, including at the institutional level;
- *Invest in both investigator-driven and mission-oriented research and innovation*, acknowledging them as mutually reinforcing contributors to both short-term solutions and long-term, sustainable development;
- *Invest in training and sustainable career paths for early-career researchers* to leverage opportunities for early-career researchers, recognising and strengthening the important role of investigator-driven research in training the next generation of researchers;
- *Adopt a positive and holistic approach to diversity, equity and inclusion across all aspects of the new ERA*. This approach should also connect to actions taken in the European Education Area and take into account the work that has been done so far in the context of the European Higher Education Area (EHEA);
- *Co-create a broad and forward-looking definition of excellence* to guide the new ERA with representative bodies of universities and other R&I stakeholders;
- *Fully embrace inclusiveness with a view to closing research and innovation gaps in Europe*. EU member states, universities and other R&I stakeholders must play an active role in designing appropriate and tailored approaches to build capacity and improve performance;
- *Strengthen innovation ecosystems for knowledge circulation and valorisation* to support the full array of activities that make ecosystems dynamic sources of ground-breaking science;
- *Boost incentives and facilitate conditions for mainstreaming Open Access* through actions directed at researchers, universities, research funders and national consortia responsible for negotiating big deal contracts;
- *Build a FAIR research data culture together with stakeholders and research communities* to boost efforts in setting the right legal and infrastructural conditions and provide sustainable financial support for FAIR data sharing and re-use, as well as supporting skills and training for research data management. Actions to develop FAIR data standards in various disciplines should be undertaken together with stakeholders and research communities and aligned with efforts to establish the European Open Science Cloud (EOSC);
- *Invest in an open and world-class research infrastructure landscape in Europe*. This must be closely linked with the facilitation of access to digital resources and services for research, including through the EOSC;
- *Engage with universities at the forefront of the digital transition*. Much can be learned from the experience of universities at the forefront of the digital transition and data ownership in particular. These lessons should especially be considered in future legislative proposals and strategies related to the digital space;
- *Engage with universities in accelerating the green transition to develop a holistic approach in this process*. The role of universities encompasses a balanced contribution of investigator-driven and mission-oriented research in pursuit of climate objectives and drawing upon the best available expertise in environmental education;
- *Support openness as a cornerstone of an attractive and performant R&I system* as a cornerstone of Europe's scientific and industrial competitiveness, as well as to its overall standing in the world. The new ERA must be further strengthened through collaboration with partners around the globe. While acknowledging a changing geopolitical landscape and increasing competition around key technologies, developing European capacity for R&I in strategic sectors must not denote a closing of European research for international partnerships and people" (EUA, 2020).

We believe that above recommendations of the European academic community on the development and renewal of the ERA and involvement of the universities in this process as

important R&I actors and, at the same time, R&I stakeholders, are holistic and systematic. Implementation of the recommendations is aimed at expanding significantly and deepening the scientific mission of universities, as it will strengthen their position as an integral part of the national and European regional innovation ecosystem.
The final point of these recommendations concerning the global dimension of the European R&I cooperation has been the subject of a separate EU policy paper and our further consideration.

Strategic priorities for the development of EU global cooperation in the field of R&I and targeted recommendations of the EUA

The subject of our further consideration and structural-logical analysis were political and analytical documents, which formulated a strategy for the development of the EU global cooperation in R&I, especially the European Commission Communication "The Global Approach to Research and Innovation. Europe's strategy for international cooperation in a changing world" (EU, 2021a); the recommendations of the European academic community on the participation of the universities in this process are reflected, in particular, in the EUA document "A global approach to research, innovation, education and youth. EUA input to the European Commission Communication" (EUA, 2021b); numerous websites and documents of innovation networks and structures that are already operating or being launched in the European and global space and have become part of the European innovation ecosystem.

Analysis of the text of the Communication of the European Commission (EU, 2021a) allows us to state that adoption of the new EU R&I Strategy has a long history and good reasons: it was the result of the largest EU Research and Innovation grant program "Horizon 2020" and development of a new program – Horizon Europe, implementation of which is the provisions of the R&I-2021 Strategy.

A study of the genesis of the R&I-2021 Strategy shows that over the last decade, during the Horizon 2020 program, a number of the EC policy documents have been published (communiqués, reports, analytical reports: EC, 2012; Council of the European Union, 2013; EC, 2016; EC, 2019, etc.), which were subjected to quantitative and qualitative analysis of goals, objectives, priorities, challenges, shortcomings, achievements and results of the EU global cooperation in research and innovation, achievements and prospects of the European scientific space (EU, 2020a). The genetic analysis of the above-mentioned documents of the previous decade and the content analysis of the R&I-2021 Strategy show that the new document successively continues European policy in this area and takes into account new global and regional realities and challenges.

Thus, most of the continuation of the content priorities of the previous decade were defined in the Document the basic objectives of the R&I-2021 Strategy, which include "developing innovative solutions to deliver just green and digital transitions in line with sustainable development goals and promoting Europe's resilience, prosperity, competitiveness, economic and social well-being" (EU, 2021a).

The Communiqué formulates a number of geopolitical, geoeconomic and geotechnological factors that determine the specifics of the transformed global environment in which the new Strategy will be implemented:

1) other major science powers are now spending more on science than the EU as a percentage of gross domestic product (specific confirmations of this statement are confirmed in other documents, in particular in the above analyzed strategy ERA-2020);
2) geopolitical tensions are rising and human rights and fundamental values such as academic freedom are being challenged;
3) some countries are increasingly seeking technological leadership through discriminatory measures, and are often instrumentalising research and innovation for global influence and social control;

4) the EU's prosperity and economic competitiveness, but also its ability to autonomously source and provide its citizens with crucial technologies and services that are safe and secure need to be reinforced (EC, 2021a).

The global challenges identified above have led to the approaches proposed by the Strategy to minimize them for Europe. Such approaches include, first of all:

- *rules-based multilateralism*, pursuing reciprocal openness in research and innovation cooperation to facilitate global responses to global challenges and exchanging best practices;
- *open strategic autonomy*, which is defined as "the ability to act autonomously, to rely on one's own resources in key strategic areas and to cooperate with partners whenever needed" (EC, 2021a). This idea, although it appeared a little earlier, became especially relevant in the context of the Covid-19 pandemic, when the problem of regional autonomy in the priority of providing the population of the EU with the necessary means of combating the coronavirus became acute. Note that the conceptual foundations of Europe's strategic autonomy are the subject of heated debates that have many vital dimensions (political, economic, military, environmental, energy, demographic, etc.), including academic, in which the European University Initiative is developing (EUA, 2021c), which should be the main driver of further development of the European Education Area and the European Research Area;
- *approach* Team Europe, combining the resources of the EU, its Member States and European financial institutions, including the European Investment Bank and the European Bank for Reconstruction and Development. Combining resources will allow achieving greater effect.

The content analysis of the considered above Communiqué (EC, 2021a) shows that implementation of the R&I-2021 Strategy focuses on the following priorities:

- increasing attractiveness of the EU as a high-quality center and leader in research and innovation. The Strategy states that research and innovation are successful due to freedom of thought, development of critical thinking, evidence-based reasoning and rejection of the authority arguments. The EU therefore aims to continue to offer researchers and innovators a democratic, inclusive and supportive environment free from political interference, while protecting academic freedom and research opportunities guided by the scientific interest, respect and protection of the EU Charter of Fundamental Rights;
- development of technological innovations for the benefit of man and society. Freedom from authoritarianism and research with high ethical standards and human rights. The EU supports creation of a *rules-based innovation ecosystem* that protects intellectual property rights through an independent judiciary. The protection and enforcement of intellectual property rights should enhance the transfer, promotion and dissemination of the technological innovation in a way that promotes social and economic well-being;
- strengthening cooperation in the field of *human capital development* through training and mobility of researchers, in particular through the Marie Skłodowska-Curie programs (EC, 2021c).

An important place in the Strategy occupies explanation of the principles underlying the EU's cooperation with international partners, which the European Community strongly insists on. Such principles include:

"Academic freedom. Academic freedom, integrity and institutional autonomy form the backbone of universities and higher education institutions in the EU. The EU and its Member States should promote and protect these common fundamental values internationally and uphold the principles of the Bonn Declaration on Freedom of Scientific Research (*Bonn Declaration,* 2020).

Research ethics and integrity. The rapid development of new technologies necessitates a continuous evaluation of current approaches to address ethical challenges and ensure human-centred technological innovation. The EU should continue to promote internationally the European Code of Conduct for Research Integrity and the Global Code of Conduct for Research in Resource-Poor Settings. It will expand its international dialogues through European networks on ethics and integrity and support the World Conferences on Research Integrity.

Gender equality, diversity and inclusiveness. In line with the Commission's Gender Equality Strategy 2020-202510 and the EU agenda for gender equality and women's empowerment in EU external action, the EU should mainstream and integrate the gender dimension in international cooperation. Through dialogue with non-EU countries, it should also foster gender balance and equality, youth empowerment, inclusiveness, and diversity in the broader sense12, in research and innovation at global level.

Open data and open science. Making research data as open, standardised and interoperable as possible benefits both the EU and the world when other countries and regions do the same. The EU should continue to support bodies and platforms such as the Research Data Alliance (RDA, 2021) and the Committee on Data of the International Science Council (CODATA, 2021), as well as efforts by the OECD, the UN and the G7. The global aim is to make datasets FAIR: findable, accessible, interoperable, and reusable. (EC, 2021a). The EU will also support the international outreach of the European Open Science Cloud" (EOSC, 2021).

Standards. The EU's leading role as a setter of global standards should also be advanced through an increased role in international cooperation in pre-normative and standardisation research.

Evidence-informed policymaking. The EU and its Member States have emerged as leading practitioners of evidence-informed policymaking. They should share their own science for policy insights and experiences and engage with global networks.

Science Diplomacy, that means a stronger focus on science and technology in the EU's foreign and security policies. It would help the EU to project soft power and pursue its economic interests and values more effectively, meeting demand and interest from partner countries and playing to the EU's strengths as a research and innovation powerhouse.

A peculiarity of the analyzed Communiqué, which formulates the R&I-2021 Strategy, is identification of the steps to rebalancing the EU's global approach to research and innovation towards a level playing field and reciprocity. Justifying the need for such steps, the authors of the Document argue that "competition for technological leadership drives certain non-EU countries to adopt restrictive or discriminatory measures that are unfair to EU innovators, companies and in particular start-ups. At the same time, foreign interference can compromise the integrity and autonomy on which research and innovation systems in the EU are built" (EC, 2021a).

To the steps to renew level playing field and reciprocity in R&I sector the Communiqué referred: open standard setting, non-discriminatory state subsidies and the absence of protectionist laws, development of targeted roadmaps for research and innovation cooperation with non-EU countries with a strong research and innovation base. The EC also envisages other steps aimed at protecting the region's interests in the field of R&I, such as:

1) to present guidelines on dealing with foreign interference targeting EU research organisations and higher education institutions. These guidelines will aim to protect fundamental values by safeguarding academic freedom, integrity and institutional autonomy, and to shield students, researchers and innovators, and key research findings, from coercive, covert, deceptive or corrupting foreign actors;
2) put forward a code of practice on smart use of intellectual property21, in accordance with the Intellectual Property Action Plan (EC, 2020c). The aim of the Code will be to raise awareness among universities, research organisations and businesses of the importance of managing knowledge and intellectual property in an international environment;
3) to ensure that the EU can react to global crises independently and mitigate the risks of dependency on non-EU countries in the area of civil security, it should strengthen its civil security industry through an ambitious and capability-driven approach to security research and innovation (EC, 2021a).

The content priorities of the EU's international cooperation in the field of R&I, based on common rules and value-based cooperation, in the R&I-2021 Strategy are called solutions of the global challenges such as climate change, the biodiversity crisis, pollution, resource depletion, infectious diseases, including in crisis situations, and enabling the green and digital transitions.

The analysis of the Communiqué materials shows that in all these areas the EU already has significant positive experience of leadership and initiative participation in the international organizations and programs that have a positive impact on the R&I development in the European region and the world as a whole. In particular, in the field of ecology, or just green transition to such organizations and programs include, above all:

- *All-Atlantic Ocean Research Alliance* (AORA, 2021), aimed to strengthen international marine research and innovation cooperation and actively contribute to global initiatives such as the UN Decade of Ocean Science for Sustainable Development 2021-2030;
- *Mission Innovation* – a global initiative of 24 countries and the European Union working to accelerate clean energy innovation, thereby demonstrating global leadership in climate ambition at COP26;
- *Group on Earth Observations (GEO)* – global network in the area of earth observation. GEO has the capacity to connect government and academic institutions, data providers, businesses, engineers and citizens to create earth observation-based innovative solutions to global environmental, social and health challenges;
- *International Bioeconomy Forum*, in the framework of which the bioeconomy strategy is being developed, which is aimed at stimulating a more innovative, resource efficient and competitive society that reconciles food and nutrition security with the sustainable use of renewable resources for industrial purposes, while ensuring environmental protection;
- *Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*, which provides support for climate science in the United Nations Climate Change Conference (COP26), highlighting EU's role as a key enabler of the transition to climate neutrality and resilience;
- *The New European Bauhaus*, that has the ambition to make the European Green Deal a cultural, human-centred, inclusive and positive, tangible experience for all and to accelerate a sustainable greening of the built environment. It will tackle at local level the most pressing challenges shared at EU and global level (EC, 2021a).

In the field of *digital transition* has been launced the 2030 Digital Compass (EC, 2021d), which will guide the EU's efforts in fostering a global approach to the main technological and regulatory developments, including in the area of international connectivity and standards. The 2030 Digital Compass foster an international approach to trusted data flows, while promoting its model of a safe open and resilient global internet and pursuing ambitious goals in terms of market access. Collaboration in research and innovation is one tool to foster digital partnerships with regions around the world. International digital partnerships should result in greater opportunities for EU companies, increased digital commerce via secure networks, respect of EU standards and fundamental rights and values, and a supportive environment internationally for a human-centric digital transformation.

The most important spheres of implementation of the International digital partnerships EU considers to be: human centric policy and regulations; adapted and improved solutions for digital connectivity; enhanced innovation partnerships with the digital research and innovation ecosystems; enhanced focus and research partnerships on key technologies such as Artificial Intelligence, blockchain, internet of things, big data, space data, applications of digital technologies to green transition, health, and education.

An example of an international digital partnership in the field of R&I in the Strategy is named the EU global multi-stakeholder platform Digital 4 Development Hub (D4D Hub, 2021), that supports a human-centric digital transformation. The D4D Hub bundles a multitude of digital initiatives and promotes combining resources of the EU, Member States, and financial institutions through the Team Europe approach for coordinated impact. The D4D Hub will form regional branches in Africa, Asia, Latin America and the Caribbean, as well as in the EU's Eastern Neighbourhood and include all relevant stakeholders from respective regions (EC, 2021a).

The R&I-2021 strategy envisages strengthening of cooperation on global health, which is especially relevant in the context of the COVID-19 pandemic. In this context, the Document

mentions the EU's participation in the launch of the program Coronavirus Global Response, which has raised nearly €16 billion in pledges globally, developing the COVID-19 Data Platform and publishing the manifesto for EU COVID-19 research. It should be stressed that together with the World Health Organisation (WHO) and its international partners, the EU also played a leading role in founding the Access to COVID-19 Tools Accelerator (ACT-A) as well as the COVAX mechanism. These two initiatives aim to lead the development and equal distribution of safe and effective COVID-19 diagnostics, treatments and vaccines. Furthermore, the Pharmaceutical Strategy for Europe is set to further enhance the EU's role at global level, as a leader in health research and innovation, which can benefit patients across the world (EC, 2021a).

Significant attention is paid in the Communication R&I-2021 to the organizational aspects of innovation development. Large-scale initiatives and structures for their implementation already exist in the EU. In particular, we are talking about EU Connectivity Strategy, which envisages establishing win-win international innovation partnerships, consisting of networks of incubators and accelerators, with countries and regions that offer reciprocal openness to entrepreneurship and investment. They should foster, among other things, the creation of soft landing programmes50 and start-up collaborations between the EU and non-EU countries, thereby complementing the international dimension of European Cluster Partnerships (ECCP, 2021) and Start-up Europe initiatives (Start-up Europe, 2021) and the network of EU Digital Innovation Hubs. Metioned initiatives, programs and organizational structures complement the Marie Skłodowska-Curie actions, these partnerships will also promote the mobility of innovators in both directions.

An important role in the coordination of global cooperation in the field of R&I in the analyzed Strategy is given to such European structures as European Innovation Council (EIC, 2021) та the European Institute of Innovation and Technology (EIT, 2021), which offer the European start-up and scale-up companies the opportunity to attend international trade fairs. In parallel, to further increase EU attractiveness and innovation capacity, overseas innovators who wish to establish start-ups in the EU will be able to apply for EIC support. In addition, the European Institute of Innovation and Technology (EIT) will launch, in targeted non-EU countries, coordinated actions of its knowledge and innovation communities.

A separate section of the Communiqué is devoted to the characteristics of cooperation with different countries and regions. The basic idea of the R&I-2021 Strategy in this context is that the EU should cooperate with non-EU countries through a nuanced and modulated approach, based on levels of reciprocity, a level playing field, and the respect for fundamental rights and shared values. It is emphasized that the EU should remain a strong and open partner, while seeking to enhance, through well-targeted cooperation, its own expertise in key emerging areas. At the same time, it should co-design initiatives to support countries that wish to upgrade their research and innovation ecosystems.

Therefore, "nuanced and modulated approaches" in the R&I field are outlined, first of all, for the industrialised non-EU countries and emerging economies (in this list, the priorities of cooperation with the United States are identified separately, with which the EU shares high levels of research and innovation capacity and common values and principles, and with major science powers such as Canada, Japan, South Korea, Singapore, Australia and New Zealand, including by exploring new possibilities for closer cooperation such as association under "Horizon Europe").

In sufficient detail are described the priorities of cooperation with China as "an economic competitor and a systemic rival to the EU". The EU calls for a rebalancing of research and innovation cooperation. The EU has launched discussions with China on a joint roadmap to establish agreed framework conditions and guiding principles for cooperation to reach a level playing field and reciprocity, while respecting fundamental values, high ethical and science integrity standards. To the countries with which cooperation is "nuanced" in the Communiqué are also referred India and Russia.

The document formulates the principles of cooperation with non-EU member states which belong to EFTA countries, the Western Balkans, Turkey, countries covered by the European

Neighbourhood policy and the United Kingdom. In sufficient detail are written prospects of R&I partnerships with Africa, Latin America and some other regions and countries.

In general, a review of the EU's R&I-21 strategy and policy documents reveals that in today's rapidly changing world, research and innovation have become drivers of foreign policy, so they should be taken into account. Besides, it should be taken into account that they are at the heart of geopolitical tension. European policy declares in the R&I-21 Strategy the need to deepen cooperation on the basis of openness, equal conditions and respect for fundamental rights and values, as well as support for the EU's open strategic autonomy.

Next, we will analyze the ideas and proposals for the development of the global R&I cooperation expressed by the European academic community in documents of the EUA and academic networks and, in particular, in the appeal to the developers of the R&I Strategy (EUA, 2021b).

It should be noted that in the EUA document the subject of consideration is the policy in the field of "research, education, innovation and youth", "research, education, innovation and culture", and not only "research and innovation" (R&I), which reflects the specifics of professional interest of the EUA and the activities of its members – European universities.

It is noteworthy that university analysts first of all drew attention of the European politicians to the contradiction that exists between the concept of EU open strategic autonomy, understood as the "capacity to act autonomously when and where necessary and with partners wherever possible" and the concept of global academic cooperation, which guides the European university community in its activities. In particular, it should be mentioned that transfer of the concept of an "open strategic autonomy" in the academic sphere raises three key dilemmas for the EU's international engagement, as well as for Europe's universities, the European Research Area (ERA), the European Education Area (EEA) and the European Higher Education Area (EHEA). These dilemmas are formulated as follows:

- How can the EU strengthen its own research, technology and innovation capacity to become more independent whilst engaging in international collaboration to advance the frontiers of knowledge and develop solutions to solve global challenges?
- How can the EU and Europe's universities strive to fulfil the fundamental need for openness and a free flow of knowledge and ideas while addressing legitimate concerns over security, values and strategic interests?
- How can European political goals be achieved without interfering with the principles of institutional autonomy and academic freedom? (EUA, 2021b).

We share the European academic community's concern about politicization of the sphere of "research, education, innovation and youth" and risks for the fundamental need for openness and a free flow of knowledge and ideas, refusing the principles of institutional autonomy and academic freedom.

Opposing expansion of the "open strategic autonomy" to the sphere of research and education, EUA argues that collaboration and openness are the leading principles for universities to contribute to solving global challenges by shifting the frontiers of knowledge. Globalisation and the quest for sustainability are key drivers for more, rather than less, global collaboration in research, innovation and education. European universities are guided by their values, as stated in documents like the Magna Charta Universitatum, the Bonn Declaration and, broader, the Universal Declaration of Human Rights. They are aware of the opportunities and risks when seeking collaboration, also when interacting with partners from differing value systems. Responsible and reciprocal openness should be at the basis of any collaboration (EUA, 2021b).

EUA expresses a fundamental belief in the need to enhance responsible and reciprocal openness and international collaboration in research, innovation and education and determines three lines of action:

1. Engaging with the world through more common goals, common programmes, common funding and Open Science. There are various drivers for collaboration, hence the approach is differentiated for diverse regions. What is needed is the openness to engage with anyone willing to

jointly advance knowledge and solve societal challenges, as well as special attention to the EU's neighbourhood.

2. Empowering Europe's research, education and innovation to be effective in the global scene. This can be achieved by strengthening the ERA and EHEA, especially through competitive policies and achieving the 3 % GDP investment in (inter)disciplinary research in key priority areas, as well as in fundamental, curiosity-driven research, flexible academic career paths, innovation ecosystems, and developing a European Data Strategy.

3. Bracing for risks in order to build the resilience of Europe's research, innovation and education and promoting a global level playing field. This can be achieved by systematic and strategic risk assessment and risk mitigation measures. Further, it requires clear guidance and tools at the disposal of individual researchers, and pro-activeness in promoting values and common bilateral and multilateral rules of engagement for global cooperation. Europe should strive for setting the pace in global structures of governance in areas, such as data, technology and intellectual property, that help create a global level playing field, whilst safeguarding academic freedom and universities' institutional autonomy (EUA, 2021b).

We share the conviction of the EUA and with it the whole European academic community that this approach will help foster a stronger, more independent EU that is at the same time open, international and cooperative. Europe's universities, as strong, open and autonomous institutions, play a crucial role in these developments.

Conclusions

New EU strategies presented in the Communiqué "A new ERA for Research and Innovation" (EC, 2020a) and "The Global Approach to Research and Innovation. Europe's strategy for international cooperation in a changing world " (EC, 2021a) are aimed at significantly updating the ERA and strengthening the EU's innovation ecosystem, the region's and the world's scientific potential. This conclusion was reached, which is especially important for us, by the representatives of the European academic community in the numerous discussions that took place in the process of adopting the analyzed above documents. New strategies take into account current geopolitical, geoeconomic and geotechnological problems, contradictions and risks of the modern world. The new EU Communications emphasise the importance of strengthening the R&I dimensions of universities through the transformation agenda, aimed at increasing cooperation across institutions, circulation of knowledge and sharing of capacity. Universities will lead this agenda based on their unique mission in fostering and leveraging synergies between research, innovation, education and culture in service to society.

The growth and exacerbation of global risks have led to the formulation of a number of approaches to the development of global cooperation: rules-based multilateralism; open strategic autonomy of Europe; modulated approach Team Europe.

Successful work on the implementation of the R&I-2021 Strategy involves achieving a synergy of efforts of scientists, innovators and educators, which is especially important in the context of the UN Sustainable Development Goals. Therefore, the principles of cooperation set out in the ERA-2020 and R&I-2021 strategies, namely academic freedom, research ethics and integrity, gender equality, diversity and inclusiveness, open data and open science, standards, evidence-informed policymaking have become a categorical imperative of the European universities.

The university R&I sector is an increasingly effective force for the implementation of the vast majority of programs and projects that will be and are already involved in the Horizon Europe program.

Given the objectives, principles and approaches set out in the European Strategies ERA-2020 and R&I-2021 for assessing the prospects of involving Ukrainian universities in Horizon Europe programs, we consider it appropriate to take into account both academic and political factors that may contribute to or hinder the involvement of domestic universities in international cooperation in the field of R&I.

Academic factors influencing the prospects of involving Ukrainian universities in Horizon Europe programs include the following:

- readiness and ability of domestic scientists and educators to follow European academic values and principles of international scientific cooperation;
- the level of scientific potential and technological equipment of domestic universities, which enable participation in modern scientific programs.

A systematic analysis of these factors leads to the conclusion that Ukrainian academic community is aware of and fully shares European academic values and principles, which indicates a high level of readiness and ability to act accordingly in the implementation of the international research programs. The scientific potential and technological equipment of the best Ukrainian universities is high enough to participate in a wide range of European R&I programs, as evidenced by the quantitative and qualitative characteristics of the participation of Ukrainian scientists and educators in Horizon 2020 and Erasmus+.

Among the political factors of influence are internal, compliance with domestic legislation in the field of science, innovation and education, European regulations, and external, especially extension of Europe's open strategic autonomy in R&I and education. Regarding domestic political factors, it should be noted that in the context of Ukraine's move to join the European Union, domestic legislation, especially in the field of R&I and education, is increasingly synchronized with European legislation.

Regarding foreign policy factors, we note a new and alarming trend for us, related to the introduction of the concept of open strategic autonomy and its extension to the academic sphere. An example of such dissemination is implementation, starting in 2017, of a program to create R&I Alliances of European Universities, consisting exclusively (or mainly) of universities from EU member states. We think that this approach does not promote the integration of Ukrainian universities into the European innovation ecosystem, as it strengthens the practice of giving preference to "their" universities and scientists.

At the same time, we realize that international cooperation is possible and desirable only with a strong partner with unique world-class potential. This level should be sought by domestic universities, scientists, and educators.

References

All-Atlantic Ocean Research Alliance (AORA) (2021). *Major steps in building the All Atlantic Research Community*. Retrieved from: https://allatlanticocean.org.

Aurora Universities Network (AUN) (2021). *European Global Approach revisited – position paper by Aurora.* Retrieved from: https://aurora-network.global/aurora-eu-global-approach-strategy/.

Bonn Declaration on Freedom of Scientific Research (2020). Retrieved from: https://www.bmbf.de/files/10_2_2_Bonn_Declaration_en_final.pdf.

Committee on Data (CODATA) of the International Science Council (2021). Retrieved from: https://council.science/what-we-do/affiliated-bodies/committee-on-data-for-science-and-technology-codata/.

Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions (2012). *Enhancing and focusing EU international cooperation in research and innovation: A strategic approach*. Retrieved from: https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A52012DC0497.

Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions (EC) (2020a). *A new ERA for Research and Innovation*. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2020%3A628%3AFIN

Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions (EC) (2021a). *The Global Approach to Research and Innovation. Europe's strategy for international cooperation in a changing world*. Brussels. Retrieved from: https://ec.europa.eu/info/files/communication-global-approach-research-and-innovation_en.

Consolidated version of the Treaty on the Functioning of the European Union (TFEU) (2007). *Protocols – Annexes – Declarations annexed to the Final Act of the Intergovernmental Conference which adopted the Treaty of Lisbon, signed on 13 December 2007*. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A12012E%2FTXT.

Council of the European Union (2013). *Council Conclusions on "Enhancing and Focusing EU International Cooperation in Research and Innovation: a Strategic Approach"*. Retrieved from: http://www.consilium.europa.eu›pressdata›intm.

Digital 4 Development Hub (D4D Hub) (2021). *Eight innovative projects*. Retrieved from: https://d4dhub.eu/projects.

ESFRI (2020). *Making science happen. A new ambition for Research Infrastructures in the European Research Area. ESFRI White Paper*. Retrieved from: www.esfri.eu.

ESPAS (2019). *Global Trends to 2030: Challenges and Choices for Europe*. Luxembourg: Publication Office of the European Union. Retrieved from: https://ec.europa.eu/assets/epsc/pages/espas/index.html

EURAXESS (2021). *Information on the latest developments and actions, general advice, useful contacts and links, statistics*. Retrieved from: https://euraxess.ec.europa.eu/.

European Cluster Collaboration platform (ECCP) (2021). *Publications.* Retrieved from: https://clustercollaboration.eu/knowledge-sharing/publications.

European Commission (EC) (2005). *European Charter for Researchers and a Code of Conduct for the Recruitment of Researchers.* Retrieved from: https://euraxess.ec.europa.eu/jobs/charter-code-researchers.

European Commission (EC) (2016). *Report from the EC "Implementation of the strategy for international cooperation in research and innovation".* Retrieved from: https://www.ffg.at›annex_roadmaps_oct-2016.

European Commission (EC) (2019). *Six Commission priorities for 2019-2024*. European Commission, Brussels, 2019. Retrieved from: https://ec.europa.eu/info/strategy/priorities-2019-2024_en.

European Commission (EC) (2020b). *A Union of Equality: Gender Equality Strategy 2020-2025 (COM/2020/152 final).* Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020DC0152&from=EN.

European Commission (EC) (2020c). *Making the most of the EU's innovative potential – An intellectual property action plan to support the EU's recovery and resilience (COM(2020) 760).* Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0760.

European Commission (EC) (2020d). *Joint staff working document. Objectives and Indicators to frame the implementation of the Gender Action Plan III (2021-25).* Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020SC0284.

European Commission EC (2020e). *Science, Research and Innovation Performance of the EU 2020. A fair, green and digital Europe*. Retrieved from: https://data.europa.eu/doi/10.2777/520136.

European Commission (EC) (2021b). *Shaping Europe's digital future. European Digital Innovation Hubs*. Retrieved from: https://digital-strategy.ec.europa.eu/en/activities/edihs.

European Commission (EC) (2021c). *Marie Skłodowska-Curie Actions. Developing talents, advancing research*. Retrieved from: https://ec.europa.eu/research/mariecurieactions/science-is-wonderful.

European Commission (EC) (2021d). *2030 Digital Compass: the European way for the Digital Decade. COM(2021) 118 final*. Retrieved from: https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A52021DC0118.

European Innovation Council (EIC) (2021). *EIC Work Programme 2021*. Retrieved from: https://eic.ec.europa.eu/about-european-innovation-council_en.

European Institute of Innovation and Technology (EIT) (2021). *EIT at a glance*. Retrieved from: https://eit.europa.eu.

European Open Science Cloud (EOSC) (2021). *European Open Science Cloud (EOSC) main background documents*. Retrieved from: https://eosc-portal.eu/policy/ec-documents.

European Parliament (EP) (2000). *Lisbon European Council 23 And 24 March 2000. Presidency Conclusions*. Retrieved from: https://www.europarl.europa.eu/summits/lis1_en.htm.

European Strategy Forum on Research Infrastructures (ESFRI) (2021). *The Forum.* Retrieved from: https://www.esfri.eu/forum.

European Strategy Forum on Research Infrastructures (ESFRI) (2020). *Making science happen. A new ambition for Research Infrastructures in the European Research Area*. https://www.esfri.eu/forum.

European University Association (EUA) (2020). *Perspectives on the new European Research Area from the university sector. Policy input.* Retrieved from: https://eua.eu/resources/publications/949:perspectives-on-the-new-european-research-area-from-the-university-sector.html.

European University Association (EUA) (2021a). *Universities without walls. A vision for 2030.* Retrieved from: https://eua.eu/resources/publications/957:universities-without-walls-%E2%80%93-eua%E2%80%99s-vision-for-europe%E2%80%99s-universities-in-2030.html.

European University Association (EUA) (2021b). *A global approach to research, innovation, education and youth. EUA input to the European Commission Communication.* Retrieved from: https://eua.eu/resources/publications/961:eua-policy-input-to-the-preparation-of-the-upcoming-european-commission-communication-on-a-global-approach-to-research,-education,-innovation-and-youth.html.

European University Association EUA (2021c). *European Universities Initiative.* Retrieved from: https://eua.eu/component/tags/tag/81-european-universities-initiative.html

Research Data Alliance (RDA) (2021). *RDA Europe: the European plug-in to the Research Data Alliance*. Retrieved from: https://www.rd-alliance.org/rda-europe.

Start-up Europe (2021). *Startup Europe Initiative.* URL: https://startup3.eu/startup3-hub/startup-europe-initiative/.

United Nations (UN) (2015). *Paris Agreement*. Retrieved from: https://ec.europa.eu/clima/eu-action/international-action-climate-change/climate-negotiations/paris-agreement_en.

REGULATORY FRAMEWORK FOR EDUCATION OF SPORTS-GIFTED STUDENT YOUTH IN UKRAINE AND POLAND

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Abstract. The purpose of the study is to reveal the features of the regulatory framework for the education of sports-gifted schoolchildren in Ukraine and Poland. The relevance of the chosen research topic is due to the increased interest of the world scientific community in the education of gifted children. Development of various new programs and plans for sports-gifted students has aroused interest in the legal framework regulating this process. Sports education is an important part of life of the younger generation, because it is responsible for a significant part of health education. The adoption of laws, projects and programs for the education of gifted youth gives a new course in education and upbringing. Healthy gifted youth are the driving force for the development of any nation.

Key words: innovations, gifted education, gifted child, sports gifted child, regulatory framework.

Introduction

The dynamic growth of the world economy leads to constant change in all spheres of human life. To implement such changes, society needs educated citizens, so the attention of the world community is focused on education. The education of gifted youth, sports and health education of schoolchildren has recently been of interest to many researchers in the field of pedagogy, psychology, physiology, etc.

In the general system of comprehensive and harmonious human development, the physical development of a school-age child occupies a special place. It is at school that the foundations of good health, proper physical development and high efficiency are laid. During these years there is a formation of motor activity, and the development of physical aspects begins. We propose to consider the legal framework for physical education for gifted students of Ukraine and Poland in this section. Among modern domestic researchers, O. Yezhova, M. Zavadska, N. Shchekotylina, A. Besedina, O. Karpus, V. Orzhekhovska and others were interested in the impact of physical education on children's health. M. Boychenko, O. Antonova, D. Skalski, S. Naumenko, V. Shchors, O. Stoliarenko, O. Boliukh and others studied the issues of development of gifted children's abilities.

Foreign scientists such as T. Moore, T. Campanella, F. Rabelais (physical development and preservation of human health), S. Grossing, Z. Grot, N. Kulinko (history of the formation of physical education in the world), A. Fouquet, F. Schmidt, H. Barnard, G. James (comparison of aspects of physical education in different countries), K. Reese, J. Barrett, B. Hooligan (generalization of innovative areas of physical education) were interested in the issue of sports education of schoolchildren. In the works of E. Balz, B. Crum, R. Naul, K. Hardman, B. Peneva, D. Bonacin reflects on the classification of the concepts of physical education. Searches by A. Hofmann, P. Schempp, W. Dietrich, L. Hendey, and others are devoted to the study of certain aspects of physical culture and sports. The following scientists developed the concepts of physical education: T. Elyot, J. Funke, J. Guts Muths, F. Jahn, G. Ling, K. Koch, A. Maclaren, P. de Coubertin, H. Saltzmann, M. Shearman, A. Spiess.

The results of the analysis of scientific sources give grounds to claim that a comprehensive study of the regulatory framework for the education of gifted students in Ukraine and Poland has

not been carried out. The relevance of the topic of this work is due to the lack of its holistic study in the context of comparative pedagogical research.

Research results

Regulatory framework for education of sports-gifted student youth in Ukraine

Attention to supporting the education of gifted students is growing in many countries around the world. During the previous century, it was believed that gifted students did not need special attention and additional conditions for comfortable learning. Thus, development of support for gifted students in schools did not take place. Only in a few decades has the need to support and develop the abilities of gifted students become more urgent.

With the acquisition of independence in Ukraine there have been significant changes in the political life of the country and the ideological views of the population. Training and education of gifted students took place in specialized schools, gymnasiums, lyceums, colleges, as well as various types of education institutions and associations. Also, to prepare the most gifted children for higher education, general specialized sanatoriums in all regions of Ukraine have been established (Boichenko, 2018).

The upbringing and education of gifted children are regulated by the following state normative documents: Concept of General Secondary Education, Law of Ukraine "On Education", National Doctrine of Education Development, Decrees of the President of Ukraine "On Additional Measures for State Support of Gifted Youth" and "On the Program of Work with Gifted Youth", etc.

The Law of Ukraine "On Education" empowers local authorities to create appropriate conditions at the place of residence for the upbringing of children and youth, development of abilities, satisfaction of their interests. The Law "On Education" also states that specialized classes, specialized education institutions, gymnasiums, lyceums, as well as various types of educational complexes and associations are created for the development of abilities, gifted and talented children. The state provides support and encouragement to especially gifted children. Although, it is not specified how these incentives will be implemented.

The Law of Ukraine "On Education" contains important statements about the giftedness of children. The document states that scientists and representatives of other fields of activity (with the permission of the educational institution) can participate in educational activities, promote intellectual and cultural development of student youth, provide advice to teachers. This will help create conditions for the most appropriate implementation of the education system for gifted students, which will allow for qualitative changes in the field of education (*Law of Ukraine "On Education",* 2017).

The Decree of the President of Ukraine "On Additional Measures for State Support of Gifted Youth" was issued in order to preserve and develop the creative potential of the population of Ukraine, creating favorable conditions in society for the personality development and support for gifted youth. Thanks to the document, gifted youth have the opportunity to receive grants from the President of Ukraine for gifted youth (since 2001). The President of Ukraine also submitted a target program for work with gifted youth for 2001-2005, which identifies priority measures to expand social and legal guarantees for young people, promote education, engage in research, etc. (*The Decree of the President of Ukraine "On Additional Measures for State Support of Gifted Youth",* 2000).

An important element of innovations in the education of gifted youth is also the intensification of research on the education and upbringing of gifted children, to develop methods and programs for working with such children to expand the network of experimental institutions for their testing. The Decree also ruled:

- create a charitable fund to support gifted youth;
- ensure the holding of all-Ukrainian Olympiads, competitions and creative contests;

- intensify the work of specialized education institutions to develop the talents of children and youth, children's cultural institutions, sports schools and sections, out-of-school education institutions, accelerate development of the regulatory framework to regulate the activities of these institutions;
- create proper working conditions, living conditions, improvement of living conditions, material and moral incentives for teachers working with gifted youth, etc. (ibid.).

The "Program of Work with Gifted Youth" (for 2001-2005) was developed in order to create favorable conditions in Ukraine for the development of creative potential of gifted youth, search, support and encouragement of gifted children and youth, self-realization of creative personality (*Decree "On the Program of Work with Gifted Youth"*). The document outlines a number of tasks that can ensure the development of scientific and theoretical foundations and relevant general and special methods and programs for identifying, developing and supporting gifted children, students, young scientists and creative workers.

In addition, according to the requirements of the normative act, special courses for training teachers to work with gifted students should be introduced into curricula and programs, scientific and methodological recommendations for the formation of psychological and physiological stability, prevention of stress, mental, emotional and other overloads of gifted young people (ibid.).

The Concept of General Secondary Education states that the education of the XXI century – is an education for a person who has the ability to think critically, develop and learn independently. It is distinguished by the ability to process a large amount of diverse information, use the acquired knowledge and skills for creative problem solving. The concept also states that the school should enable the student to develop in various ways. It promotes harmonious social, physical and intellectual development. And integration of knowledge allows us to better take into account the defining feature of students.

Changes have taken place in all disciplinary areas. Health function has become one of the key to the school. Physical education has become more important and is reflected at the interdisciplinary level. It also led to the recognition of abilities in athletically gifted students.

A key event for Ukrainian education was also the Concept of the State Program of Work with Gifted Youth, approved for the period from 2006 to 2010. The concept was developed by the Ministry of Education and Science of Ukraine to "support gifted youth by creating conditions for their creative, intellectual, spiritual and physical development" (*Order of the Cabinet of Ministers of Ukraine…,* 2006).

The Concept outlines the main problems that hinder the filling of various talented staff in various fields. There is an inefficient use of intellectual and creative potential of gifted youth and the lack of favorable conditions for the realization of their abilities (intellectual, physical, etc.). The reasons for this situation include:

- weak material and technical base, research and experimental base;
- lack of targeted funding to work with gifted youth;
- lack of systematic work with gifted youth, lack of proper legal, organizational, scientific and methodological support;
- the need to systematize the forms of social protection of gifted youth by the state (ibid.).

In 2007, the State Targeted Program for Work with Gifted Youth for the period 2007-2010 was approved, aimed at identifying gifted youth and creating conditions for providing systematic support to gifted youth and their creative, physical, spiritual and intellectual development. The main goal of the program was to educate citizens in the spirit of patriotism and democratic values. It is important to mention that the tasks of the program almost duplicated the previous one, but in a somewhat abbreviated form, but this program was recommended by the Ministry of Education and Science of Ukraine as a basis for developing regional programs to work with gifted youth. Among the tasks of the Program are:

- expanding opportunities for international cooperation to improve pedagogical technologies for identifying, educating and training gifted youth;

- ensuring coordinated activities of central and local executive bodies and local self-government bodies, education institutions and public organizations for the development of gifted youth;
- improving the regulatory framework, increasing the level of scientific and methodological support for working with gifted youth;
- raising the status of gifted youth in society;
- identification of key areas of work with gifted students, introduction of innovative methods of work (*Resolution "On approval of the State target program of work with gifted youth for 2007-2010"*).

The approval of the above-mentioned programs and decrees drew the attention of the out-of-school institutions to the issue of education and upbringing of gifted youth. This is evidenced by the Decree of the President of Ukraine on Urgent Measures to Ensure the Functioning and Development of Education in Ukraine for 2000-2010. The main thing that determines the state policy in the field of the out-of-school education is the Law of Ukraine "On Extracurricular Education" (2001). An important step in the development of the out-of-school education for gifted youth was adoption of a number of laws to preserve the potential of talented and gifted children. State and Public Creative Association Minor Academy of Sciences of Ukraine has become one of the centers of support for gifted youth in Ukraine The Minor Academy of Sciences has launched a number of activities aimed at creating additional opportunities for teaching intellectually and academically gifted children work (Boichenko, 2018).

At this time, education of the gifted is based on the achievements of previous years. However, in our opinion, the above tasks have not yet been fully resolved. These include insufficient legal support in the provision of educational services and socio-pedagogical support for gifted students. There is also the ineffectiveness of outdated methods of finding gifted students, the reduction of public funding of the out-of-school education institutions. Instead, the number of private out-of-school institutions, where fees for services are too high for some sections of the population, has increased. Because of this, not all children have the opportunity to reach their potential and develop their abilities.

Ukraine's integration into the European area requires development of new creative directions of work with gifted youth, improvement of the legal framework for the organization and improvement of scientific and methodological support of work with gifted youth, creation of scientific and methodological basis for developing effective systems of identification, training and vocational guidance, etc. (ibid.).

Changes in the system of general secondary education give good prospects for the development of creative potential of student youth. The concept of "New Ukrainian School" is aimed at educating a comprehensively developed, holistic personality. In light of this concept, students need an active position of a patriot who will be able to think critically, make responsible decisions and be creative in solving problems. The key components of the new school are presented in Figure 1.

A very important place in the "New Ukrainian School" is given to STEM-education, as evidenced by the development of critical thinking and the ability to independently find the necessary information. Introduction of STEM education reflects global trends in the development of education for gifted and talented children. Therefore, further development of a gifted person is impossible without this component of the concept of "New Ukrainian School" (*New Ukrainian School*, 2016).

The policy and organization of sports education of student youth in Ukraine is also on the path of reform and continuous improvement. The main normative document regulating the education of gifted schoolchildren is the Constitution of Ukraine. Physical education of students and sports education are regulated by the Laws "On Education", "On Physical Culture and Sports", the State Program for the Development of Physical Culture and Sports in Ukraine, approved by Presidential Decree of 22.06.94 № 334/94, Resolution of the Cabinet of Ministers of Ukraine from

02.04.98 N 422 “On the concept of physical education in the education system of Ukraine” and so on.

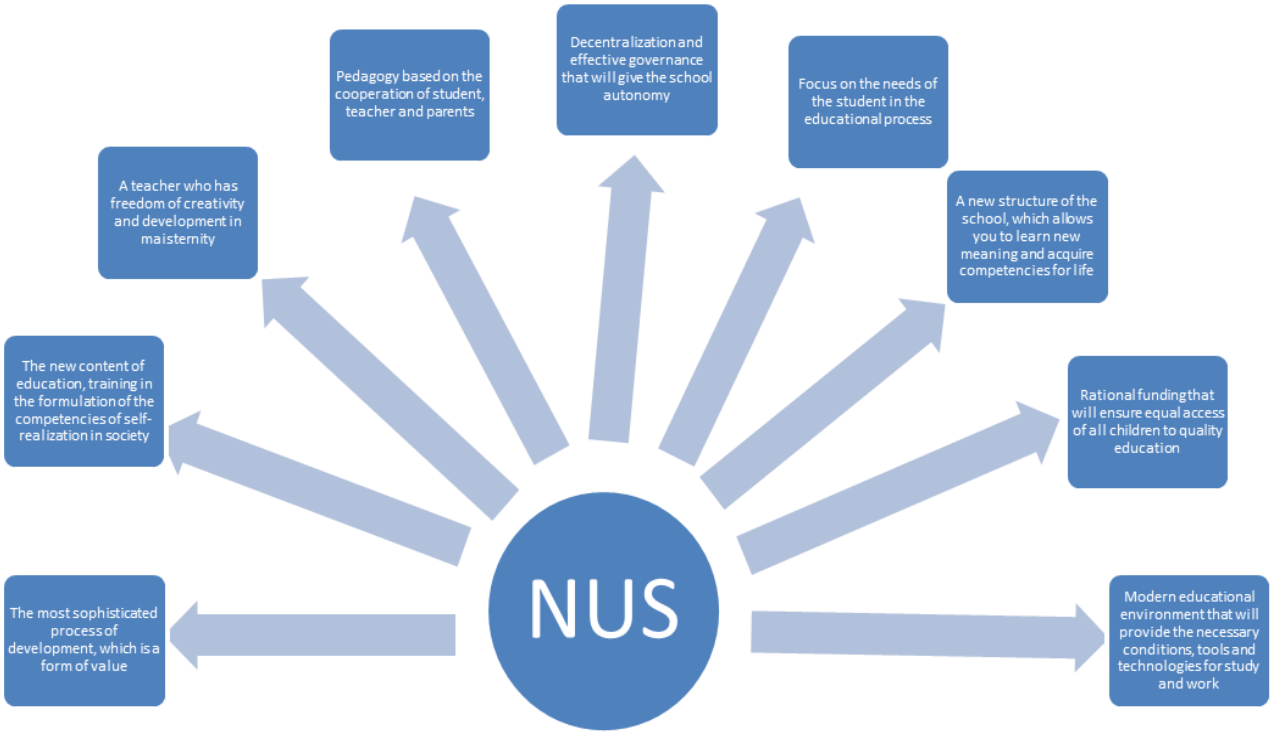

Fig. 1. Key components of the new school

The general provisions of the above laws, programs and regulations state that physical education plays a very important role in shaping the body of the younger generation, strengthening and maintaining its health, preparing for future professional activities and protecting their homeland.

In accordance with the above-mentioned Law “On Education”, regulatory documents (hereinafter “requirements”) have been proposed, which are designed to improve physical culture and health and sports and mass work in preschool, secondary, vocational and higher education institutions. Including:

1) state requirements for the system of physical education of children, pupils and students;
2) state requirements for curricula on physical education in the education system;
3) regulations on tests of physical education.

The law provides for the organization of work on physical education, physical culture and sports work in education institutions of all types and levels of accreditation, provides scientific and methodological support for this work during the educational process and in extracurricular activities; there is medical care. For the proper functioning of the system of physical education, the requirements recommend the following norms:

- medical care for students and teachers;
- medical control over the health of pupils;
- medical and pedagogical observations;
- medical examination as needed;
- division of students into groups.

The school must organize free medical care, be carried out by the institutions of the central executive body that implement the state policy in the field of health care, departmental health care institutions in accordance with current legislation (*Law of Ukraine “On Education”,* 2017).

According to the organizational and pedagogical indicators of the above requirements, the heads of education institutions must organize the educational process and extracurricular activities in physical education in accordance with the approved regulations. The system of physical

education of the younger generation of Ukraine is based on the principles of individual and personal approach, the importance of health and health orientation, the widespread use of various tools and forms of education (ibid.).

Regarding the strategic goals of physical education of student youth, the requirements include:

- formation of students' physical, moral and mental health;
- students' awareness of the need for physical improvement;
- development of interest and habits in independent physical education and sports;
- acquisition of knowledge and skills of a healthy lifestyle.

Sports education of student youth is realized through physical education, physical training, sports training, independent classes and participation in mass sports and health and sports events. In preschool, secondary and vocational institutions, the basis of sports education is the subject of "Physical Culture". The subject is introduced as compulsory and is determined by state educational standards. The content of classes is determined by curricula based on the principles of prognostic pedagogy and taking into account the age, physiological and functional characteristics of student youth.

The requirements state that sports education in the classroom should be provided with appropriate didactic complexes, special methodological materials, agreed state system for testing the effectiveness of physical education, teaching staff, logistical and regulatory framework and budget funding. The main means of sports education of children and youth include *sports exercises, health properties of nature* and *hygienic standards*. There is also a ban on drugs that can harm the physical and mental health of students.

The nature of physical education is such that in his classes, as a rule, priority is given to the development of physical and motor skills in students. Thus, young people are taught to expand their athletic abilities, achieve better coordination, faster reaction, greater speed, endurance, flexibility, balance and strength.

In addition to physical education lessons, schools practice various extracurricular activities:

- physical culture and health classes outside the lesson;
- classes in sports clubs and sports sections;
- classes in general physical training groups (GFC);
- classes in groups of therapeutic physical culture (TP),
- classes in sports schools, interest clubs, sports classes;
- classes in sports departments of higher education institutions;
- classes in regional sports clubs;
- independent sports exercises (homework in physical education), etc.

Normative indicators of state requirements and provisions on sports education of student youth of Ukraine are important. Physical education of students in schools is regulated and provided by a system of state regulations, which are criteria for the effectiveness and quality of sports education. For all types of education institutions are defined:

- volume of motor mode;
- minimum number of compulsory classes per week during the entire period of study (accounting in academic hours);
- sanitary and hygienic norms of sports activities;
- standards of sports training of students;
- norms of financial and logistical support (per student).

The number of physical education classes for secondary and education institutions is determined by the approved State Education Standards. Normative indicators are approved by the Cabinet of Ministers of Ukraine. An important place in sports education is also played by the scientific component. This applies both to improving the system of sports education and improving the skills of specialists in the subject. The development of the system of sports education requires fundamental, theoretical and practical research and involves:

- development of the concept of further development of science in the field of physical culture and sports;
- introduction of new forms of organization and management of scientific activities in the field of sports education;
- development of normative bases of physical education of student youth taking into account influence of adverse ecological factors;
- creation of computer technologies for the development of individual programs and plans for sports training of students;
- development of the program of actual directions of scientific researches on physical culture and sports;
- creation of a data bank of scientific developments made in Ukraine in previous years (*Law of Ukraine "On Education",* 2017).

The Law "On Physical Culture and Sports" is important for sports education in Ukraine. Within the framework of this law, everyone has the right to play sports, independently choose a sport and physical culture and sports services, special sports education and act within it, etc. State policy in the field of physical culture and sports is based on the following principles:

- recognition of physical culture as an important factor in personality development and formation of a healthy lifestyle;
- ensuring the safety of life and health of persons engaged in physical culture and sports, participants and spectators of sports and physical culture and health events;
- creating conditions for social and legal protection of citizens in the field of physical culture and sports;
- affirmation of ethical and moral values of physical culture and sports;
- guaranteeing equal rights and opportunities for citizens in the field of physical culture and sports;
- providing support to public associations of physical culture and sports;
- providing conditions for the support of physical culture and sports;
- ensuring access of persons with disabilities to sports facilities, etc. (*Law of Ukraine "On Physical Culture and Sports",* 1994).

The above law provides for the organization and opening of sports clubs where you can do different sports. The founders of sports clubs can be individuals and legal entities. Public authorities and local governments encourage and promote the activities of sports clubs by providing organizational, methodological and other assistance. Sports clubs provide development of certain areas of sports, carry out health or sports activities and provide sports services (ibid.).

The law also provides for the opening of children's and youth sports schools, which are instituctions of specialized extracurricular sports education, institutions of physical culture and sports, which ensure the development of students in the chosen sport recognized in Ukraine, create the necessary conditions for harmonious education, physical development, full rehabilitation, meaningful recreation and leisure of children and youth, self-realization, acquisition of healthy lifestyle skills, training of athletes for reserve sports.

The Regulations on Children and Youth Sports School are responsible for the establishment of children's and youth sports schools. This Regulation applies to different types of sports schools, regardless of their subordination and form of ownership, including:

- complex children's and youth sports schools;
- children's and youth sports schools in sports;
- children's and youth sports schools for people with disabilities;
- specialized children's and youth sports schools of the Olympic reserve;
- specialized children's and youth sports schools for people with disabilities of the Paralympic and Deaflympic reserve.

The sports school in its structure must have departments for certain sports and other departments, which provides for its charter and meet the purpose of the sports school. The sports department of a sports school may include the following groups:

1. initial training, in which the training process is carried out at the initial stage of training to identify sports abilities (this should take into account the characteristics of the chosen sport, facilities, level of mastery of techniques and tactics of the chosen sport, general and physical training, etc.) ;
2. basic training, in which students who have completed training in groups of initial training are trained (additional recruitment to groups according to the established control standards is also carried out);
3. specialized training, in which promising students continue their education and training;
4. preparation for higher sportsmanship, which improves individual technique and tactics in the chosen sport at the stage of preparation for higher achievements, increasing the amount of educational and training work and competitive practice to maximize individual opportunities at national and international sports competitions. Besides, groups for physical culture and rehabilitation training and improvement of the physical condition of students may be provided in children's and youth sports schools for persons with disabilities, specialized children's and youth sports schools for persons with disabilities of the Paralympic and Deaflympic Reserve.

In addition to the above-mentioned schools and clubs, Ukraine provides for the establishment of specialized sports education institutions with specific learning conditions. Such institutions provide selection and sports training of the most talented children and youth, create conditions for the development of their individual abilities in order to achieve high sports results and replenish national teams in combination with students' education.

Also, for the effectiveness of education of gifted youth, creation of schools of higher sportsmanship (hereinafter – SHS) is provided. In such schools, athletes of reserve sports and sports of the highest achievements are trained by holding regular training camps and participating in relevant competitions. Regulate the work of these schools Regulations on the school of higher sportsmanship (ibid.)

SHS are designed to prepare students-athletes of reserve sports and sports of the highest achievements for joining the national teams (national teams of Ukraine, Olympic sports). The structure of SHS includes:

1) departments of one or more Olympic sports (formed from study groups of students who have met the requirements of the stage of preparation for sports improvement or higher sportsmanship;
2) department of game sports (sports game teams, which are composed of students-athletes of permanent composition, who have met the requirements of sports training for the relevant stages of training);
3) the SHS branch for Olympic sports (may be opened under certain conditions, which is regulated by the Regulations).

Among the requirements for students-athletes who study at SHS stand out:

- improving and raising the level of sportsmanship;
- observance of a healthy lifestyle, normal moral and ethical behavior, established sports regime and rules of personal hygiene;
- compliance with the requirements of medical control and compliance with anti-doping legislation;
- implementation of sports training programs and individual training plans in order to achieve the planned sports results;
- participation in competitions and training camps provided for in the individual and calendar plans of sports competitions and training camps;

Among the education institutions where gifted children can play productively are also Olympic training centers. Institutions of physical culture and sports acquire the status of Olympic

training centers by the decision of the central executive body in the field of physical culture and sports on the basis of the requirements specified in the regulations on the Olympic training center. Athletes of national teams in Olympic sports are trained in such centers. Training takes place in specially prepared complexes for living and training (*Law of Ukraine "On Physical Culture and Sports",* 1994).

Summer schools for the gifted are also an important public facility for the sports education of young students. Summer schools are a form of work with gifted students during the holidays. The work of summer schools is regulated by the Law of Ukraine "On Health and Recreation of Children", which also manages the work with gifted students. According to the mentioned law, the work of summer schools can be organized in the form of profile or thematic changes in health facilities and recreation facilities:

1) profile change – the period of the child's stay in a children's health and recreation institution, where the child receives a range of services aimed at developing certain abilities and interests (sometimes tourism, sports, additional education, young biologists, mathematicians, environmentalists and others);
2) thematic change – health or recreation change, during which the child in addition to health and recreation services receives a range of additional services aimed at developing his/her abilities and interests (in extracurricular education, physical education and sports, social rehabilitation, social protection, etc.) special program (*Letter "On the organization of summer schools for gifted children"*).

The purpose of the summer schools is to attract talented students to work in the field of their interest. We will consider the main tasks of the summer school in Table 1.

Table 1

Tasks of summer schools for sports gifted students

Number	The essence of the task
1	development of students' interest in research, design, inventive or sports activities, creating conditions for meaningful leisure for children
2	identification and selection of students who have non-standard creative thinking, abilities and further development of such students
3	involvement of students in physical culture self-improvement
4	definition of forms and methods of work with sports gifted children
5	creating a team environment, psychologically comfortable for each child climate, formation of teamwork skills
6	implementation of the idea of uncontinuing education by preparing gifted students to continue their studies in higher education institutions and continue working in big sports

A prerequisite for the regulatory framework governing the sports education of students in Ukraine is the focus on modern international standards in the field of physical culture and sports, combining national traditions and achievements with world experience in this field. World educational trends advocate the position that the basis of education of gifted students should not be an education institution, but the curriculum and educational services, which determine the content of the educational process.

Regulatory framework for education of sports-gifted student youth in Poland

Recently, there has also been an increase in interest in the education of gifted significantly influenced the development of changes in the education system for the education of gifted students since 1991. In this context scientists often refer to the experience of the European Union on gifted education. In Polish scientific discourse there are several terms to define abilities:

1) *naturalne zdolnosci, sklonnosci* – abilities, gift, natural abilities;

2) *zdolnosci* – genius;
3) *uzdolnienia* – skills;
4) *uzdolnienia* – skills and abilities;
5) *uzdolnienia kierunkowe* – specific abilities;
6) *zdolnosci tworcze* – creativity;
7) *talent* – talent;
8) *cudowne dziecko* – prodigy;
9) *geniusz* – genius and others (Limont, 2010).

The term "giftedness" is usually referred to the intellectual and academic abilities of a student, as they are related to the speed of learning and logical thinking. But the general term "ability" refers to a person who has certain talents. A person who has specific abilities (talents) can achieve high results in a particular field of activity. It can be mathematics, fine arts, music or sports.

The Constitution of the Republic of Poland is a legal document that provides equal access to education for young students with different educational needs. Education documents do not provide a formal definition of giftedness, although there is a number of laws and regulations that mention abilities. Currently, Poland is undergoing a transformation of its fundamental structures and social systems, including the education system. The reform of the education system began in 1998. The reform contributed to the adoption of new laws on the possibility of educating gifted students. The Law on School Education in Poland (September 7, 1991) states that the education system should provide support to highly gifted students, allowing them to work on individual curricula and finish school in a short time.

The Ordinance of the Ministry of National Education and Sport (December 19, 2001) adds that the specific abilities and interests of students should be developed by adjusting the volume and speed of learning according to individual needs and opportunities of students. Psychological and pedagogical criteria can be used to determine a student's abilities. Psychological criteria measure the level of intelligence and specific abilities, including character and individual personality traits, and pedagogical determines student achievement. In Poland, the needs of gifted students are supported by national scholarship systems, subject competitions, tournaments, competitions, the activities of the Association of Creative Schools (Towarzystwo Szkol Tworczych), the Polish Children's Fund (Krajowy Fundusz na Rzecz Dzieci), and the activities of education institutions (*Ministerstwo Edukacji Narodowej*, 1999).

Gifted students in Poland have the right to an individual curriculum for one or more students or to take all compulsory subjects. Under such a program, a student can process the amount of information for 2 years during one academic year, be exempted from classes, attend selected classes in the upper classes or complete the curriculum independently. This system allows you to finish school early. Gifted students can participate in university classes according to their abilities. If a student with exceptional abilities in a certain field cannot meet the requirements of school subjects not provided for in the individual curriculum, the educational requirements for these subjects may be adjusted according to the individual capabilities of the student.

Gifted students have their own specific needs, which must be determined and met by their educational programs. Due to specific personality traits it is very important to provide psychological and pedagogical support to gifted youth. MEN together with the Center for Education Development worked on the system of pedagogical support for gifted students. The development of this project was completed in 2014.

The Polish Ministry of National Education (MEN) has been working to change the system of special education, which also includes education of gifted students. Documents developed by MEN state that a gifted student has the following characteristics: a high level of intelligence, creativity and strong motivation to learn. Such a child can show abilities in various disciplines, for example:

a. scientific abilities;
b. mathematical abilities;
c. linguistic abilities;
d. musical abilities;

e. visual and spatial abilities;
f. kinetic abilities;
g. intrapersonal and interpersonal;
h. existences and spiritual abilities, etc. (*Podstawa programowa*, 2009).

The aim of the new school education system in Poland is to increase the level of education of the population by promoting secondary and higher education, equalizing educational opportunities and improving the quality of education, which is understood as a holistic process of education and training in school. This goal is implemented to restructure compulsory education so that it can offer assistance in the rapid retraining of students to meet the needs of the labor market. Introduction of diagnostic tests and exams is carried out for greater comparability of school certificates. Normative acts responsible for reforming the education of gifted youth in Poland emphasize the need to meet the educational needs of gifted students. Particularly gifted students can complete individual curricula and training courses and receive the help of an individual tutor.

Poland has also introduced an experimental form of education – academic gymnasiums, which offer a shortened educational program: instead of the usual six-year program, a student can complete the entire amount of work in 5 years. The first such academic gymnasium was opened in Toruń in 1998. There are two ministries in Poland that regulate education: MEN and Ministry of Science and Higher Education. The Polish Ministry of National Education is responsible for the entire education system except higher education. There are also several art schools and correctional facilities under the Ministry of Culture and the Ministry of Justice. Accompanied by gifted students throughout preschool, school, universities, and out-of-school education institutions. We propose to consider the upbringing of gifted children at each stage of education in Table 2.

In Poland, there is a specialized school system for young students who are gifted in the arts and or in sports. Art schools allow highly gifted children and adolescents to receive individual education in music, fine arts, ballet and circus arts. The body responsible for art schools is the Ministry of Culture with the support of subordinate institutions such as the Department of Art and Cultural Education and the Centrum Edukacji Artystycznej (the Center for Artistic Education) (ibid.).

The music school system is a separate system that provides musically gifted children and adolescents with free individual music education. After graduation, they have an opportunity to apply to academies of music. Schools of fine arts work on programs of both general and art education. Students can obtain the title of professional artist in the following specializations:

- photography;
- marketing of works of art;
- visual advertising;
- graphics;
- sculpture;
- reconstruction;
- stage design and industrial design.

Applicants to schools of fine arts take practical exams that measure their artistic skills and aesthetic sensitivity. The ballet school system has a two-tier structure and includes a general ballet school or a dance school and a music academy with a 5-year cycle. Ballet and dance schools accept applicants based on their dance skills and provide education in the field of professional dance.

Students who excel in sports can continue their education in sports schools, sports championship schools and sports classes. Sports schools and schools of sports championships operate at different levels of education, i.e. as primary schools, primary schools and secondary schools. Starting from the first grade, in sports schools, schools of sports championships and sports classes there is a general education program in all sports and a specialized program of sports education only in such disciplines;

Table 2

Education of gifted students in Poland

Learning stage	Characteristic features
Pre-school education	• is not a compulsory stage of training; • aims to develop in a comprehensive and harmonious manner all aptitudes of children; • children can receive further education in such areas as the English language, music, chess, and sports fnd other; • children with musical abilities are identified, and are subsequently referred to the 1st level music schools; • children with a high IQ may enter primary schools earlier
Primary Education	• general education in primary school is divided into two stages: The first stage of education includes Grades I to III of primary school (integrated teaching) and the second stage of education includes Grades IV to VI of primary school; • children with a high IQ can begin their education earlier (at the age of six), with the option of individual schooling; • children can skip one or two grades; • children are supervised by individual mentors and take part in various extracurricular activities on the school; • children can visit circles, workshops and interest centers outside school run by education institutions and centers (mathematics, arts, music, biology, sports and other topics, depending on students'educational needs); • children undergo psychological counseling; • children continue their education in gymnasiums (from the age of 13 to 16) after passing final examinations in primary school
Lower Secondary Education	• schools offer subject modules and complementary subjects that are open to selection, artistic classes, and practical and technical classes; • education is pursued under individual learning arrangements, correlated with comprehensive extracurricular classes held in school, and co-operation with university teachers and pupils' participation in classes held at the university
General Upper Secondary Education General Upper Secondary Education	• general upper secondary school is open to candidates who have successfully graduated from lower secondary schools • general upper secondary school is open to candidates who have successfully graduated from lower secondary school; • gifted students are offered extracurricular activities that enrich their knowledge of selected subjects; • gifted students are offered extracurricular activities that enrich their knowledge of selected subjects; • there are specialized classes at lower secondary school and general secondary school, which allow students to choose their own educational directions; • at lower secondary school, students' strengths and weaknesses are identified; • at general secondary school, students' individual interests and skills are developed
Postsecondary school	• gifted students continue their education, depending on their abilities and interests; • postsecondary schools are organized for young people (aged 19-21) and adults, and provide courses in more than 20 groups of specialization

- swimming;
- gymnastics;
- acrobatic gymnastics;
- figure skating;
- downhill skiing;
- Pingpong.

The junior high school provides specialized training in these disciplines, as well as a curriculum in other sports, which later continues in high school. Applicants are admitted to sports schools who are in very good health and have good results on the physical education test and have the written consent of their parents or guardians.

Significant attention is paid to sports education in Polish schools, as it is an important element of health education. Sport also contributes to the development of active citizenship. Sport attracts Polish citizens and most people take part in sporting events on a regular basis. This creates such important values as team spirit, solidarity, tolerance and justice. Reforms in the field of physical education in Poland give rise to the outline of the normative principles of school physical education for full awareness of these changes. The need to reform the education system in Poland was mainly due to such factors:

- dominance of boredom and fear in schools, which led to low emotional state of students, authoritarianism of leaders, as well as aggression among students;
- pedagogical conservatism of teachers, whose teaching was focused mainly on memorizing the program material and did not create appropriate conditions for the activation of students, their creativity and independence;
- lack of unity between the content of education and the needs, interests and desires of young people;
- inconsistency of the content of school education with the requirements of society;
- low efficiency of individual approach to students by teachers in the educational process, etc.

Significant changes in the Polish education system are related to the adoption of the Law on Amendments to the Education System (1990). In 1991, the Law on the Education System was amended to make the school a health-friendly learning environment. A further step towards health education was Poland's accession to the European Network of Health Promotion Schools, set up by the World Health Organization, the European Regional Office, the Council of Europe and the European Commission, which continues the international dimension of the program. The main goal of "Schools of Health Promotion" (Szkołę Promującą Zdrowie) strengthening of the health of children of different age categories (Bierkus, 2017).

Undoubtedly, the key moment for Poland was creation of the European Physical Education Association (EUPEA). Its purpose is to study the experience of physical education of children and youth of the European countries (mostly those of the European Union), as well as finding the most effective ways to improve the system of physical education of schoolchildren and students, providing advice to specialists in physical culture continent. The Congress in Madrid (1991) adopted the EUPEA Declaration, with which its participants addressed the governments of the member states of the European Society for Physical Education. The Declaration emphasizes that the subject of "Physical Education" is one of the main in the curriculum of secondary school. In Polish schools, the principal positions in the education system for children and young people are now mandatory, which we propose to consider in Figure 2.

The Declaration notes that the effectiveness of students' sports education largely depends on a clear, scientifically sound program in this subject, which will provide available physical education and sports for students of each class, as well as various forms of physical activity. This means that every student, regardless of age, can perform useful, interesting and feasible physical exercises, participate in moving and sports games, enrich their motor experience, gain the necessary knowledge of valeology (Bierkus, 2017).

Since 1990, the main organizational forms of physical education in all types of Polish schools have been two compulsory physical education classes, corrective gymnastics classes for students with musculoskeletal problems, therapeutic physical education classes for students in special medical groups, and classes in sports sections in free time. For primary school children with posture problems, corrective exercises were performed twice a week.

The increase in the number of students who lead a sedentary lifestyle, are often ill and have insufficient physical training, contributed to the adoption of the Law "On Physical Education" (Ustawa o kulturze fizycznej, 1996) (*Ustawa z dnia 3 października 2008 r. o zmianie ustawy o kulturze fizycznej*).

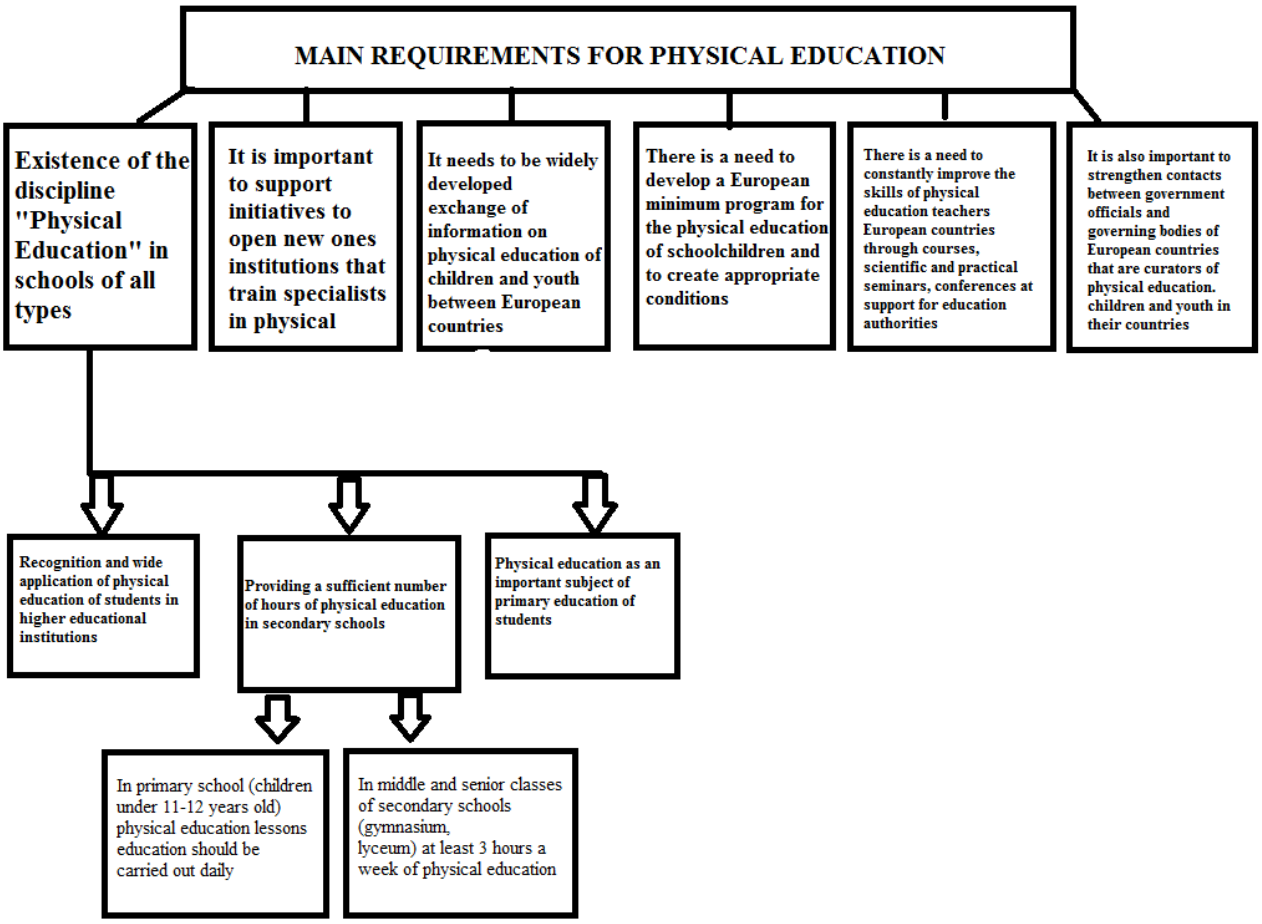

Fig. 2. Main requirements for physical education

Articles of the law emphasize that physical education is part of the national culture and is protected by law. Citizens, regardless of age, gender, religion, race and special needs, have equal rights to engage in various forms of physical education. The Law draws attention to the main ways of leading a healthy lifestyle – physical education, sports, recreation, and physical rehabilitation if necessary. It is also said that kindergartens, schools, universities should provide physical education. To educate junior students in the desire to become famous athletes in the future and adhere to the relevant health conditions, it was decided to create sports schools or athletics schools, which will implement training programs in specific sports. The adoption of this law should help improve the children's physical health.

The law provides for a gradual increase in compulsory physical education lessons (up to five per week) in all types of schools. The content of these classes depends on the capabilities of the

school's sports facilities, geographical and climatic conditions of the region, the interests of students, the professional training of physical education teachers. Each student chooses which elective classes (in a group) he will attend. They can be conducted in the form of:

1) recreational and sports activities;
2) mobile and sports games;
3) corrective gymnastics and therapeutic exercise;
4) swimming, aerobics, rhythmic or gymnastics,
5) tourism (Edginton, 2015).

For students who have the ability to play sports, schools create classes in the relevant sport, which are provided by the program of physical education. A large number of young athletes attend sports schools and schools of sportsmanship (Olympic reserve). The activities of sports classes and sports schools are funded by the Ministry of Tourism. It should also be noted that since 1989 private schools have been opened in the country. The subject of "Physical Education" in these schools have the same requirements as in public education institutions of general secondary education. In 1997, Poland developed the "National Health Program", which focuses on various ways to improve the health of schoolchildren, physical fitness and increase physical activity of the entire population.

The national program orients the teaching staff of schools to involve at least 50 % of students in regular physical education and sports in their free time. However, one of the significant problems that hinders the deployment of sports and mass work in secondary schools is the material base. Among rural schools, only 30 % have gyms and 85 % sports grounds. As for urban schools, the situation is somewhat better: more than 80 percent of them have gyms and about 90 percent have sports grounds.

In 1999, the Ministry of Education and Sports reserved the right to determine the basic content of knowledge, skills, and abilities in all disciplines and to develop a compulsory curriculum for primary school, gymnasium, and lyceum. Teachers were given the right to implement in their pedagogical activities independently compiled author's programs, students were allowed to use alternative textbooks. Teachers were given the opportunity to choose from a variety of educational programs (ibid.).

The reform of sports education has set the following tasks for a physical education teacher:

- supplementing and consolidating the knowledge needed by students to use conscious and systematic physical activity as a condition of a healthy lifestyle and rational care for the body's readiness to counteract the negative effects of civilization;
- accustoming students to independent actions in the direction of harmonious physical development, as well as taking care of the appropriate level of physical fitness;
- preparing students to perform the functions of an organizer and active participant in various forms of physical activity, as well as spectators and fans of sports competitions;
- organization of lessons of physical culture education and optional classes in physical culture and sports, where special attention is paid to various forms of physical activity of student youth.

The development of society and changes in educational trends in Poland in 1999 also caused a number of reforms. Thus, on September 1, 1999, the Law "On the Reform of the Education System" came into force, which facilitated the transition from a two-tier to a three-tier system. The reform program developed by J. Buzka helped increase the duration of secondary school education and improve the system of external testing and control carried out by the Central Examination Commission. The discipline "Physical Education" was designed to implement a health function.

The system of physical education is closely connected with the systems of education, health care, defense, material production, culture, science and develops under the influence of the changes taking place in them. Athletically gifted students raise countries among others in rankings among a variety of sports. Realizing its pedagogical functions, the system of physical education is also able to solve problems of moral, aesthetic, intellectual development, achieving success where other systems are ineffective.

The European Commission has been paying close attention to the problems of physical education and sports in the EU member states since 2007, when the "Report on Sport" was published (*White Paper on Sport, 2007*), which states that increasing the number of compulsory hours for physical education at school and intensifying extracurricular activities in the field of sports can have a positive impact on improving the health of children and young people in the EU member states. Its main goal is to determine the role of sport in the daily lives of Europeans. The report recognizes the impact that sport can have on all spheres of life, as well as identifies the needs and specific characteristics of the world of sport. The main objectives of the "Sports Report" are:

- definition of strategic directions of work;
- encouraging discussion of specific issues;
- increasing the role of sports in shaping national policy;
- highlighting the needs and specific characteristics of the sector;
- finding out the appropriate level of government involvement in determining next steps;

In detail, the Report states that:

- the sporting dimension was present in all areas of European politics;
- legislative transparency in the sports field has created the conditions for improving sports governance in Europe.

The Report covers the following main topics:

- social role of sport, i.e. what is sport as a social phenomenon;
- economic dimension of sport, i.e. the contribution of sport to development and creation of jobs in Europe;
- organization of sports, i.e. the role of all stakeholders and institutions (public, private, economic, sports, etc.) in management;
- sports industry (ibid.).

Evidence of increased attention to sport in the Member States of the European Union was adopted in 2011 by the European Commission Communication "Development of the European dimension in sport" *(European Commission,* 2013). According to him, the actions of the European Union are in line with the directions set by the Europe 2020 strategy and are aimed at social inclusion through sports and education.

The result has been the creation of a number of European Union programs, which are now integrated into the integrated Erasmus + program. Thus, the Erasmus + program provides support for activities in the field of education, training, youth and sports for the period 2014-2020.

We also consider it appropriate to consider the concepts of physical education that operate in the context of Polish sports education. We offer the following concepts of physical education, which are the basis of curricula and plans:

1. Pedagogical concept;
2. Personalistic concept;
3. Biological concept.

The pedagogical concept is based on the ideas of philanthropy. For many years, school education in Austria has been based on this concept. Movements within the programs in the spirit of this concept are considered a means of personal development of character, inner discipline, strength of spirit of the individual, social and aesthetic education of the pupil. Emphasis is placed on the ability to express oneself by means of movement, contact with others, comparison of one's own abilities with the abilities of other students. The motto of this concept can be briefly defined as "move, learn" (Peneva & Bonacin, 2011).

Physical education in this concept is considered a necessary component of general education of people. The purpose and objectives of physical education are related to strengthening the will, faith in the person, training concentration, as well as social and intellectual development. There is not much variety in physical education programs. The pedagogical concept involves development of the ability to interact, the desire to take risks, self-belief, responsibility and more. In this case, the content of the program will include orienteering, running games and relay races. The task of

teachers according to the concept is to ensure good organization and a comfortable atmosphere during classes (Crum, 1994).

Physical education is a separate element of the educational process. The educational process is an inseparable system, which is determined by the unity of purpose and basic principles that are outlined in the curriculum. Pedagogy is based on physiology and psychology, and physical education should be interpreted as the integrity of processes and people who are constantly changing in their attitude to the main educational ideals and goals in modern society. We propose to consider the essence of physical education within the pedagogical concept (see Fig. 3)

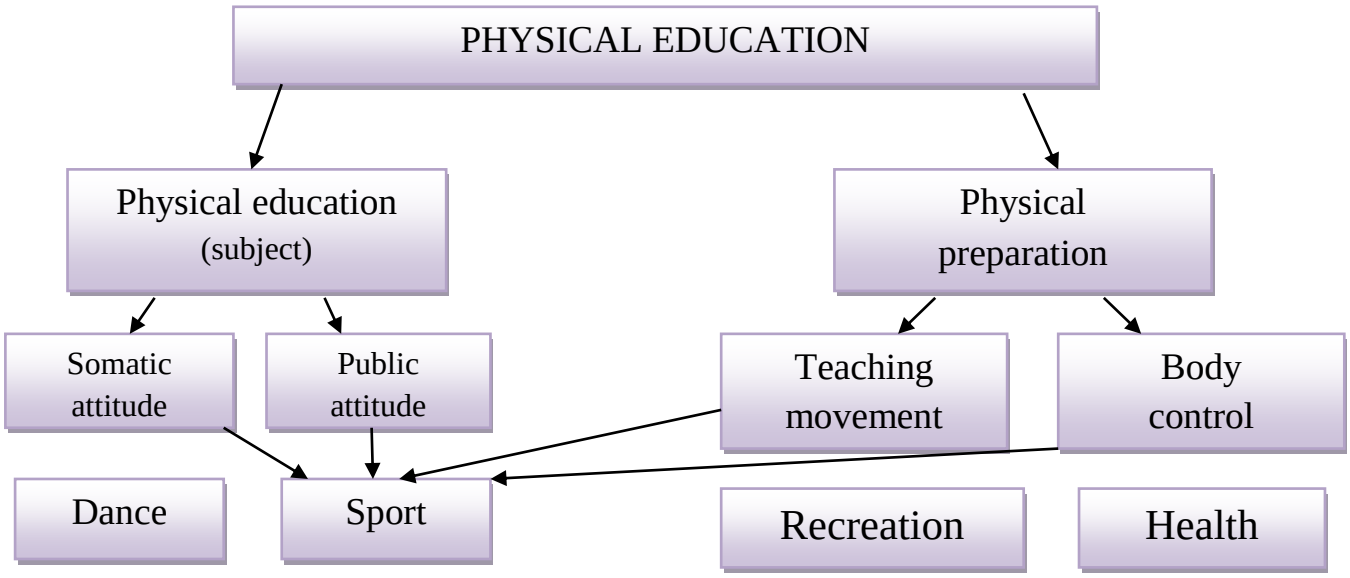

Fig. 3. Physical education as physical training and physical education (subject)

In addition to spontaneous motor activities (walking, running), it is important that children and young people benefit from physical education lessons at school. This has a number of advantages:

- protects against osteochorosis;
- increases bone strength;
- helps to reduce body weight and maintain appropriate weight;
- improves metabolism;
- reduces the likelihood of depression;
- improves mental state;
- increases self-esteem;
- improves physical condition;
- reduces the risk of disease;
- prevents excessive accumulation of fat in the body.

The term “giftedness” usually refers to the intellectual and academic abilities of a student, as they are related to the speed of learning and logical thinking. But the general term “ability” refers to a person who has certain talents. A person who has specific abilities (talents) can achieve high results in a particular field of activity. It can be mathematics, fine arts, music or sports. Man, performing the action, simultaneously realizes himself. Hence the main principles of physical education (sports education), their scope and content.

Personalism (Latin persona – dignity, personality) - the name of various philosophical and pedagogical areas, which are based on their theories of the characteristic issues of human individuality, perceived metaphysically. It concerns the individual, his role in the modern world, the

conditions of development, a person's attitude to their activities, technology, work, culture, art and social life (Limont, 2010).

The personalistic concept of sports education puts the personal and creative aspect in the forefront. A student of a modern school must be ready for self-education, self-education and self-study skills. You need to learn to work, learn to solve problems, create new life values for yourself. Physical education lessons are important in the context of this concept, as they are an integral part of the process of working on yourself and your body (see Figure 4).

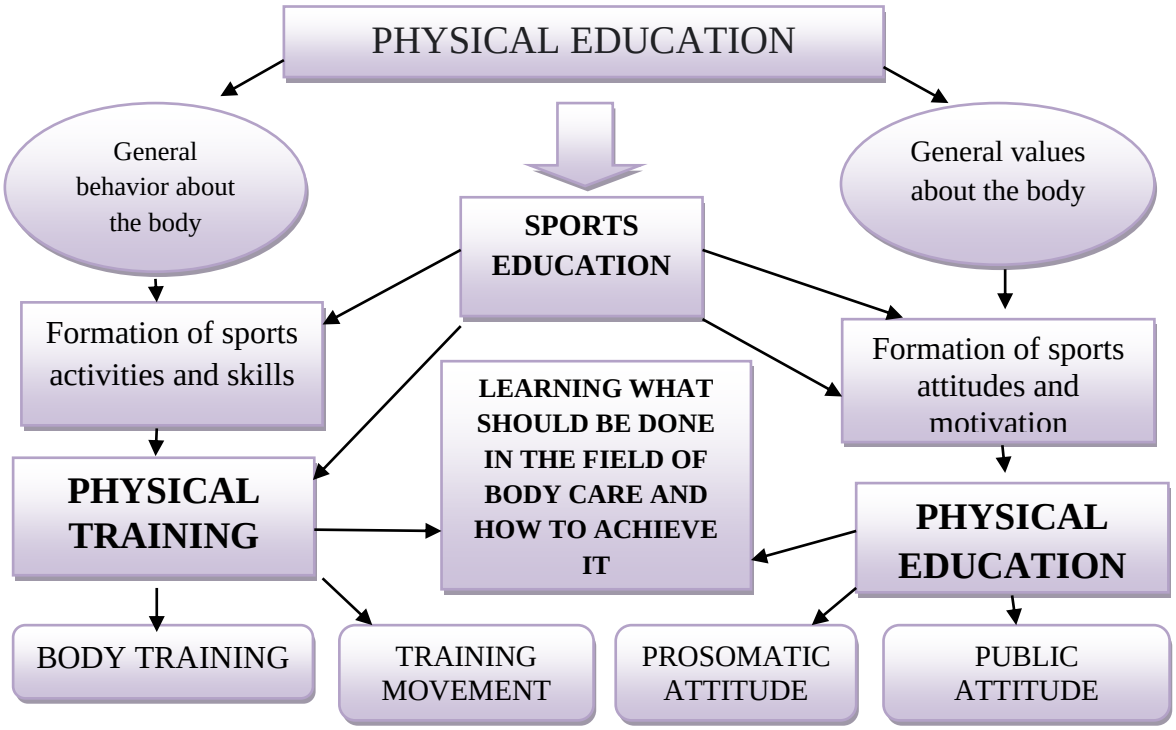

Fig. 4. Sports education as physical education

Therefore, the preparation and conduct of lessons are of great importance. Among the many elements that are considered in planning and conducting a successful lesson, the main thing is to outline its objectives. Goals and objectives are norms that determine educational standards that indicate the desired personality traits, physical characteristics, attitudes and behavior. They identify some general changes or transformations in this area.

The biological concept is based on knowledge of medicine and biology. Physical education programs based on this concept aim to develop and improve the physical condition of students, so they focus on components such as motor skills, strength, speed, flexibility, endurance, mobility, balance, coordination (Nakoneczna, 1993). According to this concept, physical education classes are conducted in order to biologically adapt the body's functions to the environment and its changes. Physical education involves a complex process aimed at improving the physical condition of students. The biological concept of physical education aims at education based mainly on the physical component.

The biological concept in physical education should be interpreted as part of a holistic process. In Poland, its main provisions were formulated by the scientist Andrzej Sniedecki, giving it a holistic vision. It can be argued that A. Sniedecki initiated the science of metabolism and was the first to outline life as a form of protein. According to his concept, man is a creation of nature that is able to develop public opinion (Skalski, 2018).

According to this concept, the main value of a person is health. It is a fundamental concept and subject of study of supporters of the biological concept. Physical education should bring certain biological results to the pupil. According to the general program, the purpose of training and

education in the field of physical culture is to create optimal conditions that provide children and youth:

1) harmonious physical development;
2) development of psychomotor skills;
3) development of the psyche;
4) providing students with the necessary knowledge in the field of physical education;
5) formation of the character and the desired way of life in both individual and team activities;
6) teaching the aesthetics of movement;
7) social integration;
8) cooperation and joint activities with teachers, parents and the community (ibid.).

Thus, the biological concept of physical education, to which an interdisciplinary approach is applied, is based on a fundamental principle. The point is that from the moment of birth, two influences should be directed at a person: one of them should be aimed at socialization, the other – at maintaining physical shape. Both influences are components of education as a multifaceted introduction to culture. The biological concept is closely linked to the healthy upbringing of young students in Poland. As evidenced by the large number of programs and plans developed on its basis (Polish EURYDICE Unit, 2011).

Conclusions

In conclusion, we can say that Ukraine and Poland are very responsible in developing plans, programs and approaches to the education of gifted students. Detailed provisions and instructions are disclosed in a number of legal frameworks of both countries. The development of support for gifted children began mainly with school initiatives. Even the initial stages of work on this issue and the first innovations have made it possible to identify gifted students and gifted students in other fields. Teachers and mentors also work with students at the school. At the present stage of development, innovations and educational experiments are being introduced that will be able to improve technologies and approaches to identifying gifted students.

References

Алфімов, В. М. (2015). Феномен обдарованості особистості у наукових дослідженнях зарубіжжя. *Духовність особистості: методологія, теорія і практика, 3 (66),* 13-19 (Alfimov, V. M. (2015). Phenomenon of gifted personality in scientific research abroad. *Spirituality of personality: methodology, theory and practice, 3 (66),* 13-19).

Антонова, О. Є. (2012). Проблема розвитку обдарованої особистості в Україні і світі: сучасний стан і перспективи. *Нові технології навчання, 73,* 8-15 (Antonova, O. Ye. (2012). The problem of development of gifted personality in Ukraine and the world: current status and prospects. *New Learning Technologies, 73,* 8-15).

Антонова, О. Є. (2006). Теоретико-методологічні підходи до вивчення природи обдарованості. *Педагогічний процес: теорія і практика, 1,* 7-17 (Antonova, O. Ye. (2006). Theoretical and methodological approaches to the study of the nature of giftedness. *Pedagogical process: theory and practice, 1,* 7-17).

Антонова, О. Є. (2012). Теоретичні та практичні умови створення науковопедагогічного супроводу обдарованої особистості в Україні (Antonova, O. Ye. (2012). Theoretical and practical conditions for the creation of scientific and pedagogical support of a gifted person in Ukraine). *Społeczeństwo i edukacja: Międzynarodowe Studia Humanistyczne, 2,* 386-399.

Баграмянц, М. Л. Основные этапы становления психологической концепции одарённости. *Вестник МГУ, 1,* 38-44 (Bagramiants, M. L. The main stages of formation of the psychological concept of giftedness. *Journal of MSU, 1,* 38-44).

Березівська, Л. Д. (2009). Реформування шкільної освіти в Україні у ХХ ст.: історіографія питання. *Історико-педагогічний альманах, Т. 1, № 10,* 15-28 (Berezivska, L. D. (2009).

Reforming school education in Ukraine in the twentieth century: historiography of the issue. *Historical and Pedagogical Almanac, Vol. 1, № 10,* 15-28).

Бобир, О. В. (2005). *Особистісні характеристики юнацтва з різними формами обдарованості* (дис. ... канд. психол. наук: 19.00.07). Дніпропетровськ (Bobyr, O. V. (2005). *Personal characteristics of youth with different forms of giftedness* (PhD thesis). Dnipropetrovsk).

Бойченко, М. А. (2014). Діяльність Європейської мережі підтримки таланту: процесуальний аспект. *Вісник Глухівського національного педагогічного університету імені Олександра Довженка. Серія: Педагогічні науки, 26,* 15-20 (Boichenko, M. A. (2014). Activities of the European Talent Support Network: procedural aspect. *Bulletin of Glukhiv National Pedagogical University named after Oleksandr Dovzhenko. Series: Pedagogical Sciences, 26,* 15-20).

Бойченко, М. А. (2015). Діяльність міжнародних організацій у сфері освіти обдарованих і талановитих школярів. *Педагогічні науки: теорія, історія, інноваційні технології, 5 (49),* 33-40 (Boichenko, M. A. (2015). Activities of international organizations in the field of education of gifted and talented students. *Pedagogical sciences: theory, history, innovative technologies, 5 (49),* 33-40).

Вітвицька, С. С. (2008). Моделі ступеневої педагогічної освіти західноєвропейських країн, США та України: порівняльний аналіз. В О. А. Дубасенюк (ред.), *Професійно-педагогічна освіта: сучасні концептуальні моделі та тенденції розвитку,* (сс. 71–103). Житомир: Видво ЖДУ ім. І. Франка (Vitvytska, S. S. (2008). Models of graduate pedagogical education in Western European countries, the United States and Ukraine: a comparative analysis. In O. A. Dubaseniuk (ed.), *Professional and pedagogical education: modern conceptual models and development trends,* (pp. 71-103). Zhytomyr: Publishing house of ZhSU named after I. Franko).

Григорова, Л. С. *Організація соціально-педагогічної роботи з обдарованими дітьми в Україні в 70–80-х рр. XX ст.* Режим доступу: http://www.nbuv.gov.ua/old_jrn/Soc_Gum/Pfto/2010_8/files/PD810_16.pdf (Hryhorova, L. S. *Organization of socio-pedagogical work with gifted children in Ukraine in the 70-80's of the XX century.* Retrieved from: http://www.nbuv.gov.ua/old_jrn/Soc_Gum/Pfto/2010_8/files/PD810_16.pdf).

Єрмакова, Т. С. (2010). Досвід формування здорового способу життя учнів старших класів у вітчизняній педагогіці (друга половина XX століття). *Педагогіка, психологія та медико-біологічні пролеми фізичного виховання і спорту, 5,* 56-65 (Yermakova, T. S. (2010). Experience of forming a healthy lifestyle of high school students in domestic pedagogy (second half of the twentieth century). *Pedagogy, Psychology and Medical and Biological Problems of Physical Education and Sports, 5,* 56-65).

Завгородня, Н. М. (2006). *Педагогічні умови соціалізації обдарованих учнів у навчально-виховному середовищі загальноосвітнього навчального закладу* (автореф. ... канд. пед. наук: 13.00.05). К.: Нац. пед. ун-т ім. М. П. Драгоманова (Zavgorodnia, N. M. (2006). Pedagogical conditions of socialization of gifted students in the educational environment of a secondary school (PhD thesis). K.: Nat. ped. Univ. named after M. P. Drahomanov).

Закон України «Про освіту» (2017). *Відомості Верховної Ради (ВВР), 38-39,* 380. Режим доступу: http://zakon.rada.gov.ua/laws/show/2145-19 (Law of Ukraine "On Education" (2017). *Information of the Verkhovna Rada (VVR), 38-39,* 380. Retrieved from: http://zakon.rada.gov.ua/laws/show/2145-19).

Закон України *«Про основні засади державної підтримки обдарованих дітей та молоді на Україні».* 1 січня 2005. Режим доступу: http://www.zakon.rada.gov.ua/ (*Law of Ukraine "On Basic Principles of State Support of Gifted Children and Youth in Ukraine".* January 1, 2005. Retrieved from: http://www.zakon.rada.gov.ua/).

Закон України «Про позашкільну освіту» (2001). *Освіта України. Нормативноправові документи,* (сс. 229-250). К.: Міленіум (Law of Ukraine "On Extracurricular Education" (2001). *Education of Ukraine. Regulatory documents,* (pp. 229-250). K.: Millennium).

Закон України *«Про фізичну культуру і спорт»* (1994). Режим доступу: https://zakon.rada.gov.ua/laws/show/3808-12#Text (*Law of Ukraine "On Physical Culture and Sports"* (1994). Retrieved from: https://zakon.rada.gov.ua/laws/show/3808-12#Text).

Здібності, творчість, обдарованість: теорія, методика, результати досліджень / за ред. В. О. Моляко, О. Л. Музики. (2006). Житомир: Вид-во Рута (*Abilities, creativity, talent: theory, methodology, research results* / ed. V. O. Moliako, O. L. Musyka. (2006). Zhytomyr: Ruta Publishing House).

Лист *«Про організацію роботи літніх шкіл для обдарованих дітей».* Режим доступу: https://zakon.rada.gov.ua/rada/show/v-518729-13#Text (*Letter "On the organization of summer schools for gifted children".* Retrieved from: https://zakon.rada.gov.ua/rada/show/v-518729-13#Text).

Нова українська школа (2016). Режим доступу: https://mon.gov.ua/storage/app/media/zagalna%20serednya/nova-ukrainska-shkola-compressed.pdf (*New Ukrainian School* (2016). Retrieved from: https://mon.gov.ua/storage/app/media/zagalna%20serednya/nova-ukrainska-shkola-compressed.pdf).

Постанова *«Про затвердження Державної цільової програми роботи з обдарованою молоддю на 2007-2010 роки».* Режим доступу: https://zakon.rada.gov.ua/laws/show/1016-2007-%D0%BF#Text (*Resolution "On approval of the State target program of work with gifted youth for 2007-2010"*. Retrieved from: https://zakon.rada.gov.ua/laws/show/1016-2007-%D0%BF#Text).

Постанова *«Про програму роботи з обдарованою молоддю».* Режим доступу: https://zakon.rada.gov.ua/laws/show/78/2001#Text (*Resolution "Program of Work with Gifted Youth"*. Retrieved from: https://zakon.rada.gov.ua/laws/show/78/2001#Text).

Постанова *«Про затвердження Положення про дитячо-юнацьку спортивну школу».*ВІд 5 листопада 2008 р. № 993 Київ. Режим доступу: https://zakon.rada.gov.ua/laws/show/993-2008-%D0%BF#Text (*Resolution "On approval of the Regulations on children's and youth sports school".* From November 5, 2008 № 993 Kyiv. Retrieved from: https://zakon.rada.gov.ua/laws/show/993-2008-%D0%BF#Text).

Розпорядження Кабінету міністрів України від 12 квітня 2006 р. N 202-р «Про схвалення Концепції Державної програми роботи з обдарованою молоддю» (2006). Режим доступу: https://zakon.rada.gov.ua/laws/show/202-2006-%D1%80#Text (*Order of the Cabinet of Ministers of Ukraine of April 12, 2006 N 202-r "On approval of the Concept of the State program of work with gifted youth"*. Retrieved from: https://zakon.rada.gov.ua/laws/show/202-2006-%D1%80#Text).

Указ Президента України «Про додаткові заходи щодо державної підтримки обдарованої молоді» (2000). Режим доступу: https://zakon.rada.gov.ua/laws/show/612/2000#Text (*The Decree of the President of Ukraine "On Additional Measures for State Support of Gifted Youth"* (2000). Retrieved from: https://zakon.rada.gov.ua/laws/show/612/2000#Text).

Bierkus, M., Skalski, D. & Lizakowski, P. (2017). *Bezpieczeństwo zdrowotne w aspekcie kultury fizycznej*. Wybrane problemy. Gdynia-Koszalin – Skarszewy: Kociewskie WOPR w Skarszewach.

Boichenko, M. (2014). Peculiarities of quality assurance in the European Universities. Матеріали *Міжнародної науково-практичної конференції «Інноваційний розвиток вищої освіти: глобальний та національний виміри змін», 4–5 березня 2014 р. (International Scientific and Practical Conference "Innovative Development of Higher Education: Global and National Dimensions of Change", March 4-5, 2014),* (pp. 42-45). Sumy.

Boichenko, M. (2016). Programs of future teachers' master training to work with gifted students. *Матеріали ІІІ Міжнародної науково-практичної конференції «Інноваційний розвиток*

вищої освіти: глобальний та національний виміри змін» (6–7 квітня 2016 року, м. Суми), Том 1 (Proceedings of the III International Scientific and Practical Conference "Innovative Development of Higher Education: Global and National Dimensions of Change" (April 6-7, 2016, Sumy), Vol. 1), (pp. 122-124). Sumy.

Boichenko M. (2017). Genesis of gifted education in Ukraine. *Педагогічні науки: теорія, історія, інноваційні технології (Pedagogical sciences: theory, history, innovative technologies), 2 (66),* 182-192. *DOI 10.24139/2312- 5993/2017.2/182-192.*

Boichenko, M. (2017). Role of international organizations in gifted education policy-making. *Україна – ЄС: крос-культурні порівняння в освітніх дослідженнях: матеріали І Міжнародної наукової конференції, 22–23 травня 2017 р., м. Київ (Ukraine - EU: cross-cultural comparisons in educational research: materials of the First International Scientific Conference, May 22-23, 2017, Kyiv),* (pp. 14-16). Kyiv – Drohobych.

Boichenko, M. (2018). Foreign concepts of giftedness: medical-biological aspect. *Хабаршы. «Педагогикалық ғылымдар» сериясы [Journal of educational sciences], 1 (54),* 4-10

Boichenko, M. (2016). The use of ICT in the process of pedagogical support of gifted school children: Ukrainian and foreign experience. *Scientific Letters of Academic Society of Michal Baludansky, 2,* 9-11.

Crum, B. (1994). A critical review of competing PE concepts. In J. Mester (Ed.), *Sport sciences in Europe 1993: current and future perspectives* (pp. 516-533). Aahen: Meyer & Meyer.

Dinold, M. (2013). Challenges of (inclusive) physical education (IPE) in Europe. *Journal of the International Federation of Physical Education, 83 (3),* 83-85.

Downs, D. S., & Hausenblas, H. A. (2005). The theories of reasoned action and planned behavior applied to exercise: A meta-analytic update. *Journal of Physical Activity and Health, 2 (1),* 76-87.

Edginton, C. R., & Chin, M. K. (2013). Joy in physical activity. *The Global Journal of Health and Physical Education Pedagogy, 2(2),* i-ii.

EIPET functional map for general physical education teachers in an inclusive setting (2018). Retrieved from: http://unescoittralee.com/wpcontent/uploads/2015/01/Functional_Map_-_3pp_English.pdf.

EUFAPA (2018j). *Poland.* Retrieved from: http://www.eufapa.eu/index.php/apa-ineurope/information-from-countries/46-poland.html.

European Commission (2008). *EU physical activity guidelines. Recommended policy actions in support of health-enhancing physical activity.* Retrieved from: https://eacea.ec.europa.eu/sites/eacea-site/files/eu-physical-activity-guidelines2008.pdf

European Commission (2014). *Special eurobarometer 412: sport and physical activity.* Brussels: European Commission. European Commission, Directorate-General for Education, Youth, Sport and Culture (2017). *Special Eurobarometer 472.* Retrieved from: http://ec.europa.eu/commfrontoffice/publicopinion/index.cfm.

European Commission. (2011). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Developing the European Dimension in Sport.* Retrieved from: http://eur-lex.europa.eu/legalcontent/EN/TXT/PDF/?uri=CELEX:52011DC0012&from=EN.

European Commission. (2015). *EU work plan for sport 2014-2017. Expert group on health-enhancing physical activity.* Retrieved from: http://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupDetailDoc&id=19860&no=1.

European Commission (2018). *Sport.* Retrieved from: https://eacea.ec.europa.eu/erasmus-plus/actions/sport.

Fairclough, S. & Stratton, G. (2015). Physical education makes you fit and healthy'.Physical education's contribution to young people's physical activitylevels. *Health Education Research, 20 (1),* 14-23. https://doi.org/10.1093/her/cyg101.

Fouque, A. (2000). Health education as a part of the P.E. curricula in Sweden an Germany (State of North Rhine-Westphalia) within the last ten years. In Tolleneer, & R. Renson (Eds.), *Old borders, new borders, no borders,* (pp. 351-362). Aachen: Meyer & Meyer.

Fox, K. R., & Biddle, S. J. (1986). Health related fitness testing in schools: introduction and problems of interpretation. *Bulletin of Physical Education, 22 (3),* 54-64.

Grabowski, H. (1997*). Teoria fizycznej edukacji.* Kraków: WSiP.

Grabowski, H. (2000). *Co koniecznie trzeba wiedzieć o wychowaniu fizycznym.* Kraków: Impuls.

Hardman, K. (1996). *The fall and rise of physical education in international context.* Symposium Paper, Pre-Olympic and International Scientific Congress, July 9-14, 1996, Dallas Texas.

Hardman, K. (1998). School physical education: current plight and future directions in international context. *Paper presented at the 11th Commonwealth and International Scientific Congress, September 3–8, 1998*, Kuala Lumpur, Malaysia.

Hardman, K. (2013). W(h)ither school physical education provision in Europe: two decades of research evidence. *Journal of the International Federation of Physical Education, 83,* 115-119.

International Journal of Physical Education. Retrieved from: https://www.dersportverlag.de/sportwissenschaft.html?idcat=120.

International Journal of Sport Science. Retrieved from: http://www.sapub.org/journal/aimsandscope.aspx?journalid=1113.

International Paralympic Committee. (2018). Retrieved from: https://www.paralympic.org/.

International Wheelchair and Amputee Sports Federation. (2018). Retrieved from: http://www.iwasf.com/iwasf/.

Jones, R. & Cheetham, R. (2001). Physical Education in the National Curriculum: Its Purpose and Meaning for Final Year Secondary School Students. *European Journal of Physical Education, 6:2,* 81-100. DOI: 10.1080/1740898010060202

Knight, E., Henderson, S. E., Losse, A., & Jougmans, M. (1992). Clumsy at six – still clumsy at sixteen: the educational and social consequences of having motor difficulties in school. In T. Williams, L. Almond, & A. Sparkes (Eds.), *Sport and Physical Activity: Moving towards Excellency,* (pp. 249-259). London: Chapman and Hall.

Konukman, F. & Marx, F. (2009). An Interdisciplinary Approach to Physical Education and Sport, *Journal of Physical Education, Recreation & Dance, 80:4,* 12-13. DOI: 10.1080/07303084.2009.10598304

Lenartowicz, M. (2011). Kultura fizyczna w rodzinie. Kariera sportowa i jej społeczne uwarunkowania. In Z. Dziubiński, & Z. Krawczyk (Eds.), *Socjologia kultury fizycznej,* (pp. 339-443). Warszawa: AWF.

Limont, W. (2010). *Uczen zdolny. Jak go rozpoznac i jak z nim pracowac [Gifted students. How to identify and work with them]*. Sopot, Poland: Gdanskie Wydawnictwo Psychologiczne.

Limont, W., & Cieslikowska, J. (Eds.). (2005). *Wybrane zagadnienia edukacji uczniow zdol-nych. Uczen-Nauczyciel-Edukacja [Selected aspects of the education of gifted students. Student-teacher-education] T.2.* Krakow, Poland: Oficyna Wydawnicza Impuls.

Limont, W., Dreszer, J., Bedynska, S., & Piechowski, M. (2009). Overexcitability and creative attitude of gifted students. In S. Popek, R. E. Bernacka, C. W. Domanski, B. Gawda, D. VordiplomTurska & A. M. Zawadzka (Eds.), *Psychologia tworczosci – nowe hory-zonty [Psychology of creativity – New approaches],* (pp. 317-326). Lublin, Poland: Wydawnictwo UMCS.

Ligozat, F., Lundqvist, E., & Amade-Escot, C. (2018). Analysing the continuity of teaching and learning in classroom actions: When the joint action framework in didactics meets the pragmatist approach to classroom discourses. *European Educational Research Journal, 17(1),* 147-169. https://doi.org/10.1177/1474904117701923.

Lyngstad, I., Bjerke, Ø. & Lagestad, P. (2019). Students' views on the purpose of physical education in upper secondary school. Physical education as a break in everyday school life – learning or just fun? *Sport, Education and Society*. DOI: 10.1080/13573322.2019.1573421

Ministerstwo Edukacji Narodowej. (1999). Ministerstwo Edukacji Narodowej o uczniu zdol-
nym [The Ministry of National Education on the gifted student]. Warszawa, Poland: Minis-
terstwo Edukacji Narodowej Biuro Administracyjno-Gospodarcze
Ministerstwo Edukacji Narodowej. (1999). Ministerstwo Edukacji Narodowej o uczniu zdol-
nym [The Ministry of National Education on the gifted student]. Warszawa, Poland: Minis-
terstwo Edukacji Narodowej Biuro Administracyjno-Gospodarcze
Ministerstwo Edukacji Narodowej (1999). *Ministerstwo Edukacji Narodowej o uczniu zdol-nym [The Ministry of National Education on the gifted student]*. Warszawa, Poland: Ministerstwo Edukacji Narodowej Biuro Administracyjno-Gospodarcze.

Moska, W., Skalski, D., Makar, P. & Kowalski, D. (2018). *Pływanie jako wieloaspektowa aktywność fizyczna.* Starogard Gdański: Pomorska Szkoła Wyższa.

Moska, W., Skalski, D., Makar, P. & Kowalski, D. (2018). *Trening zdolności motorycznych w pływaniu.* Gdańsk: Akademia Wychowania Fizycznego i Sportu im. Jędrzeja Śniadeckiego.

Mrazik, M., Dombrowski, S. C. (2010). The Neurobiological Foundations of Giftedness. *Roeper Review, 32,* 224-234. DOI: 10.1080/02783193.2010.508154.

Ministerstwo sportu (2007). *Strategia rozwoju sportu w Polsce do roku* 2015. Retrieved from: https://issuu.com/michaljaros/docs/strategia_rozwoju_sportu_w_ polsce_do_2015.

Ministry of Education, Youth and Employment. (2007). *Re-shaping sport: towards personal development, health and success. A medium-term strategic plan for enhancing Sport Culture in Malta: 2007-2010.* Retrieved from: https://education.gov.mt/en/resources/Documents/Policy%20Documents/reshaping_sports.pdf.

akoneczna, D. (1993). Uczniowie zdolni i ich nauczyciele [Gifted students and their teachers].
Warszawa, Poland: CDN.

Nakoneczna, D. (1993). *Uczniowie zdolni i ich nauczyciele [Gifted students and their teachers]*. Warszawa, Poland: CDN.

Naul, R. (2017). Identical global terminology with different continental meanings versus different continental terminology with equivalent global meanings. In *Abstract book of the 12th FIEP European Congress.* Luxembourg (ICSSPE invited Symposium, Sept.).

National Academy for Gifted and Talented Youth (NAGTY) Summer Schools 2005: Seven Case Study Strands / S. Cullen, M. A. Cullen, G. Lindsay (2005). Centre for Educational Development, Appraisal and Research University of Warwick.

Peneva, B., & Bonacin, D. (2011). Conceptions about physical education at schools. *Sport Science,* 4, 40-44.

Perceptual and Motor Skills. Retrieved from: https://journals.sagepub.com/home/pms.

Perrenoud, P. (2011). *Quand l'École Prétend Préparer à la Vie: Développer des Com-pétences ou Enseigner d'autres Savoirs?* Paris: ESF Editeur.

Physical Education and Sport Pedagogy. Retrieved from: https://www.researchgate.net/journal/1740-8989_Physical_Education_and_Sport_Pedagogy/.

Physical Education in Schools Should Be Compulsory (2017). Retrieved from: https://debatewise.org/debates/2726-physical-education-compulsory/

Physical Education Support Document. Retrieved from: https://pdst.ie/sites/default/files/SSE%20for%20Physical%20Education%202018.pdf.

Protocol between the Ministry of Education, the Olympic Committee and the Youth and Sports Agency, 2008-12. (2008). Retrieved from: http://www.edu.ro/index.php/pressrel/8297.

Podstawa programowa przedmiotu wychowanie fizyczne (2009), tom. 8. Warszawa: MEN
pdf

Polish EURYDICE Unit. (2011). National system overview on education systems in Europe.
Eurydice, European Commission. Retrieved from http://eacea.ec.europa.eu/education/
eurydice/documents/eurybase/national_summary_sheets/047_PL_EN.pdf
pdf

Polish EURYDICE Unit. (2011). National system overview on education systems in Europe. Eurydice, European Commission. Retrieved from http://eacea.ec.europa.eu/education/eurydice/documents/eurybase/national_summary_sheets/047_PL_EN.pdf

Polish EURYDICE Unit (2011). *National system overview on education systems in Europe.* Eurydice, European Commission. Retrieved from: http://eacea.ec.europa.eu/education/eurydice/documents/eurybase/national_summary_sheets/047_PL_EN.pdf.

Skalski, D., Lizakowski, P. & Zabolotna, O. (2017). *Bezpieczeństwo i profilaktyka zdrowotna wypoczynku dzieci i młodzieży.* Wybrane aspekty. Starogard Gdański: Pomorska Szkoła Wyższa w Starogardzie Gdańskim.

Skalski D., (2018). *Bezpiecznie na fali czyli O tym, jak bezpiecznie spędzać wakacje (i nie tylko) nad wodą.* Gdynia: Gdyńskie Centrum Sportu.

Tannenbaum, A. (2000). A history of giftedness in school and society. In K. Heller, F. Mönks, R. Sternberg, R. Subotnik (Eds.), *International handbook of giftedness and talent,* (pp. 23-53).

Ustawa z dnia 3 października 2008 r. o zmianie ustawy o kulturze fizycznej. Retrieved from: https://sip.lex.pl/akty-prawne/dzu-dziennik-ustaw/zm-ustawa-o-kulturze-fizycznej-17496604.

White paper on sport. Brussels, 11.7.2007 COM (2007) 391 final https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52007DC0391&from=CS.


9 788396 397713