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WDROŻENIE INNOWACYJNYCH TECHNOLOGII W METODYCZNYM PRZYGOTOWANIU PRZYSZŁYCH NAUCZYCIELI BIOLOGII

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Streszczenie. W artykule skuteczność wykorzystania innowacyjnych technologii nauczania w metodycznym przygotowaniu przyszłych nauczycieli biologii na uniwersytetach pedagogicznych jest uzasadniona i praktycznie zweryfikowana. Ujawniono istotę metodycznego przygotowania przyszłych nauczycieli i innowacyjnych technologii nauczania. Opisano cechy takich innowacyjnych technologii, jak technologie interaktywne, technologie case, technologia projektu, warsztaty metodyczne i portfolio metodyczne. Technologie interaktywne zapewniają interakcję między uczniami, ich wzajemne uczenie się i współpracę. Technologia case ułatwia uczniom rozwiązywanie rzeczywistych sytuacji w praktyce szkolnej. Technologia projektu zapewnia wszechstronne badanie materiałów dydaktycznych i stworzenie ostatecznego produktu metodycznego. Warsztat metodyczny zapewnia uczniom możliwość zdobycia wiedzy, aby wykazać zdolności twórcze. Portfolio metodologiczne pomaga uczniom śledzić ich rozwój zawodowy. Autor analizuje aktualny stan wykorzystania innowacyjnych technologii w metodycznym przygotowaniu przyszłych nauczycieli biologii. Opisano wyniki badania skuteczności wprowadzenia tych technologii w procesie edukacyjnym instytucji szkolnictwa wyższego. Ustalono, że wykorzystanie tych technologii w grupach eksperymentalnych pomogło zmniejszyć liczbę uczniów o niskim poziomie osiągnięć o 20,5%, przy średnim poziomie 5,0%, przy wzroście liczby studentów o wystarczającym poziomie 19,3%, a przy wysokim – o 6,2%. Perspektywy dalszych badań znajdują nowe metody i środki do poprawy metodycznego przygotowania studentów biologii na uniwersytetach pedagogicznych.

Słowa kluczowe: metodyczne przygotowanie, innowacyjne technologie, przyszli nauczyciele biologii, technologie interaktywne, projekt, portfolio, case, warsztat metodyczny.

THE IMPLEMENTATION OF INNOVATIVE TECHNOLOGIES IN METHODOLOGICAL TRAINING OF FUTURE BIOLOGY TEACHERS

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Abstract. The article deals with the effectiveness of the usage of innovative teaching technologies in the methodological preparation of future biology teachers in pedagogical universities. The content of the article is theoretically grounded and practically verified. The essence of methodological preparation of future teachers and innovative teaching technologies are revealed. Features of such innovative technologies as interactive technologies, case technologies, project technology, methodical workshop and methodical portfolio are described. Interactive technologies provide interaction between students, their mutual learning and cooperation. Case technology facilitates the students' ability to solve real situations from school practice. The project technology provides a comprehensive study of the teaching material and the creation of a final methodical product. The methodical workshop provides students with the opportunity to acquire knowledge, to demonstrate creative abilities. The methodical portfolio

helps students to track their professional growth. The author analyzes the actual state of using innovative technologies in the methodical preparation of future biology teachers. The results of testing the effectiveness of the implementation of these technologies in the educational process of institutions of higher education are described. It was established that the usage of these technologies in experimental groups helped to reduce the number of students with a low level of achievement by 20,5%, with an average level by 5,0%, with an increase in the number of students with a sufficient level by 19,3%, and with high level by – by 6,2%. Prospects for further research are to find new methods and means for improving the methodological training of biology students at pedagogical universities.

Key words: methodological preparation, innovative technologies, future biology teachers, interactive technologies, project, portfolio, case, methodical workshop.

ВПРОВАДЖЕННЯ ІННОВАЦІЙНИХ ТЕХНОЛОГІЙ У МЕТОДИЧНІЙ ПІДГОТОВЦІ МАЙБУТНІХ УЧИТЕЛІВ БІОЛОГІЇ

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Анотація. У статті теоретично обґрунтовано і практично перевірено ефективність використання інноваційних технологій навчання у методичній підготовці майбутніх учителів біології в педагогічних університетах. Розкрито сутність методичної підготовки майбутніх педагогів та інноваційних технологій навчання. Схарактеризовано особливості таких інноваційних технологій, як інтерактивні технології, кейс-технології, проектна технологія, методична майстерня та методичне портфоліо. Інтерактивні технології забезпечують взаємодію студентів, їх взаємонавчання та співпрацю. Кейс-технології сприяють формуванню в студентів умінь вирішувати реальні ситуації зі шкільної практики. Проектна технологія забезпечує різнобічне вивчення навчального матеріалу та створення кінцевого методичного продукту. Методична майстерня дає можливість студентам самостійно здобувати знання, виявляти творчі здібності. Методичне портфоліо допомагає студентам простежити своє професійне зростання. Автором проаналізовано реальний стан використання інноваційних технологій у методичній підготовці майбутніх учителів біології. Описано результати перевірки ефективності впровадження цих технології в освітній процес закладів вищої освіти. Встановлено, що застосування цих технологій в експериментальних групах сприяло зменшенню кількості студентів з низьким рівнем успішності на 20,5%, з середнім рівнем – на 5,0%, з зростанню кількості студентів достатнім рівнем на 19,3%, а з високим – на 6,2%. Перспективи подальших досліджень полягають у пошуку нових методів і засобів удосконалення методичної підготовки студентів-біологів у педагогічних університетах.

Ключові слова: методична підготовка, інноваційні технології, майбутні вчителі біології, інтерактивні технології, проект, портфоліо, кейс, методична майстерня.

Introduction. The Concept «New Ukrainian School» states that a graduate of a comprehensive educational institution must be a holistic person, fully developed, capable of critical thinking, a patriot with an active position and an innovator who can change the world around, compete on the labor market, learn throughout the whole life course *(Nova ukrayins'ka shkola: kontseptual'ni zasady reformuvannya seredn'oyi shkoly, 2006, p. 6).*

A teacher must also be an innovator in order to educate an innovator at school: a teacher must use innovative technologies, demonstrate a creative approach to the organization of educational activities and constantly work on self-improvement.

Current students will come to work at the New Ukrainian School, so they should be the carriers of innovations. However, during their studies at a university, future teachers are often confronted with outdated approaches, methods and learning forms, lack of necessary scientific literature and modern teaching tools. Future teachers, who have to form new generations of citizens of our state, are traditionally trained with the help of the boards and the chalk. Thus, there is a contradiction between the existing traditional teacher training system and the new requirements for the professional qualities of future professionals.

The methodological training, which combines knowledge of psycho-pedagogical and natural sciences, is considered as a systematic component of future teachers training.

We consider the methodological training of future biology teachers as a purposeful process of methodical knowledge formation, skills, competences of students in the context of solving methodological problems from the school's course of biology *(Hrytsai, 2016., p. 23–24)*. The future teachers are introduced to the latest approaches in biological education, they study the peculiarities of innovative teaching technologies, learn to apply them in practice during the methodological training course. A high school teacher must enrich his professional activity with innovative forms, methods, means and learning technologies because methodological training is crucial in the professional development of future professionals, in the choice of their further professional activities.

Methodological training of future teachers of natural sciences was studied by N. Burinska, A. Hrabovy, M. Grynova, M. Krylovets, N. Chaychenko, V. Sharko, O. Yaroshenko.

Scientific works by V. Verbitsky, O. Ivantsiv, V. Onipko, I. Potashnyuk, V. Tanskaya, O. Tymets (Braslavska), Yu. Shapran, S. Yalanskaya and others are devoted to the problems of professional training of specialists in the field of biological education.

Current issues on methodological preparation of future biology teachers were studied by Ukrainian and foreign scientists: N. Andreeva, T. Bondarenko, L. Bulavintseva, S. Vovk, A. Yermakova, G. Zhirska, V. Kisil, M. Kolesnik, M. Marinescu, L. Mironets, N. Mishchuk, I. Moroz, N. Raicheva, V. Stavinsky, A. Stepanyuk, C. Sumatohin, D. Traitak, L. Tushinskaya, K. Ushakova, J. Fruktova, N. Tsanova, O. Tsurul', M. Shvetsova, V. Shuldyk, N. Yanovichi and others.

Problems of methodical preparation of future teachers of biology on various aspects were studied in dissertations by I. Azizova (the system of methodological preparation of students-biologists on the basis of the strategy of subjective reflexive learning), O. Arbuzova (the designing of a reflexive learning system by the usage of an innovative teaching and methodical complex in a biology teaching methodology), L. Orlova (a system of methodological training of biology teachers). However, the usage of innovative teaching technologies in the methodological training of students-biologists wasn't the subject of a special scientific research. It is worth mentioning only some publications by T. Bondarenko (the method of concrete situations), N. Mishchuk (the case method), O. Tsurul' (the technology of critical thinking development).

The purpose of the research is: to justificate theoretically and test practically the efficiency of the innovative teaching technologies usage in the methodical preparation of future biology teachers in pedagogical universities.

Tasks of the research work: to find out the essence of innovative teaching technologies, to identify and characterize technologies that have the greatest potential for application in the methodological training of future biology teachers, to verify the

effectiveness of the usage of the proposed technology during a pedagogical experiment in higher education institutions.

Methods of research: theoretical analysis of scientific sources, observation of educational process in higher education, questioning of teachers of higher education with the purpose of finding out the real state of using innovative technologies, pedagogical experiment on the introduction of innovative technologies in methodological preparation of future biology teachers in higher educational institutions.

The experiment covered 482 students of higher educational institutions in Ukraine. Future biology teachers were divided into two groups: the control group (CG) – 243 students and the experimental group (EG) – 239 students.

In the experimental group, innovative teaching technologies were introduced, that contributed to a better understanding of methodological knowledge, the development of methodological thinking of future teachers, their creative abilities, methodological reflection. In the control group the teaching was conducted according to the traditional method.

Methodological preparation of future biology teachers at pedagogical universities takes place while studying the methodology of teaching biology and other disciplines of methodological direction. Teaching these disciplines involves a combination of traditional and innovative learning technologies.

In the conducted research work, we will consider innovations which are based on new knowledge, skills and competence of students and that are aimed at the formation of highly skilled biology teachers in general education institutions. According to V. Strelnikov and I. Britchenko, innovation technologies are characterized by such features as a forward-looking character, a personally oriented approach, structuring of personal knowledge, reliance on the totality of information and knowledge systems, the focus on the organization of an independent cognitive-research activity of the student, etc. *(Strel'nikov, Britchenko, 2013.).*

Scientist and methodologist O. Igna names a number of requirements for the techniques of a qualified methodological training of the teacher: the activation of learning; modeling of future professional activity; independent decision-making by students; high theoretical level of educational material; intensification of training; personal orientation; providing a liaison with the professional activity of the teacher; practical orientation; problematic nature of educational material; motivation increasing for future professional activity *(Igna, 2013).*

In order to obtain information on the practical use of innovative technologies in the methodological preparation of future biology teachers, a questionnaire was conducted among the teachers who deal with the methodology of biology teaching and other methodically oriented disciplines. 34 teachers from 26 universities of Ukraine (pedagogical and non-pedagogical) took part in the inquiry.

Teachers-methodologists use the following innovative teaching technologies in the methodological training of students-biologists: interactive technologies (38,2%), information and communication technologies (29,4%), design technologies (29,4%), game technologies (20,6 %), multimedia technologies (20,6%), technologies of research training (17,6%), personally oriented technologies (17,6%), technologies of problem learning (11,8%), technologies of critical thinking development (8,8%), technologies of distance learning (8,8%), trainings (8,8%), technology for creating a situation of success (5,9%), individual lifelong learning (5,9%), technologies of professional competencies

forming (5,9%). Individual respondents indicated a case study, a productive learning, a portfolio technology, a module of training development, a technology of collective learning, a technology of developmental education, pedagogical workshops, etc. *(Hrytsai, 2016, p. 64).*

The theoretical analysis of scientific sources, the generalization of teaching practice in higher education institutions and the experience of teaching methodological disciplines has led to the assertion that the following innovative technologies are effective in the methodological training of future biology teachers: interactive learning technologies, a project technology, a technology of a methodological workshop, a portfolio technology, a problem learning technology, a contextual learning technology, case technologies, information and communication technologies, etc. (Table 1).

Table 1

Innovative learning technologies that are used in the methodological training of future biology teachers

The name of technology	***Significance in methodological preparation of students***
Interactive technologies	Provide interaction between students, their mutual learning and cooperation
Case technologies	Promote the formation of the students' abilities to solve real situations which are from school practice
Project technology	Contributes to the versatile study of educational material and the creation of a final methodological product
Methodological workshop	Allows students to acquire («build») knowledge on their own, to show creative abilities
Methodological portfolio	Helps students to track their professional growth, contributes to the objective assessment of methodological competences of future teachers, the formation of methodological reflection

In general, these technologies contribute to the activation of cognitive activity of biology students, the development of their methodological competences, the enhancement of motivation for future professional activity, the growth of the level of methodological readiness, the formation of an individual methodological style and the methodological formation of future biology teachers. Let's consider them more closely.

Interactive teaching technologies are important among the latest technologies that are being introduced in the methodological training of future biology teachers. The scientific and teaching research works by O. Pometun and L. Pirozhenko reveal the essence of interactive learning and characterize the types of interactive learning technologies. It has been established that interactive learning technologies envisage continuous active interaction of all students, group and collective learning in collaboration, when the teacher and students are equal subjects *(Pometun, Pyrozhenko, 2006).*

O. Lavrentieva notes that certain patterns make the psychological basis of interactive methods. They are: better assimilation of facts, phenomena and values by a person that takes place in direct practical activity, if information is provided in all possible types (verbal, visual, acoustic, etc.) in the process of mutual learning *(Lavrent'yeva, 2006).*

The organization of interactive training in practical and laboratory classes on methodological disciplines involves the usage of role-playing games, simulation of

learning situations, the creation of a problematic situation, brainstorming, training, etc. Interactive interaction eliminates the dominance of one participant in the learning process over the other and one thought over another. In such classes, future teachers learn how to think critically, make informed decisions, participate in discussions and communicate with others. Thus, the educational process creates an atmosphere of interaction and cooperation.

The plan for conducting a practical lesson by using interactive technology may be as follows: 1) motivation for a learning activity (story, conversation, examination of a pedagogical situation, video demonstration, etc.); 2) the presentation of the theme and the purpose of the lesson; 3) discussion of theoretical material on the subject; 4) interactive part – work in pairs, small groups, brainstorming, discussion; 5) summing up and evaluating *(Pometun, Pyrozhenko, 2006).* The most commonly used interactive technologies are «brainstorming», «microphone», «debate», «aquarium», «jigsaw», «learn by teaching», etc.

The benefits of interactive learning are that future educators learn to interact and make collaborative decisions, participate in discussions, develop communication skills, develop their own thinking and find a compromise.

Case technologies. Case- technologies are based on learning by solving concrete tasks – situations (cases).

As a result of the theoretical analysis of scientific literature, it was found that the case method was used at the Harvard Business School for the first time at the beginning of the XX century. Today, there are two classic case-study schools – Harvard (American) which is characterized by the searching for the only one correct decision and Manchester (European) which is characterized by a multivariate problem solving *(Adonina; Dolgorukov;) 13]*. Case technologies are applied predominantly in business education, as well as in sociology, medicine and other fields of knowledge.

«Case» (event, situation) – this is a very detailed description of any particular educational situation. Case studies are based on real situations as a reflection of the actual problems of teaching methods.

We agree with K. Gerasimenko, who considers the technology of case-study as a technology of active problem-situational analysis, which enables to present academic theory from the point of view of real events, promotes active learning of knowledge and skills of information processing *(Gerasymenko, 2011).*

Case technology includes case studies, situational analysis method, situational tasks, analysis of specific situations, method of «incident», method of analyzing business correspondence, method of situational-role games, method of conducting a discussion. O. Shimutina asserts that the method of situational analysis, which is used for case technologies, it is the analysis of specific situations (a detailed study of the real and the simulated situation) and this method has the following varieties: situational exercise (it is a proposed text with a detailed description of the situation and the problem for resolution) and case study (familiarization with a description of the problem, an independent analysis of the situation, the presentation of own ideas and a problem solving in the discussion with other participants) *(Shimutina, 2009).*

As a result of scientific research, it has been found, that among case technologies, the most common case-method is the method that combines the methods of cognition: modeling, system analysis, description methods, problem method, classification method, game techniques, brainstorming, discussion, morphological and synectical analysis

(Gerasymenko, 2011; Shimutina, 2009; Situatsionnyy analiz, ili anatomiya keys-metoda, 2002; Yeriomina M., 2004).

Case is a kind of learning tool that simulates the real life situation during a lesson (school practice), which needs to be discussed and it should be found a well-founded solution.

Each case has a certain structure. So, Yu. Surmin names the plot part (events that reveal the contents of the case), the information part (information that is necessary for analysis), the methodical part (the task case formulation) *(Situatsionnyy analiz, ili anatomiya keys-metoda, 2002, p. 168).* K. Gerasimenko points out the following components: a situation-case, a problem or a story from a real life; the context of the situation (time, place, actions of the participants); commentary on the situation; questions or tasks for working with a case; applications *(Gerasymenko, 2011).* The case must be relevant, possess an appropriate level of complexity, meet the purpose of the class, describe the real situation and promote the development of critical thinking in students.

The case method is aimed at solving a problem that is not presented in the finished form, but it is formulated in accordance with the conditions of a real learning situation. The process of teaching biology at school, which means students' future professional activities, is the main source of methodical cases.

The essence of the case-method is that the future teachers of biology are offered a «case», which describes the real situation in school practice. Students need to get acquainted with it in advance, to understand the problem and to find ways to solve it. Then, future teachers discuss the situation in small groups and offer a variety of options to solve it, choosing the best at the time of their auditorium classes.

Creative groups are formed for the solution of the methodical case in classes on methodological disciplines. After individual case analysis by each student, a group goes to a joint discussion, develops a general draft decision and its design and determines the way of presentation in the class. In order to increase the efficiency of work, M. Yeriomina recommends to chose a «coordinator» (organizes the work), a «secretary» (fixes the results of work) and a «skipper» (presents the project to a collective discussion). The analyzed and solved case is presented by the students personally at the time of presentation by showing their personal interest in the problem. When presenting a case, it is desirable to use visual materials to keep the audience's attention and give presenters the opportunity to examine the issues in details *(Yeriomina M., 2004).*

Thus, the working technology of future biology teachers with a methodological case involves the following stages: 1) individual independent work with case materials (familiarization with the situation, the allocation of the main problem, proposals for its resolution); 2) work in microgroups to solve the problem, analysis of the consequences of making one or another decision, the development of a single position; 3) presentation of the results of the work of microgroups in the process of discussion, the choice of one or several solutions to the problem; 4) analysis of the activities.

Methodological cases are similar to the tasks solved by students in laboratory and practical classes on methodological disciplines. But the objectives of the tasks and cases are different: the tasks are focused on the learning of the teaching material, and case studies contribute to the formation of a wide range of different skills and abilities (analytical, constructive, practical, creative, communicative, social, self-analysis skills). In addition, tasks usually have one correct solution and cases possess many alternative solutions.

Case studies provide students with the ability to analyze situations, think critically, evaluate alternatives and choose the best option. By examining the case, future teachers actually get a ready-made solution that can be used in similar circumstances in future professional activities. The more cases will be analyzed by a student, the better he will cope with similar situations when working at school.

Thus, case technologies combine features of training and future professional activities that directly affect the process of personal growth of a student, his methodological formation, the formation of a subjective experience of solving problems in future professional activities on the basis of methodological situations analysis. The ability to test theoretical knowledge in practice, skills developing to argue own views and listen to the thoughts of others, the formation of team skills and the ability to find rational solutions to the problem are the main advantages of case technologies.

Cases about the formation of cognitive interest of schoolchildren in the lessons of biology, sexual education of schoolchildren in the lessons of biology and extracurricular work, the development of critical thinking of schoolchildren in the study of evolutionary concepts, etc. are the most interesting cases in the methodology of teaching biology.

The project technology takes a special place in the methodological training of future teachers. During the implementation of projects, students have the opportunity to form a holistic view of future professional activities.

The project-based learning method appeared in the United States in the 20's of the twentieth century, due to the educational activities of John Dewey and his followers, V. Kilpatrick and E. Collings. In the 20-30's of the twentieth century, this method was used in the USSR, but after 1937 it was removed from the school curriculum, as the scientific works by J. Dewey's were also excluded from the libraries. Since the 90s of the twentieth century, the project-based learning method has returned to educational practice *(Hrytsai, 2016; Zosymenko, 2011; Novyye pedagogicheskiye i informatsionnyye tekhnologii v sisteme obrazovaniya, 2002; Shyyan, 2011).*

The essence of the concept «project» implies its pragmatic focus on the result that we obtain when solving a given theoretically or practically significant problem. We agree with the scientists V. Bespalko, O. Kobernik, Y. Polat, O. Pekhota, V. Slastyonin, N. Shiyan, etc., who name the project-based learning method a technology which covers various teaching methods: research, search, problem *(Zosymenko, 2011; Novyye pedagogicheskiye i informatsionnyye tekhnologii v sisteme obrazovaniya, 2002; Shyyan, 2011).*

The researchers identified the main requirements for using the project-based learning method: the presence of a significant problem, which requires integrated knowledge, research search for its solution; practical, theoretical, cognitive significance of the expected results; independent activity; structuring of the content part of the project; the usage of research methods *(Novyye pedagogicheskiye i informatsionnyye tekhnologii v sisteme obrazovaniya, 2002, p. 68).*

The advantage of the project-based learning method is that its application helps to strengthen the connection between the theory and the practice; it is accustomed to the activities planning, facilitates the formation of the ability to observe, verify, analyze and generalize. The content of the professional activity of the teacher is modeled at the time of project preparation.

The theoretical analysis of scientific sources made it possible to determine the following features of the project-based learning technology: orientation to action; work

in a team; self-organization of students; situational orientation; correlation with real life; reliance on previous achievements of the student, on the existing experience; interdisciplinarity; connection with actual sociocultural tendencies; integrity; focus on the finished product, on a certain result; focus on cooperation, not competition. The project work is oriented towards the student, although the teacher offers his support and guidance throughout the execution of the project *(Hrytsai, 2016; Zosymenko, 2011; Novyye pedagogicheskiye i informatsionnyye tekhnologii v sisteme obrazovaniya, 2002; Shyyan, 2011).*

The project-based learning technology consists of the following stages, such as: *preparatory* (formation of groups, selection of the theme of the project, definition of purpose, structure, form of the final product); *educational* (collecting information by students, processing and analysis of information); *final* (preparation for the presentation of the final product, presentation and evaluation of the project by all participants).

In most studies, there are five stages of work on the project: the first stage – initiation (search of an idea, definition of the theme and problems); the second stage – work planning; the third stage – project implementation; the fourth stage –presentation of the project; the fifth stage – reflection of the project *(Novyye pedagogicheskiye i informatsionnyye tekhnologii v sisteme obrazovaniya, 2002; Shyyan, 2011)*.

At the initial stage of work it is determined which type of a project will be implemented: individual, pair or group. If the project is pair or group, then microgroups are formed by interests, they distribute roles, types of practical activity in the project. For example, N. Shiyan offered the following division of responsibilities: the project manager, or the project administrator (management of the group activities, contact with the teacher), the developer of ideas (generation, concept, original proposals), a designer (registration of the main ideas for the project), a technologist (processing of the descriptive part), specialists in the specific tasks preparation *(Shyyan, 2011)*.

The results of scientific research have led to state that in studying the discipline «Methodology of teaching biology» and other disciplines of methodological direction, there are great opportunities for of the project technology application. So, we consider the following themes of the projects as relevant: «Teaching biology in the profile school», « Interdisciplinary connections usage at the lessons of biology», «A computer as a means of teaching biology», «Virtual excursions on biology», etc.

A specific feature of methodological disciplines is their practical and they are of oriented character, therefore, the involvement of future biology teachers in the project activity will make it possible to enhance the practical orientation of learning. Printed notebooks, programs for the clubs activities, extracurriculars, electronic manuals, visual teaching aids, presentation of lessons, methodological recommendations, etc. can be the final product of methodological projects.

The technology «methodical workshop». In France, in 1922, the public movement GFEN (le Groupe francais d'education nouvelle – French group of new education), which promoted the ideas of free education by J. J. Russo, S. Frenne, the humanistic psychology by J. Piaget, K. Rogers, etc. At the beginning of the movement were psychologists Paul Langevin, Henri Wallon, Jean Piaget. The leading idea of the movement is «All capable!» *(Origines et jalons historiques).*

The representatives of GFEN developed the technology «workshop», which involves «building» knowledge simultaneously with the «construction» of the individual. In France, this technology is called «les Ateliers» (studio, workshop).

According to I. Mukhina, the pedagogical workshop is a form of learning that creates conditions for the ascent of each participant to new knowledge and new experience through an independent or collective discovery *(Mukhina).*

The technology of the pedagogical workshop is similar to the technology of problem learning and technology of research training. The peculiarity of the technology of the workshops lies in the creation of a special developing space, which enables participants during self-search and group discussions to «self-build» of their knowledge through a critical attitude to information and the implementation of creative abilities.

The technology of the workshop has received such a name because its participants independently acquire («build», «grow») knowledge and skills and the teacher appears as a counseling Master, who helps to organize training, gives advice on the gaining knowledge, creates conditions for expression of participants in the workshop through their creativity. The Master selects such questions that do not have a concrete answer, but promote creativity, stimulate, motivate action. The technology is aimed at immersing the workshop participants in the process of searching, cognition and self-knowledge. While working in a workshop, the increase of self-estimation of participants, they aspire to gain knowledge on their own.

In the works of I. Mukhina and T. Yeromina, the principles of the pedagogical workshop are substantiated: 1) the value-semantic equality of all participants; 2) the right of everyone to error; 3) activities without evaluation; 4) freedom within the framework of accepted rules; 5) significant element of uncertainty, incomprehensibility; 6) dialogue as the main principle of interaction, cooperation, co-creation; 7) organization of the space in which workshop works, depending on the task of each stage; 8) restriction of participation, practical activity of the Master *(Mukhina; Yeriomina T., 2007).*

The methodical workshop is used in methodical preparation of future biology teachers. The methodical workshop is a technology of training future teachers, which creates a training space for modeling the situations of professional activity, which systematically develops and improves the methodological competence of students *(Hrytsai, 2016,* p. 320].

The methodical workshop as a technology that is built on a certain algorithm, the most common of which is as follows: induction – self-construction – socio-construction – socialization – advertisement – break – reflection. The essence of each of the elements (stages) is given in table. 2.

Table 2

The main elements of the technology «methodical workshop»

№	***Element's name***	***The essence***
1.	Induction	Motivation for creative activity
2.	Self-construction	Individual problem solving, creation of a creative product
3.	Socio-construction	Work in mini-groups, creating a joint (collective) product
4.	Socialization	Collective discussion of the problem
5.	Advertisement	Presentation of the results of the problem
6.	Break	Internal emotional conflict
7.	Reflection	Analysis of the work stages and feelings

Other variants of the algorithm of work are possible, subject to compliance with the general principles and rules of the methodical workshop conducting.

The methodical portfolio. A portfolio (briefcase) is a peculiar «dossier of achievements» of a person, his self-presentation. The idea of using a portfolio in the educational industry appeared in the United States in the 80's of the twentieth century.

In the pedagogical science, the portfolio is interpreted as a collection of works, a way of accumulating and evaluating individual achievements, an alternative way of evaluation, an exhibition of educational achievements etc. A portfolio can be of different types depending on the purpose: a portfolio of documents, process, exemplary; reflexive, problem-research, thematic portfolio; a portfolio of external achievements and a personal development (*Peyp, Choshanov, 2000; Dolzhenkov, Postoyan, 2015; Hal, Keresten′, 2010*).

A portfolio is a technology of students' work with products of their creative, project activities, intended for demonstration, analysis, development of reflection, awareness of the results of their activities.

We agree with J. Peip and M. Choshanov that the pedagogical philosophy of the portfolio is to shift the emphasis on what the student does not know and cannot do to what he knows and can do; to transfer the pedagogical emphasis from the estimation of learning to self-estimation *(Peyp, Choshanov, 2000, p. 76).*

Researchers O. Dolzhenkov, T. Postoian point out the following functions of the portfolio: diagnostic (fixes changes and growth rates of training); motivational (encouraging interaction in achieving positive results); content (maximally reveals the range of achievements and performed work); developmental (provides continuity of the process of development, education and upbringing); rating (shows the range and level of skills and abilities); goal-setting (supports educational goals defined by the standard) *(Dolzhenkov, Postoyan, 2015).* In our opinion, the reflexive function of the portfolio which consists in developing skills for evaluating oneself and own learning activities, forming reflexive abilities is one of the most important.

In the methodological training of future biology teachers, the creation of their own methodological portfolio will provide an opportunity to demonstrate the methodological knowledge and skills of students, their creative abilities, professional growth, it will help to identify and take into account the individual characteristics of the student, the formation of the ability to analyze and evaluate the results of their activities. While studying the disciplines of methodological direction, each student forms his own collection of materials, supplemented by its information which is obtained during the study of psychological and pedagogical disciplines, materials of pedagogical practice, etc.

Methodical portfolio is a collection of materials on the methodology of biology teaching, which serves for generalization and systematization of information, analysis of the experience of teaching biology, the presentation of own methodological ideas, as well as the reflection of own abilities, the comparison of achievements, etc.

In our opinion, the following structure is the most appropriate for a portfolio:

- «My portrait» («My profession and I»);
- «Methodical treasury» – a collection of practically significant information for the student on the methodology of teaching biology;
- «My results» – the materials which show the progress of the author of the portfolio in methodical work.

The technology of the portfolio consists of the following stages: *familiarization* (familiarization with the methodology for the portfolio production); *content* (definition of portfolio content); *procedural* (production of portfolio, collection and sorting of material); *reflexive* (mutual discussion with the student); *corrective* (remarks, additions, and corrections); *evaluative* (evaluation of learning outcomes by using a portfolio) *(Hal, Keresten′, 2010, p. 33).*

Self-presentation and demonstration of a methodological portfolio is carried out in the form of a conference, competition-defense or a business game «Competition of a professional skill» or «Recruitment» *(Zelenko N. V., Mogilevskaya, 2009, p. 63).* Self-presentations involve demonstration of pedagogical knowledge and skills, theoretical substantiation of the proposed methods, forecasting directions of further work, joint analysis and evaluation of students' creative abilities and their methodological achievements. The future teacher should explain why he considers this work as own achievement, what changes he has seen in his pedagogical work, what else should be worked out. Unlike the traditional approach, where evaluation is fragmentary, according to individual tasks, the portfolio provides an opportunity to make a comprehensive assessment of student methodological training.

Pedagogical experiment on the introduction of innovative technologies in the training of future biology teachers took place at the Poltava National Pedagogical University named after V. G. Korolenko, Rivne State University of Humanities, Sumy State Pedagogical University named after A. S. Makarenko, Melitopol State Pedagogical University named after Bogdan Khmelnitsky, Kriviy Rig Pedagogical University, Chernihiv National Pedagogical University named after Taras Shevchenko, Central Ukrainian State Pedagogical University named after Volodymyr Vynnychenko, Uman State Pedagogical University named after Pavlo Tychyna, Kharkiv National University named after V. N. Karazin.

The results of the students' achievement in the control and experimental groups of methodical disciplines before and after the experiment are given in table. 3 and on fig. 1.

Table 3

Success of students of the control and experimental groups on methodological disciplines

	The control group (n=243)				The experimental group (n=239)			
	Before the experiment		After the experiment		Before the experiment		After the experiment	
Low	82	33,7%	77	31,7%	83	34,7%	34	14,2%
Average	107	44,1%	102	42,0%	104	43,5%	92	38,5%
Sufficient	50	20,6%	56	23,0%	49	20,5%	95	39,8%
High	4	1,6%	8	3,3%	3	1,3%	18	7,5%

As we can see from the table, in the experimental groups the following dynamics took place: the number of students with a low level of success decreased from 34,7% to 14,2% (increase - 20,5%), with the average level decreased from 43,5% to 38,5% (increase -5,0%), with a sufficient level increased from 20,5% to 39,8% (increase +19.3%), and with a high level – increased from 1,3% to 7,5% (increase +6,2%).

In the control group, the increase according to the levels was as follows: low – - 2%, average – +2,1%, sufficient – + 2,4%, high – + 1,7%. A slight increase gives grounds to argue that the traditional method is less oriented to master the

methodological knowledge and to develop the ability to perform various types of methodological activities.

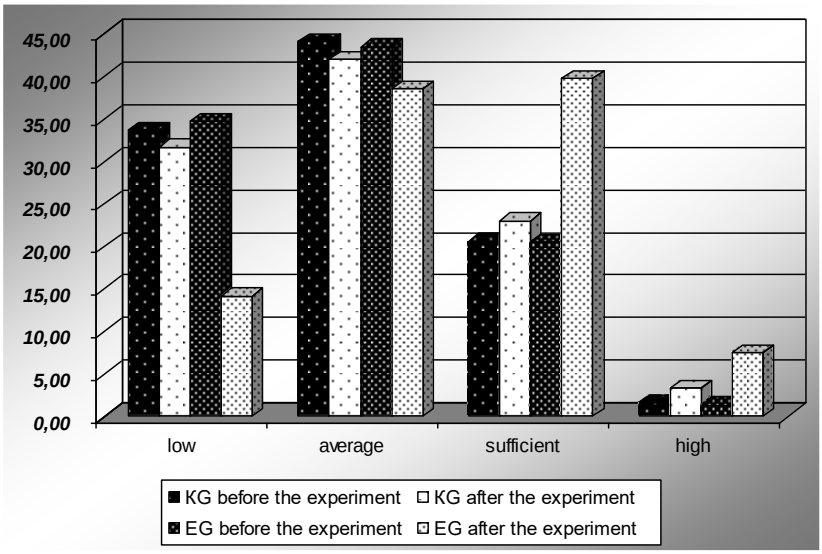

Fig. 1. Results of students' progress in the control and experimental groups on methods of biology teaching

The effectiveness of the implemented of innovative technologies in methodological training of future biology teachers was proved using the testing of statistical hypotheses method according to the Pierson criterion.

Conclusions. Innovative learning technologies are important in the methodological training of future biology teachers. They contribute to the conscious learning of methodological knowledge, the formation of the necessary methodological skills and competencies, the development of student autonomy, their creative abilities, methodological reflection, critical thinking and the development of an individual methodological style, which ensures an increase in the level of methodological readiness of students for future professional activities.

Interactive technologies, case technologies, a project technology, a methodological workshop technology, a methodical portfolio are effective in the methodological training of future biology teachers. The usage of these technologies in experimental groups helped to reduce the number of students with a low level of success by 20,5%, with an average level by 5,0%, with a sufficient level by 19,3% and with a high level by 6,2 %.

The prospects for further research are seen in the search for new methods and means for improving the methodological training of students-biologists in pedagogical universities, the development of electronic textbooks and manuals on methods of teaching biology and other disciplines of methodological direction.

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