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THE USE OF INNOVATIVE PEDAGOGICAL TECHNOLOGIES IN EDUCATION PROCESS OF HIGHER SCHOOL (ON THE EXAMPLE OF HIGHER MATHEMATICS)

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ВИКОРИСТАННЯ ІННОВАЦІЙНИХ ПЕДАГОГІЧНИХ ТЕХНОЛОГІЙ У НАВЧАЛЬНОМУ ПРОЦЕСІ ВИЩОЇ ШКОЛИ (НА ПРИКЛАДІ ВИВЧЕННЯ ВИЩОЇ МАТЕМАТИКИ)

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The article is devoted to the actual problem of the use of innovative educational technologies in the educational process of higher education. The essence of the concept of "pedagogical technology" was defined, the necessity of introduction of innovative pedagogical technologies in process training of the professional in a higher school was scientifically justified, and the example of using of interactive teaching technologies in the process studying of higher mathematics by future specialists was presented on the basing of the analysis of scientific and educational literature**.**

Keywords: a higher mathematics, innovative pedagogical technologies, interactive teaching technologies, a higher school, educational process, the future specialists.

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Problem statement. Modern Ukrainian society is now experiencing intense socio-economic transformation, with particularly high scientific and practical importance of pedagogical innovations aimed at modernizing higher education, improving its quality and gaining practice-oriented training of future professionals to ensure their competitiveness in the labor market. Furthermore, the issue of improving sustainability and competitiveness of educational institutions is becoming of crucial importance alongside with the problem of changing the current educational model.

Analysis of study models has revealed that innovative educational technologies and methods are more effective compared to traditional ones. The current system of higher education in Ukraine is being dynamically updated, the momentum of which were, on the one hand, reforming of society as a whole, on the other hand, the logic of the development of the educational system itself.

Educators today must prepare for the educational systems of the future.

The willingness of the teacher to innovation in the learning process is mainly determined by the foundation laid during his\her studies in higher school. Therefore, in order to be effective the educational system must also change in accordance with trends that determine the development of general education.

Problem solving effectiveness in most cases is provided by the introduction of innovative educational technologies and active methods to the educational process. Therefore, the problem of the use of innovative pedagogical technologies in educational process of higher school is acquiring special relevance today.

Analysis of recent scientific and educational research and publications which started solving the problem has shown that the issue of introduction of innovative educational technologies in the educational process of higher education institutions is of great interest to reputable scientists and educators-practitioners.

The following researchers have been the most active in this area: G. Boychenko, A. Hurevych, M. Huslova, M. Klarin, B. Likhachev, V. Mihelkevych, L. Ovchinnikova, O. Okuneva, G. Panfilova, V. Slastonin, S. Sysoieva, N. Talyzina, A. Faktorovych, V. Chechet, P. Erdniyev, M. Shatalova, F. Yanushkevich, etc.

These researchers have investigated the main aspects of innovation in terms of theory and practice of introduction of pedagogical science achievements and dissemination of best teaching practices, and problems of innovative processes technologization in secondary school.

However, the issue of innovative pedagogical technologies use in educational process of higher school, particularly in the process of studying of Higher Mathematics by future professionals remains unsolved.

The purpose of the article is to review the main aspects of the introduction of interactive teaching technologies in educational process of higher school while studying the course of Higher Mathematics by future experts.

In order to achieve the given objective, the following tasks must be solved: to reveal the essence of the concept 'pedagogical technology', supply examples of interactive teaching technologies in the study of Higher Mathematics by future professionals, identify opportunities to implement innovative technologies to systematize the students' knowledge at practical classes in Higher Mathematics.

The presentation of the main research material. The first step is to determine what pedagogical technology is. The concept of 'pedagogical technology' in the scientific and educational literature is interpreted as a type of learning process that will resolve the problem of humanization of education through the integration of theoretical knowledge and practical experience (A. Faktorovych [11]); a set of principles, methods, and techniques applied by a teacher based on his/her own personal and professional competence, culture and activities (S. Vitvytska [1]); the system (set) of means and methods of organization and management of educational and professional process that give an opportunity to reach educational goals successfully (V. Chechet [12]); a combination of tools and techniques reproducing theoretically grounded learning, a way of achieving educational goals, which involve creating a unique space of human relations that occur between a teacher and a student (Y. Rapatsevych [7]).

Therefore, pedagogical technology involves combination of methodological principles and study manuals; performance algorithm and personal teaching experience, thus enabling the teacher to predict a variety of educational situations, alter stereotypical educational models based on his/her own high level of skill, methodological culture, and the author's interpretation of theoretical and practical suggestions. In particular, the teacher's activity should be based not only on his/her professional pedagogical and psychological knowledge and skills, but also on personal artistic, cultural, and professional characteristics of each student.

From the scientific and educational sources and from our own experience it is known that pedagogical technology allows preliminary design of educational and professional process of higher school.

Thus, in our pedagogical work we were guided by S. Vitvytska's concept according to which pedagogical technology combines aspects such as scientific (pedagogical technology is an element of pedagogical science designing educational processes in educational systems); procedural-narrative (description, process algorithm, set of objectives, content, methods and ways to achieve guaranteed results and intended purpose); procedural-operational (technological process implementation, operation of personal, instrumental and methodological, pedagogical methods) [1].

Moreover, we have considered A. Faktorovych's idea [11], according to which background of pedagogical technology implementation comprises highly developed theoretical and methodological (ability to project the educational process, its holistic vision, reflection, design) and technological (operation in a particular educational situation) cultures of the teacher and ensure effectiveness of results achievements.

As it is known, today in the process of training in higher educational establishments it is necessary to implement traditional forms and methods of teaching along with innovative technologies aimed at forming professional abilities and skills of future professionals.

In particular, the scientific and pedagogical sources define pedagogical innovation as "innovation in educational activities, changes in the content and education technology aiming at increasing their efficiency" [7, p. 198].

Analysis of scientific and educational publications [2; 3; 4; 5; 6; 9; 10, etc.] has shown that the main innovative pedagogical techniques include:

– information and communication technologies (impact of multimedia technologies on integration of different subject areas, including the use of electronic educational materials, video lectures, computer testing of knowledge, etc.);

– personality-oriented technologies (fulfillment of professional and personal potential of each student taking into consideration his/her individual preferences and social requirements for professional training);

– project-based learning technology (creating conditions for independent acquisition of knowledge and skills);

– problem-based learning technology (combination of systematic independent research of students with acquisition of complete knowledge);

– critical thinking technology (development of students' critical thinking through their interactive inclusion in the educational process and the formation of their ability to ask new questions, work out various arguments, make independent deliberate decisions);

– modular training technology (involves presenting training content in logically complete information blocks (modules) in accordance with the set didactic goals);

– technology of concentrated study (characterized by continuous studying one discipline for days or weeks);

– distance learning technology (creation of active communication between teachers and students using specialized information-educational environment focused on information exchange over all distances via the Internet);

– technology of simulation-modeling focus (implementation of simulation games, business and role-playing scenarios related to the acquisition of professional experience in solving personal problems and situations);

– case study (analysis of profession-related situations).

It is well-known that Higher Mathematics is one of the main scientific foundations and effective instruments for the vast majority of general theoretical, general engineering, medical, biological, economic and social sciences. Knowledge of fundamentals of Higher Mathematics is necessary for both successful mastering certain subjects and solving applied and research tasks faced by future professionals of different areas. Forming appropriate mathematical view and providing future professionals with methodological apparatus, techniques of mathematical modeling of various situations determine its effective functioning in the modern world of professionals.

In particular, in our pedagogical work we pay special attention to the organization of educational work on mastering complex mathematical knowledge using innovative methods and techniques of teaching.

Interactive learning technology has been chosen from a number of methods. The choice is conditioned by the fact that due to this technology there is the possibility of establishing a fruitful environment for self-development and self-realization of future specialists. It is also an opportunity to move away from traditional knowledge broadcast to the level of its active search through students' self-activation and self-regulation of their learning activities.

Interactive learning which comprises these technologies is considered by O. Pometun as a 'created by a teacher learning environment in which the student

will individually discover, acquire and design his/her own knowledge and expertise in various fields of life [8, p. 8]'. Its principles are: establishing subject-subject relationship between teachers and students (parity); existence of multilateral communication; construction of student's knowledge; use of self-assessment and feedback; ongoing active steps [8]. Technologies that provide this are: interactive lectures, namely the use of the method of 'question-answer'; short presentations prepared by students who would reveal one of the issues raised in the subject; testing; implementation during practical classes such forms as 'round table', 'workshop' where students during the discussions solve important professional problems based on their own independent developments; debates, discussions, analysis of profession-oriented situations; converting student's self-study, individual research work as a mandatory component of learning the subject; using during practical classes presentations, publications, and web-sites prepared by students; use in the educational process of high school role and business games, case studies, and 'brainstorming' that promote activity and creativity of future professionals; conducting master classes and trainings; extensive use of multimedia in the lectures and workshops, electronic and various kinds of lectures support, providing students with educational information on electronic media, Internet search etc., using elements of simulation, reflection, and relaxation during some practical classes; new approaches to monitoring and assessment of student's achievement.

It should be noted that the use of interactive teaching technologies in the study of Higher Mathematics requires from a teacher certain efforts to select the content suitable for interactive work; define organizational forms of learning, conducive to the use of interactive technologies; arrange prior students' preparation for interactive work.

For example, let us consider the practice session, which is held before the verification of knowledge on '*Differential equations*'.

The day before a group of 4 students is created, in each of which the teacher assigns the student-consultant and works with him/her individually in preparation for the lesson.

During the lesson the groups receive information packages that contain the cards-tasks, additional cards designed by students-consultants under the teacher's guidance. The teacher acts as an expert.

Each group receives a card of one of the following types: equation; type of equation; way of solution.

For instance, the lesson covered the following equations:

a) $3x - xy' = 0$; b) $y' = \frac{y}{x} - \frac{x}{y}$; c) $y' - \frac{2y}{x} = x^2 \ln x$; d) $xy + y'\sqrt{1-x^2} = 0$;

e) $y'' - 4y' - 5y = 0$; f) $xy' + 2y = 3x^2y^2$; g) $y'' - y' - 6y = 0$.

The students make decisions on each of the equations after discussion of the received task in each group. The students have 3 minutes to fill in the cards. Then a representative from each group describes one of the equations given in the card as directed by the teacher and writes down all the information from the completed card on the board. At that time other groups make corrections and supplement answers if needed, and then the students and the teacher discuss the work done and grading.

Here is an example of another final practical lesson in Higher Mathematics on '*Indefinite integral*'. It is well-known, that this issue contains a lot of theory, but its practical application causes great difficulties. In order to systematize and efficiently interiorize the students' knowledge on the methods of integration, we have organized the work on the model of 'brainstorming'.

The purpose of this form of work is to improve the cognitive activity; update and systematize students' knowledge on the mentioned topic; form a coherent perception of the material studied; teach to help one another, conduct a dialogue and find common solutions.

The students were previously informed about this form of the final lesson on this topic, aimed to prepare for module testing. They were provided with a list of questions and examples of integrals for self-study. Preparation lasted for 3 weeks. To do this, 5 students with different levels of knowledge were selected to be an expert group. Each representative of the expert group chose the topic on which he was the main expert. During the lesson, the students were divided into 4 groups of 5 people each.

The cards with the tasks are on the teacher's desk. There are 5 types of cards; each is an example of the application of a particular method of integration, or a representative of the class of functions that are integrated in some way:

card 1: $\int \frac{dx}{\sin x + \cos x}$; card 2: $\int \frac{(4x-1)dx}{\sqrt{-x^2-2x+3}}$;

card 3: $\int \frac{6x^2+25x+16}{(x+4)(x+1)(x+2)}dx$; card 4: $\int x^2 \cdot 3^x dx$; card 5: $\int \frac{\sqrt{x}}{4x - \sqrt[3]{x^2}}dx$.

One by one students from each group took the card and recorded the example. The task is to determine the method of finding indefinite integral and explain the process of decision. If there was a problem, the student asked his

group for help, while other groups had an opportunity to participate in the discussion, give advice, make suggestions, etc. The student had to bring a solution to the answer. No more than two students were allowed at the board. The teacher was not an active participant in this process, but he acted as a coordinator and observer. Work with each example lasted for 10–15 minutes; totally 5 examples were solved.

The last stage of 'Summing up' was the most emotional and meaningful to each student. Performance evaluation was performed at three levels: personal evaluation (self-evaluation), the experts' evaluation, the teacher' evaluation. The criteria for evaluation were as follows: theoretical validity and completeness of response, ability to navigate in theory, level of integration technology, the ability to follow advice, the ability to ask questions, the ability to work in a team.

It has been found that working together and conducting a constructive dialogue not only lead to improving the quality of acquired knowledge and expanding the methodology of knowledge search, but also unite students helping to establish cooperation, realize personal mistakes and assess the level of their own knowledge.

This interactive form of conducting lessons helps to systematize knowledge, develop the students' ability to analyze, compare, synthesize and, consequently, identify the type of equation or integral by appearance, and actively stimulate cognitive activity.

However, it should be mentioned that the illiterate use of technologies, apparently similar to the interactive ones, can lead to excessive dependence between group members, emergence of unhealthy competition and even conflicts.

Thus, the use of interactive pedagogical technologies in teaching Higher Mathematics in higher educational establishments requires a thorough study of the ways of selecting the content of educational material on Higher Mathematics suitable for the use of interactive technologies; selecting organizational forms of learning that promote the use of interactive technologies; rational combining of traditional technologies in terms of educational and professional process management.

Conclusions. Summarizing the above-mentioned, it should be stressed that the educational and professional process of higher school requires a rational use of traditional teaching methods, and development of new educational technologies. As the use of traditional forms of education aimed only to transfer a certain amount of knowledge is not intensifying internal motivation of students

to self-management of learning activities. The conditions for the growth of creative and research potential of future professionals are created through the introduction of innovative information technology.

In addition, the use of interactive technologies in the educational process of higher school will enable to significantly improve the overall quality of training future professionals, will enrich the process of formation of their competencies and scientific worldview and ensure their future competitiveness in the global labor market.

Prospects for further investigations in the research area. It is advisable to implement innovative educational technologies in the training of future professionals and track the results experimentally. It is necessary to conduct a qualitative analysis of formation of creative skills and explore the process of personal development of a professional with regard to his/her future professional performance. It is of crucial importance to pursue research on the influence of interactive technologies on the level of professional competence of future professionals to develop the methodological basis for their implementation.

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Ситник Ю. В., Жовтоніжко І. М. Використання інноваційних педагогічних технологій у навчальному процесі вищої школи (на прикладі вивчення вищої математики). Стаття присвячена актуальній проблемі використання інноваційних педагогічних технологій у навчальному процесі вищої школи. На основі аналізу науково-педагогічної літератури визначено сутність поняття «педагогічна технологія», науково обґрунтовано необхідність впровадження інноваційних педагогічних технологій у навчально-професійному процесі вищої школи та наведено приклад використання інтерактивних педагогічних технологій під час вивчення майбутніми фахівцями вищої математики.

Ключові слова: інноваційні педагогічні технології, інтерактивні педагогічні технології, вища школа, вища математика, навчальний процес, майбутні фахівці.

Ситникова Ю. В., И. Н. Жовтонижко. Использование инновационных педагогических технологий в учебном процессе высшей школы (на примере изучения высшей математики). Статья посвящена актуальной проблеме использования инновационных педагогических технологий в учебном процессе высшей школы. На основе анализа научно-педагогической литературы определена сущность понятия «педагогическая технология», научно обоснована необходимость внедрения инновационных педагогических технологий в учебно-профессиональном процессе высшей школы и приведен пример использования интерактивных педагогических технологий при изучении будущими специалистами высшей математики.

Ключевые слова: инновационные педагогические технологии, интерактивные педагогические технологи, высшая школа, высшая математика, учебный процесс, будущие специалисты.

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