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**ANALYZING THE SPECIFICS AND SUMMARIZING THE EXPERIENCE OF
IMPLEMENTING INNOVATIVE EDUCATIONAL TECHNOLOGIES IN THE TEACHING OF
THE COURSE "TECHNOLOGICAL SCHEMES AND BASIC EQUIPMENT OF PUMPING
STATIONS".**

© O. Prokopenko, N. Antonenko
Ukrainian Engineering Pedagogics Academy

Information about the authors

Antonenko Nataliia Serhiivna: ORCID: 0000-0001-8319-2826, nsantonenko2015@gmail.com, Associate Professor; docent of Department Automatization, Metrology and Energy-saving technologies; Ukrainian Engineering Pedagogics Academy, 16 Universitetskast., Kharkiv, 61003, Ukraine

Prokopenko Olena Oleksandrivna: ORCID: 0000-0001-8337-2739, prokopenko.o.o@uipa.edu.ua, Associate Professor; docent of Department Automatization, Metrology and Energy-saving technologies; Ukrainian Engineering Pedagogics Academy, 16 Universitetskast., Kharkiv, 61003, Ukraine

In this paper, we put forward essential resources that provide valuable insights into the pressing matters concerning the preparation of vocational education graduates for the oil and gas industry. These resources encompass various scientific and pedagogical aspects, thereby offering comprehensive expertise in the field. The article covers the interconnection between providing education opportunities to people who are at a considerable distance from an education institution or do not have the opportunity to attend face-to-face classes and the development of distance learning models on which the educational environment of a higher education institution is based. The analysis focuses on the educational course "Technological Schemes and Basic Equipment of Pumping Stations," tailored for first-level (bachelor's degree) higher education students in the field of Vocational Education (specifically, the extraction, processing, and transportation of minerals) within the educational program "Vocational Education (Oil and Gas)." This course model was devised at the Department of Automation, Metrology and Energy-Efficient Technologies at Ukrainian Engineering Pedagogics Academy. The study delves into scientific and pedagogical outcomes resulting from the integration of innovative technologies within the educational curriculum. The utilization of this model effectively enables the provision of accessible and high-quality education within a university setting, especially during military operations or situations where limited physical attendance is possible for participants engaged in the academic process. The relevance of creating and implementing the model in the educational process is substantiated. The results of its implementation based on the Moodle system are presented. The structure and features of the model and the factors affecting them are analyzed. The principles of didactics and a group of principles considering the specifics of distance learning, on which the model is based, are determined. The scientific approaches, based on which the model was developed and implemented, are characterized. The use of innovative technologies in the development of individual elements for the model is shown. The factors that were considered during the implementation of the personal components of the discipline content are identified and classified. The study substantiates that the success of implementing innovative educational technologies relies on establishing a straightforward feedback mechanism via a robust communication toolset within the Moodle system. It also highlights the effectiveness achieved by combining diverse interaction methods through modern information technologies, thereby facilitating a comprehensive evaluation of students' progress and accomplishments throughout the educational process.

Keywords: oil and gas industry, training of higher education students, training system, educational program.

Прокопенко О.О., Антоненко Н.С. «Аналіз особливостей та узагальнення досвіду впровадження інноваційних освітніх технологій при викладанні курсу «Технологічні схеми та основне обладнання насосних станцій»

У роботі представлено матеріали, що висвітлюють важливі і актуальні проблеми підготовки бакалаврів професійної освіти для нафтогазової галузі в різних аспектах науково-педагогічної діяльності. Висвітлено взаємозв'язок надання можливості отримання освіти людям, які перебувають на значній відстані від освітньої установи або не мають можливості для відвідування аудиторних занять та розробкою моделей дистанційних курсів, на яких базовано освітнє середовище вищого навчального закладу. На прикладі моделі курсу Технологічні схеми та основне обладнання насосних станцій для здобувачів вищої освіти першого (бакалаврського) рівня спеціальності Професійна освіта (Видобуток,

переробка та транспортування корисних копалин) за освітньою програмою (ОП) «Професійна освіта (Нафтогазова справа)», модель якого розроблено на кафедрі Автоматизації, метрології та енергоефективних технологій Української інженерно-педагогічної академії проаналізовано науково-педагогічні результати запровадження у освітній процес інноваційних технологій. Показано, що використання моделі надає реальну можливість забезпечення доступності та якості освіти у вищі під час бойових дій та обмеженості відвідування навчального закладу учасниками освітнього процесу. Обґрунтовано актуальність створення і впровадження моделі в освітній процес. Наведено результати реалізації її на базі системи Moodle. Проаналізовано структуру та особливості використання моделі та фактори, які впливають на них. Визначено засади дидактики та групу засад, що враховують специфіку дистанційного навчання, на які спирається модель. Охарактеризовані наукові підходи, на базі яких було здійснено розробку та впровадження моделі. Показано використання інноваційних технологій при розробці окремих елементів моделі. Визначено та угруповано фактори, які були враховані під час реалізації особистісних компонент змісту навчальної дисципліни. Показано, що ефективність впровадження інноваційних освітніх технологій базована на простоті організації зворотного зв'язку через добре розвинену систему інструментів для організації комунікації у системі Moodle, ефективності поєднання різних видів комунікації при використанні сучасних інформаційних технологій, забезпеченні комплексності оцінки досягнень під час освоєння здобувачами освіти.

Ключові слова: інноваційні освітні технології, підготовка здобувачів вищої освіти, дистанційна освіта, модель навчального курсу.

Statement of the problem in general.

Improving the effectiveness of the higher education system is a pressing scientific and practical challenge. To tackle this challenge, we must focus on creating, validating, and implementing innovative pedagogical technologies. One of the ways of solving this problem is the application and implementation of innovative and information technologies in the academic process.

The prevailing belief has always been that the communication goals and objectives of different components of university programs can only be attained through continuous and obligatory interaction among participants in the educational process, which involves implementing interactive learning methods during face-to-face classes.

However, modern realities require creation of educational opportunities for people who are at a considerable distance from an educational institution or are unable to attend classroom classes. As martial law continues in Ukraine, the importance of distance education (DE) is progressively growing. DE is seen as a genuine solution to ensure both accessibility and quality in higher education institutions. The development of an information educational environment for an educational institution is crucial for implementing distance-learning courses aimed at higher education students.

Analysis of studies and publications that have started to solve this problem. By analyzing various publications discussing the improvement of the educational process, modern scientists have concluded that the Ukrainian educational system must adapt to the requirements of the European community and integrate into a common European educational space. To achieve this, it is crucial to

incorporate innovative approaches, especially information technologies, at all levels of the educational system, with a particular focus on higher education.

Reformation and adaptation are one of the basic principles of a successful system for educating and training future specialists, which is focused on continuous improvement and development [1] and represents an actual task. One of the directions of its solution is the introduction of innovative educational technologies and updating the approaches and methods of professional education. At the same time, there is an urgent need to replace the old methods of teaching in universities and introduce new ones using modern information technologies [2].

Distance education is considered, on the one hand, as a structured set of information resources, data transmission facilities, protocols of interaction between organizational and methodological, hardware and software, and, on the other hand, as an independent didactic system consisting of such components as goals, objectives, content, forms, methods and teaching aids; regulatory and legal frameworks, etc.

Such factors as the goals and current needs of society; the existing system of knowledge, skills and abilities to be formed in the educational process; professional, ideological and civic, considering the prospects of development of society, science, technology, culture and art have an impact on the content of higher education [3].

Presentation of the main material. The aim of this work is to analyze and summarize the scientific and pedagogical results of applying innovative technologies in the academic process in

teaching the course "Technological schemes and basic equipment of pumping stations" for first (bachelor's) level higher education students majoring in Professional Education (Mining, Processing and Transportation of Minerals) under the educational program (EP) "Professional Education (Oil and Gas Industry)" at the Department of Automation, Metrology and Energy Efficient Technologies of the Ukrainian Engineering Pedagogics Academy. The tasks of the work are to highlight the specifics, main aspects and factors affecting the effectiveness of their implementation and application.

Based on the specifics of the Professional Education (Oil and Gas Industry) study program, the curriculum provides for the teaching of the course Technological schemes and basic equipment of pumping stations in the third semester.

In the current situation of martial law in Ukraine, higher education students are encountering challenges due to the stark disparities between the organization of the educational process at the university and secondary school. The limitations of distance learning, as the only viable option at present, further exacerbate these difficulties. Online lectures, though beneficial, lack the geographical proximity that facilitates close feedback between teachers and students, resulting in increased academic demands compared to secondary education.

However, these obstacles can be overcome by implementing innovative pedagogical technologies as a solution. Using the Moodle e-learning management system, we can establish an educational environment in educational institutions that is both informative and engaging. This system allows us to provide well-designed teaching and learning materials, ensuring that students have unlimited access to these resources regardless of time constraints or their geographical location. Additionally, it facilitates effective communication between teachers and students, enables the sharing of important managerial information, and promotes seamless feedback among all parties involved.

The models are based on the educational network and information environment and a set of tools allowing to organize communication between the subjects of the learning process in different modes.

The primary objective of models is to address issues concerning the enhancement of the practical aspect of the learning process, the transformation of teaching methods and tools to foster the growth of professional skills in university students, the implementation of focused management to improve students' independent study skills and their ability to organize themselves,

the establishment and consolidation of a digital library of materials, the utilization of external educational resources, and the efficient organization of the learning process.

When constructing the course model "Technological Schemes and Basic Equipment of Pumping Stations," we based our approach on established didactic principles. Moreover, we have integrated a specific set of principles that are perfectly tailored to suit the distinctive needs of remote learning.

- didactic usefulness;
- consistency and systematics;
- taking into consideration the specifics of the subject area being studied and the students' group (focus on their individual characteristics);
- flexibility, maneuverability of the academic process (modular construction of content, implementation of differentiation in learning);
- pedagogical relevance of using information and communication technologies;
- mobility of learning (creation of information networks, databases and data banks allowing to adjust the educational program);
- providing information security;
- interactivity;
- individualization (different forms of control).

The development of the course model "Technological schemes and basic equipment of pumping stations" was carried out on the basis of the following scientific approaches:

- personality-oriented, providing reliance on the students' active cognitive activity in mastering the course content;
- activity-based, aimed at mastering the ways of gaining knowledge, skills and abilities;
- modular, defining the degree of systematization of the mastered material in the training content;
- systemic, which has many advantages, the main of which make it possible to implement an integrated approach to the development of a knowledge system in the subject area.

The Moodle system provides effective opportunities for designing, creating and further managing the resources of the information and educational environment [6]. The success of students' learning and the quality of education greatly rely on harnessing the full potential of Moodle for organizing distance education. By effectively utilizing Moodle's advantages, such as the seamless transmission of various types of information (visual, sound, static, dynamic, textual, graphic) over any distance, storing information for as long as needed, and enabling editing, processing, printing, and more, we can foster interactivity

through multimedia content. The quality of mastering the course directly depends on the organization of the educational process, the quality of teaching materials and teachers' proficiency involved in the process [7, 8].

The Moodle system is focused on distance education, so it has a large set of tools for organizing communication. A positive aspect of using Moodle is the simplicity of organizing communication between students and teachers and between each other. For this purpose, different types of communication can be used: asynchronous and synchronous. In asynchronous communication, the exchange of information is performed at any time. This may involve e-mail, forums, bulletin boards, special forms, etc. In synchronous communication, information is shared in real time. Various tools can be used for this purpose, such as video conferencing, audio conferencing, chats (text conferencing), etc. The organization of synchronous communications (real-time communications) is technically more complicated than asynchronous communications.

We will consider the use of two types of communication in teaching the course "Technological schemes and basic equipment of pumping stations". The Moodle system contains a textbook and presentations on all course topics. Students have access to these materials before the training and can use them to prepare for lectures. They have the opportunity to discuss the material with each other, ask questions to the lecturers and receive answers. Implementing asynchronous communication offers a unique chance to engage in a lecture using the dynamic dialogue method, a problem-based approach to teaching content, and conducting primary analysis. Traditional aspects, such as science, informativeness, and live communication with the audience, can characterize such a lecture. The lecturer has the ability to display their skills, offer and discuss distinctive examples, draw from personal experiences, and even convey their emotions. However, the same lecture has such characteristics as novelty, dialogue, the ability to generate close feedback from the lecturer to the audience and the use of a wider variety of technical potential. The implementation of this form makes the lecture more interactive in nature and is certainly quite promising. Conducting a lecture by using such synchronous and asynchronous communication tools provides an opportunity to make the learning material more accessible, maintain the logic of the presentation, facilitate its learning, and draw attention to previously presented points. This form of lecture allows demonstrating the operation of various types of technological equipment via videoconferencing and simultaneously broadcasting parameters,

characteristics and graphical information on its operating modes, and much more. Such technology enables us to move away from the usual stereotypes of teaching in higher education, the lecture becomes understandable to students from the first time, it is possible to present the material taught by the lecturer in an unusual, visual and accessible way, and to establish emotional contact with the students. At the same time, students do not need to take notes on the lecture material from the lecturer. They are able to pay more attention to the content of the lecture. The use of various communication methods in this technology has proven to be incredibly alluring. It enables direct communication and visual connection with the audience, regardless of their physical location or distance from the teacher.

The structure of the course "Technological diagrams and basic equipment of pumping stations in the system of DE of the Ukrainian Engineering Pedagogics Academy" is shown in Fig. 1.

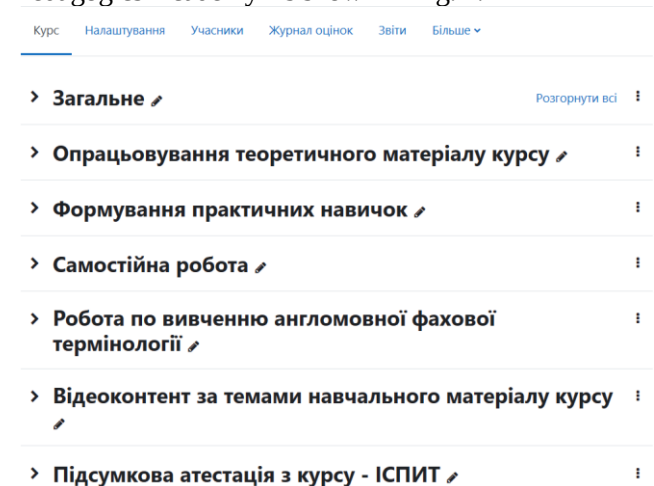


Figure 1 - Course structure Technological schemes and basic equipment of pumping stations

Another area where innovative technologies can be implemented is in solving the challenges that arise in organizing the educational process for teachers. This can help overcome the difficulties faced in getting students actively engaged in learning due to a lack of motivation. Technology and gadgets have become an indispensable aspect of the lives of modern higher education students. They consume an increasing amount of time and capture students' attention, gradually supplanting activities beyond the realm of these technological marvels.

Using the Moodle environment, the emphasis shifted from the traditional methodology focused on mathematical tasks to an environment for viewing video content with its discussion in various forms, including problem-based learning. Therefore, the didactic material of the course under consideration was adapted to the new needs of higher education students using the information and

communication technologies of the educational environment.

In addition, in teaching the course Technological schemes and main equipment of pumping stations, innovative technologies are introduced in preparing students for practical classes, in which information becomes not the goal, but a means for mastering the actions and operations of professional activity. The teacher - the author of the course - has selected material for practical classes that is both personally significant and interesting for students, stimulating interest and questions about themselves as future professionals, and affecting the emotional sphere. Nevertheless, at the same time, the educational process is based on the previous cognitive experience of the student, on its value and meaning part and provides for the possibility of its personal transformation.

The personal component of academic discipline content under consideration is reflected through the implementation of the principle on content variability. The process of knowledge accumulation is highly complex and has the properties of nonlinearity and probability. A precondition for its implementation is a number of factors. For each specific case, the combination of these factors is different and depends on the genetically determined traits of the learner and his/her subjective experience.

It is almost impossible to identify these factors and provide their implementation for each individual student in a group-learning environment. However, using the diversity of course content to create an educational environment for mastering the discipline Technological schemes and basic equipment of pumping stations based on Moodle allows students to choose the material that is more suitable for them and therefore most successfully "master" the necessary knowledge. The following parameters were considered in the selection process to provide a sufficiently intensive educational environment: the level of preparedness and educational and professional motivation of the applicant; the style of information processing (speed and accuracy), the development of sensory channels; preferred forms of work and subjective experience.

The authors applying modern information technologies based on Moodle achieved the variability of the educational content, ensuring the personalization of meaning, and creating appropriate didactic task sets, the development of which is based on the subjective experience of the

teachers-developers and is focused on the students' needs and interests.

The building of these complexes of tasks is based on clearly defined principles, the most important of which are the principles of developing the creative, reflective and communicative orientation of the student's personality.

The problem of measuring and evaluating learning achievements is one of the most important in pedagogical theory and practice. The effectiveness of its solution is an indicator of the effectiveness of pedagogical innovations and technologies used in teaching a course. The adequacy, fairness and objectivity of the assessment was ensured by the use of Moodle features for all control activities.

Innovative educational technologies are used in the final control of students' progress. The use of the Moodle system for this purpose is determined by the fact that it has effective tools for organizing knowledge control. For this purpose, a database of questions for computer-based testing has been developed. Three test versions have been developed for the final assessment based on the mastery of the first and second content modules, as well as the comprehensive understanding of the entire course.

Computer-based testing includes the following types of tasks:

- Closed-ended tasks:

- a) selecting one correct answer from the proposed options for answering the question (usually from four proposed options);

- b) selecting all the correct answers from the proposed options (usually three to four options out of six to seven proposed options);

- open-ended tasks (in addition), offering to complete the definition of concepts;

- tasks on correlation of information in two groups (for example, equipment and its characteristics, etc.).

The questions in the database are developed based on the course syllabus and cover the content of all didactic units of the curriculum. The total number of questions in each version is 240. There are 40 closed-type tasks, and 40 open-type tasks and tasks on the correlation of information. The selection of questions is carried out by software in a random order.

In organizing the assessment of the course "Technological schemes and basic equipment of pumping stations" by students, the use of a 100point system is provided.

The assessment system for determining the success of students in the course was formed taking into consideration the following criteria

- Successful completion of the program in classroom (lecture and practical) classes;

- Successfulness and timeliness of extracurricular and classroom work and assignments.

Compliance with the time component of the educational process schedule is an important condition for achieving high academic results.

In the initial lesson, the head teacher will present participants with a comprehensive schedule, detailing the different assessment criteria, deadlines, and the corresponding amount of points that students can achieve. Additionally, the criteria for evaluating each task and the requirements for course certification will also be clearly communicated. This information is also provided in the distance learning course, Fig. 2.

Максимальна кількість балів, яку здобувачі освіти мають можливість отримати при роботі над курсом	
Вид роботи	Бали (макс.)
Робота над курсом	100
Робота протягом семестру в тому числі :	83
Робота над теретичним матеріалом (виконання теоретичних завдань)	7
Виконання практичних завдань	36
Підготовка реферату та його публічний захист з демонстрацією презентації	20
Складання термінологічного словника англійською мовою	10
Інші (в т. ч. особливі і додаткові) навчальні досягнення	10
Іспит	17

Figure 2 - Information on the course control activities

Based on the abovementioned analysis of the scientific and pedagogical results obtained by the authors in the process of introducing innovative technologies based on Moodle into the educational process in teaching the course "Technological schemes and basic equipment of pumping stations" for higher education students of the first (bachelor's) level of the specialty Professional Education (Extraction, processing and transportation of minerals) under the educational program (EP) "Professional Education (Oil and Gas Industry)", the following conclusions can be drawn:

1. Developing and implementing innovative pedagogical technologies to teach subjects in the training of bachelors in professional education for the oil and gas industry is an important scientific and pedagogical challenge.

2. The problem at hand can be effectively solved by developing and implementing an information educational environment. This environment will be built using distance learning course models that utilize the Moodle-based educational resource management system.

3. The distance course "Technological schemes and basic equipment of pumping stations" has been developed and implemented in the educational process for applicants for higher education of the first (bachelor's) level of the specialty Professional Education (Extraction, processing and transportation of minerals) under the educational program (EP) "Professional Education (Oil and Gas Industry)".

4. Developed and implemented in the educational process the information and educational and methodological support of the educational component Technological schemes and basic equipment of pumping stations of the EP "Professional Education (Oil and Gas)".

5. Using innovative educational technologies in teaching the course "Technological schemes and main equipment of pumping stations" based on Moodle made it possible to implement the personal component of the content in the discipline by considering the level of students' preparedness and educational and professional motivation; style of information processing (speed and accuracy), development of sensory channels; preferred forms of work and subjective experience.

6. The introduction of innovative educational technologies has provided an opportunity to ensure the high quality of the educational process in the distance teaching of the course «Technological schemes and basic equipment of pumping stations» in war conditions through the use of the advantages provided by the Moodle system: simplicity of organizing feedback through a well-developed system of tools for communication, the effectiveness of combining different types of communication using modern information technologies, ensuring the complexity of evaluating achievements in the development of ensuring the complexity of the assessment of achievements in the process of mastering the components of the educational program by students, stimulating the students' cognitive activity and improving the quality of educational results in general, etc.

7. The development of the theoretical model and, consequently, the teaching technology and the integration of modern innovative educational technologies into the educational process was based on a detailed analysis of the students' psychological traits. Without considering these data, it is impossible to ensure the personal components of the discipline's content.

Prospects for further research. According to the authors, the prospects for improving the training of students in the components of the educational program "Professional Education (Oil and Gas Industry)" are in the development of the dual educational system.

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