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## **PEDAGOGICAL MODEL OF PREPARATION OF FUTURE ENGINEERS IN SPECIALTY "ELECTRIC POWER, ELECTRICAL ENGINEERING AND ELECTRICAL MECHANICS" WITH USE OF MASSIVE ONLINE COURSES**

**Abstract.** The article presents an experimental model of training future engineers in specialty "Electric Power Engineering, Electrical Engineering and Electromechanics" in conditions of massive open online courses (MOOC). The article reveals the concepts of modeling, designing and validity in pedagogy. The stages of construction of the pedagogical model are presented. Four blocks of the model of training the students in specialty "Electric Power Engineering, Electrical Engineering and Electromechanics" for educational and scientific activities in the conditions of MOOC are presented: motivational, content and procedural, technological and productive. The motivational block is characterized by the definition of the main goals of the introduction of pedagogical technology: the preparation of a highly qualified specialist. The content and procedural block is based on the implementation of pedagogical conditions of educational and scientific training. The technological block consists of three stages: motivational, cognitive-procedural and control-evaluation. The productive block provides monitoring of educational and scientific training of students in the specialty "Electrical power, electrical engineering and electromechanics". It is determined that there is feedback between all blocks of the model, which allows to make changes in the content, forms and methods of teaching. The principles of construction and the main structural elements of each of the blocks are analyzed. The general principles for the training of future engineers in specialty "Electric Power Engineering, Electrical Engineering and Electromechanics" are determined in conditions of MOOC; forms, methods and means of instruction are described. It is considered that educational and scientific training is implemented through such forms of teaching as lectures, video lectures, webinars, workshops, video conferences, discussion in forums, participation in scientific conferences and seminars. It is

determined that the result of the developed model is readiness of the students majoring in ‘Electric Power Engineering, Electrical Engineering and Electromechanics’ for research and study.

**Keywords:** educational and scientific activity; pedagogical model; students, specialty “Electric Power Engineering, Electrical Engineering and Electromechanics”; massive open online courses (MOOC).

## 1. INTRODUCTION

**Formulation of the problem.** The development of Ukraine, in terms of European integration, with an orientation towards the fundamental values of the world culture, is determined by its European vector. Electrical power is the basis of scientific and technological progress of the present, because it provides humanity with heat, light and energy. Professional training of future engineers is carried out on the basis of experience in the construction and operation of power consumption systems, the best practices of the world's electric power industry, the development of new technologies for receiving, transmitting and consuming electricity, energy conservation requirements, global information management of power consumption, a clear perspective on the development of new sources of electricity generation, and increasing attention to the application of energy saving measures in industry.

The professional training of future engineers is based on the latest information technologies; special attention is paid to computer design of electric systems and networks, electrical equipment and machines, studying the issues of creating modern renewable energy sources, the use of energy efficient technologies.

The applicants of higher education majoring in this specialty are engaged in the development of design and work documentation of power systems, computer options for design and engineering documentation, calculation of electrical circuits and the use of computing equipment for project calculations, planning of loads and electricity consumption. They control the work of electrical equipment and automatic control systems at power plants, take care of power plants maintenance and electric power networks.

In order to develop an experimental model for training students in specialty ‘Electric Power Engineering, Electrical Engineering and Electromechanics’ in the conditions of massive open online courses (MOOCs) we study such concepts as model and modeling. Modeling as one of the methods of scientific research is widely used in pedagogical science. It is a universal form of knowledge is used in the study and transformation of phenomena in any field of activity, this is the most common method of researching objects of various nature, including objects of a complex social system. In modern pedagogy, the term “model” is defined both as a system and as a sample, and as an analogue of a natural or social phenomenon. The term “model” can also refer to the general picture of the phenomenon created on the basis of a certain system of views and ideas, which, with the help of creative intuition and hard work, helps to understand and describe what we are studying. A model is a system of objects or signs that reproduces some essential properties of the original system, it is a generalized reflection of the object, the result of abstract practical experience, rather than the direct result of the experiment. During the study, an experimental model was developed based on the tasks of the experiment and the theoretical approaches to the educational and scientific training of students majoring in “Electric Power Engineering, Electrical Engineering and Electromechanics”.

Globalization, democratization and informatization of society put forward new requirements for the training of engineers. The progressive experience of developed European countries involves the implementation of a key function of educational and scientific training of the future engineers – acquisition of competencies by specialty. The reform of higher

education provides the transition to the training of future engineers based on modern approaches, innovative technologies of massive education, taking into account world experience and meeting the needs of independent study and self-improvement throughout life. There is a good legal base in Ukraine for that: Laws "On Education" (2017) [1], "On Higher Education" (2014) [2], the National Strategy for the Development of Education in Ukraine for 2012-2021 (2013), Concepts of Pedagogical Education Development (2018) [4]. MOOC is such an online course, where access to educational materials is open, and it has a global, rather than regional, character and goes beyond the boundaries of the university. The course is based on modern information and communication technologies and reduces the barriers to learning. It enhances the independence of students, who acquire professional skills to participate in global interactions. Future engineers's qualification is reflected in the results of their research presented at conferences, in international and home publications, their participation in contests, competitions, start-ups, round tables, etc. With the help of MOOC future engineers get abstract writing skills, interact with colleagues and tutors, share experiences. MOOC gives a possibility to participate in webinars, online conferences of international level, to present the future engineers' educational and research achievements. In today's Ukraine, MOOC is not yet sufficiently used for education and research in the context of interaction with tutors, and specialists from abroad.

**Analysis of recent research and publications.** V. Yu. Bykov explored the theoretical aspects of informatization of education [5] such as systems of modern computerized educational environment, development of technological platform of informational and educational environment, informational educational resources and network services. I. S. Chernetskyi and I. A. Slipukhina [6] paid their attention to the problem of informational technologies in education, such as technological competencies of future engineers through the forms, tools, methods and technologies of the computer laboratory. T. M. Korotun, O.O. Slabospyska, H. I. Koval [7] observed the quality of monitoring in educational process using educational environment at the university. I. V. Stavvytska [8] investigated the level of foreign language application for the students of engineering specialties using multimedia environments. M. A. Kyslova and K. I. Slovak [9] considered the peculiarities of work in the conditions of mobile learning and represented the technique of using it for training of the future engineers. M.M. Berezytskyi, V.P. Oleksyuk [10] compared the MOOC with the traditional systems, investigated the limitations and the shortcomings of learning, statistical information of the MOOC platforms. K. A. Lisetskyi [11] researched the use of different forms of online learning in connection with the traditional form of learning. O. Yu. Tsugai [12] studied the process of studying in the MOOC. This type of learning teaches the participants to control their progress, take part in the discussions, work according to a flexible schedule, adhering to the requirements of the program, get advice from experienced specialists, work in a group, take part in the evaluation of other students' work.

The development of MOOC is investigated in the works of foreign scientists. Theoretical aspects of teaching in MOOC are investigated by K. Carey [13]. The problems of mixed learning using MOOC were analyzed by D.Bruff, D.Fisher, K. McEwen [14].

Analysis of educational platforms for MOOC was carried out by S. Audsley, K. Fernando, B. Maxon [15]. Pedagogical basics of MOOC were studied by P. McAndrew and E. Scanlon [16]. The introduction of online learning within the framework of massive and open education in higher education institutions has been the subject of research by such scholars as J. Denneen, T. Dretler [17]. Elements of organization of training in MOOC are presented in works by R. Boyatt, M. Joy, C. Rocks [18]. But the question about development and implementation of the pedagogical model of training future engineers in conditions of MOOC needs additional attention.

**The purpose of the article** is to develop a pedagogical model of training future engineers in specialty “Electric power engineering, electrical engineering and electromechanics” in the conditions of MOOC.

**Methods of research.** The study is based on the methods of pedagogical observation, research interview, generalization of pedagogical experience, study of documentation and materials, reports on students’ activity. The method of modeling is integrative; it allows combining empirical and theoretical aspects in pedagogical research. The pedagogical object is connected with the experiment, logical constructions and scientific abstractions.

## 2. RESULTS AND DISCUSSION

The model represents an artificially created object in the form of physical structures, sign forms or formulas, which, being similar to the investigated object (or phenomenon), reflects and reproduces in a simpler and generalized form the structure, properties, interconnections and the relations between the elements of this object [8]. The practical value of the model in any pedagogical study is mainly determined by its adequacy to the investigated peculiarities of the object, as well as how correctly the basic principles of modeling – visibility, certainty, objectivity, which are largely defined as opportunities and the type of model, and its functions in pedagogical research are taken into account at the stages of the model construction. To describe the effectiveness of modeling a pedagogical validity was introduced in pedagogy, which is close to reliability, adequacy, but not identical to them [19]. Pedagogical validity is substantiated comprehensively: conceptually, criterially and quantitatively, therefore, multifactorial phenomena are usually modeled. It is related both to the general method of scientific knowledge, and to the need for solving psychological and pedagogical tasks. The result of a completed pedagogical research of a model system is its design, so it is advisable to consider the problem of pedagogical design. Pedagogical modeling often accompanies designing. On the basis of the analysis, when comparing the concepts of "design" and "modeling", we note that design is widely used in modeling as a means of representing and transforming an object. This differs modeling in designing from modeling in theory, where the model is a means to highlight the essential aspect of the real object, truncate the latter for the convenience of the next logical analysis.

Pedagogical designing is the activity of the subject or subjects of education, which is aimed at constructing models of transformation of pedagogical reality. The essence of pedagogical design is to identify and analyze pedagogical problems and the causes of their occurrence, construct valuable principles and design strategies, identify goals and objectives, search for methods and tools for implementing a pedagogical project [20]. For our study we developed an experimental model based on the design of the tasks of the experiment and the theoretical approaches to the educational and scientific training of students majoring in specialty ‘Electric Power Engineering, Electrical Engineering and Electromechanics’. In particular, the developed model has elements of monitoring and evaluation of research results. An integrated model is not a simple sum of model components, but represents a system that combines constituent elements that themselves are interconnected with each other. We emphasize that what is meant is a complex set of models, which does not lead to a scientific interpretation of the predicted results [21]. Let us turn to the theory of modeling, in particular, to two basic theorems for modeling: the incompleteness and consistency of formal systems. The first argues that in the logical systems it is fundamentally impossible to formalize the entire holding part, that is, any axioms system is incomplete. The second concerns the impossibility to prove the consistency of the formal system with the means of this system [22]. Modeling, in general, is defined as a method of mediated cognition, in which for the

purpose of obtaining information about the object, a phenomenon or system is investigated additionally at the expense of an object or structure, having a certain conformity with real phenomena and replacing the originals in obtaining generalized knowledge [23].

The practical value of the model of educational and scientific training of future engineers in pedagogical research is determined by its adequacy to the investigated features of the object, as well as to how correctly the basic principles of modeling are used – visibility and certainty. Let's study a model of training of future engineers for educational and scientific activity in the conditions of MOOC in detail (Fig. 1). The model consists of four blocks: motivational, content-procedural, technological and productive.

**Motivational block.** This block is characterized by the definition of the main objectives of the introduction of pedagogical technology: the training of a competitive, highly skilled specialist; formation of readiness for continuous education. The motivation block envisages increasing the need for self-improvement and independent study throughout life in conditions of European integration and is based on updated requirements for the training of future engineers at the technological level and the social order for students in engineering specialties capable of educational and scientific activity of innovative character.

**Content-procedural block.** The implementation of the content-procedural block in the framework of tasks of the model is based on the implementation of pedagogical conditions of educational and scientific training: motivational, organizational, technological and methodological. Using the expert estimation method, the expediency of using the motivational, organizational, technological and methodological conditions of educational and scientific training with the use of MOOC was determined. The main directions of educational and scientific training are set in the educational and qualification characteristics and they are changed in accordance with the level of development of science, production and society. The content of training is determined by educational and scientific training programs, structural-logical scheme of training, syllabi of educational disciplines, other normative documents and methodological literature. General and special training of future engineers at the university includes the study of such blocks of academic disciplines as a block of compulsory academic disciplines, a block of disciplines of a faculty or institute choice, and a block of disciplines of students' free choice, as well as research work and practice. Each of the blocks covers the normative and selective part of the content of the training. The normative part of the content of study is compulsory for students. It is formed in accordance with the requirements of educational and qualification characteristics as content modules with indication of their volume and level of study, as well as forms of state attestation. Formed content modules with indication of their volume and attestation forms, are designed to meet the needs and capabilities of the individual, considering the achievements of scientific schools and educational institutions. During general training, a list of MOOCs is approved by the university, faculty or institute. The list of elective MOOCs may be formed by a higher education institution or a student. If the MOOC is included in the list of compulsory disciplines, the content of such a course is approved by the university. If the MOOC is included in the list of disciplines of the choice of the faculty, the content of the course is approved by the faculty or institute.

**Technological block.** This block consists of three stages: motivational, cognitive-procedural and control-estimating. The motivational stage involves the process of motivating students to achieve personal goals. Moreover, the incentive for educational and scientific activities is ensured not only in the conditions of MOOC, but also in the process of classroom training. Students' motivation is determined by the tasks set by the lecturer and future engineers themselves.

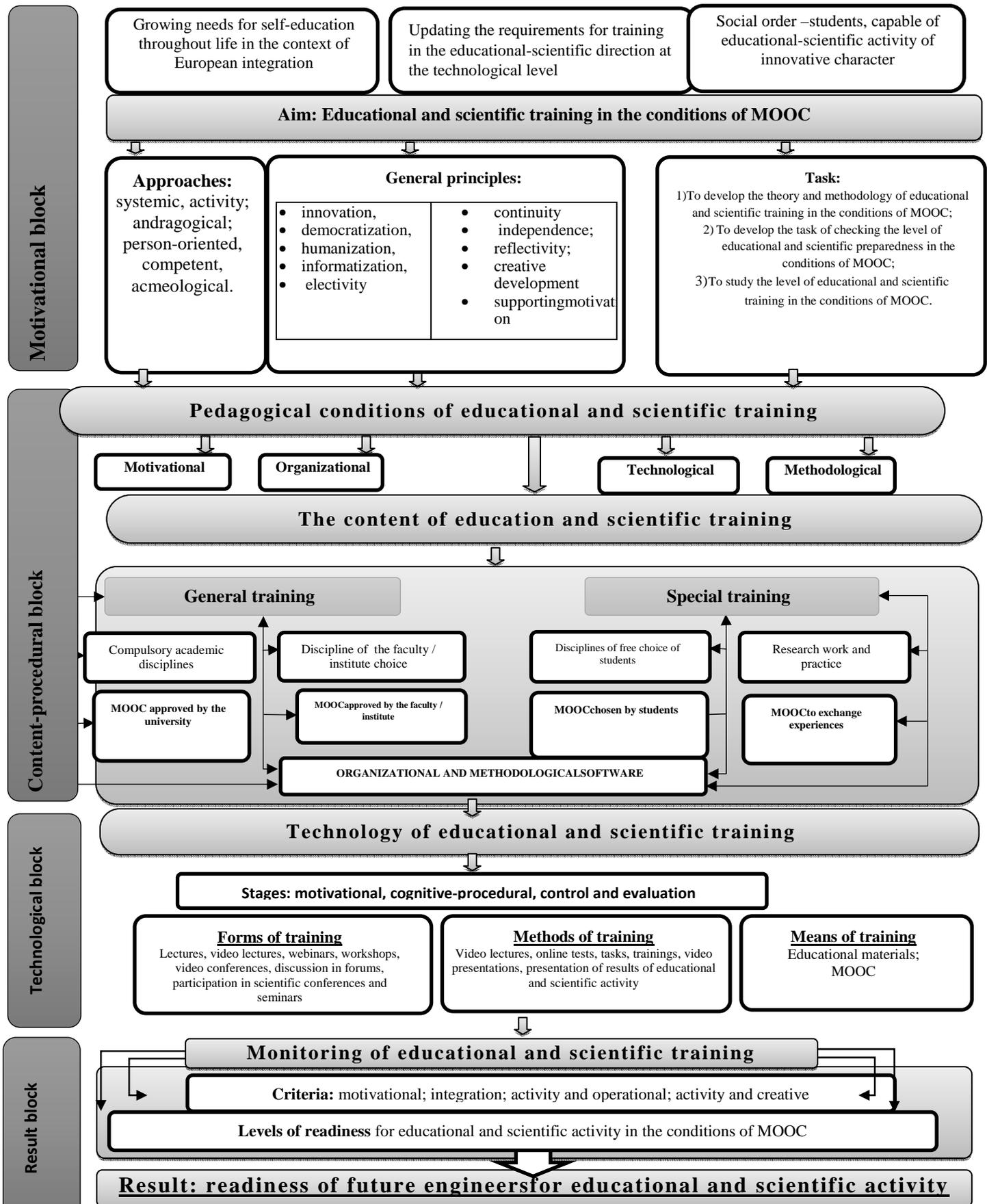


Figure 1. Model of training students in specialty “Electric Power Engineering, Electrical Engineering and Electromechanics” for educational and scientific activity in the conditions of MOOC

The motivation to study in a MOOC can be an introductory video by leading lecturers, where they explain the relevance of the training material presented in their courses. In this video, the lecturers talk about the course, the connection of the course material with the study materials of other disciplines, etc. The information may also be presented in the form of slides and a brief textual description. The motivation stage can also be sustained through classroom training, counseling, practice, and participation in scientific conferences and seminars.

Video lectures, online tests, tasks, trainings, video presentations, presentation of results of educational and scientific activity are used as methods of training future engineers in MOOCs. Testing and using training simulators will enable the future engineer to work out the skills of drawing up electrical circuits, controlling the operation of automatic control systems of power plants. Using video lectures allows the student to get acquainted with the structure and operation of the equipment they will deal with in practice.

The MOOC is based on the active participation of hundreds and thousands of students who organize their participation in accordance with the objectives of education, knowledge and skills, as well as general interests.

The cognitive-procedural stage involves the development of all types of mental processes in future engineers such as perception, memory, formation of concepts, problem solving, imagination and logic. The cognitive-procedural stage of educational and scientific training of students in engineering specialties is realized when the students are active participants in the educational process. Thus, future engineers can work in MOOC independently; provide mutual assistance in thematic forums, plan participation in conferences and scientific seminars. Students will have the opportunity to analyze the study material, apply theoretical knowledge during the practice, research, talks at scientific conferences and seminars.

The control and evaluation stage includes the control and evaluation of educational and scientific training of students in specialty 'Electric Power Engineering, Electrical Engineering and Electromechanics'. It is carried out based on the results of studying the educational material of the disciplines included in the curriculum, on the results of practice, scientific research and the students' ability to present their results. The systematic and active work of the applicant of higher education in specialty 'Electric Power Engineering, Electrical Engineering and Electromechanics' consist in studying of the topics of the module of MOOC, tasks, calculations, writing scientific articles; presentations at conferences and tests that are monitored and evaluated.

Educational and scientific training is being implemented through such forms of study as lectures, video lectures, webinars, workshops, video conferences, discussion in forums, participation in scientific conferences and seminars. Lectures are logically complete, scientifically substantiated, consistent and systematic presentation of a certain scientific problem, topic or section of the subject in the classroom. They provide a scientific account of a large volume of clearly structured and concentrated, technologically competently developed modern scientific information, establishing contact with the audience and providing effective feedback. In conditions of MOOC a more modern form of training is used – video lecture. Video is the main form of presentation of educational material in the conditions of MOOC. Didactic requirements for video lectures are quite similar to the requirements for traditional lectures. The forms of presentation of video lectures differ from the forms of presentation of traditional lectures. There are the following types of video lectures:

1. Video recording of the lecturer. This is the least productive and didactically ineffective form of online learning.
2. Live recording. This record of university lectures occurs with the help of specialized equipment.

3. Studio video lectures and video tutorials. Such recordings are well edited. Often, this videotutorial is accompanied by a demonstration of images, video clips.

4. Slide films. Elements of video clips and animation accompanied by a voice of the lecturer or speaker. This type is as close to the documentary educational film as possible.

5. Interactive video lectures and video tutorials. The lecturer's monologue is accompanied by slides, video clips, and tasks. In this case, the principle of multiple screens is used.

Webinar is a seminar organized with the help of Internet technologies. The lecturer makes a report and answers the questions of the listeners. During webinars there is an opportunity to perform the tasks of the lecturer, answer the questions, and also present the report or the results of research. After completing the event, there is a record that can also be used for training purposes.

Video lectures is the basis of the video library. The use of video materials in MOOC helps in a very short time in a concentrated form to provide a large amount of information professionally prepared for perception, provides an opportunity to look into the essence of phenomena and processes that are not accessible to the human eye (ultrasound image, spectral analysis, the influence of radioactive elements on the course of biological, chemical and biochemical processes, the course of rapid and slow processes, etc.). The use of video lectures in the educational process of MOOC allows to:

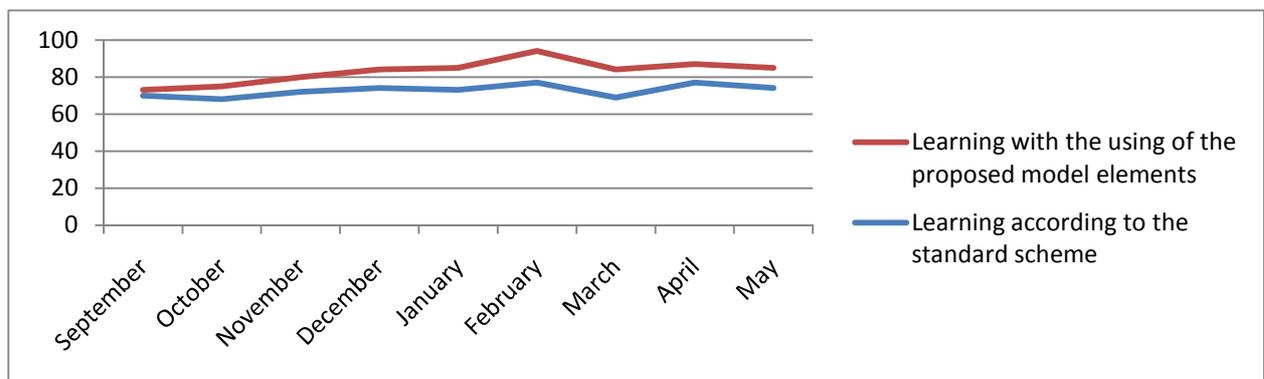
- provide future engineers with more complete information about the phenomena and processes;
- enhance the role of visibility in the learning process;
- organize the process of study considering the demands, desires and interests of future engineers;
- dismiss the lecturer from a part of the technical work related to the control of knowledge;
- organize a complete and systematic monitoring of the students' progress.

Seminars (workshops) are a kind of practical exercises aimed at deepening, enlarging, detailing and consolidating theoretical material. Seminars promote the activation of cognitive activity of future engineers, the formation of independence of judgments, the ability to defend their own thoughts, prove them on the basis of scientific facts, and provide for the mutual verification of tasks performed in virtual learning environments. This can make the assessment process in the course automated and provide an opportunity to analyze the work of other students and evaluate them. Video conference is a way of exchanging video images, sound and data among several participants in the learning process, equipped with appropriate hardware and software. For educational purposes, the unlimited number of participants in a videoconference is important. This actually means that a lot of participants from all over the world can join any virtual lecture, workshop, round table, etc. This approach brings university education to a new level, because it makes opportunity for a daily, continuous exchange of experience, thoughts, and outcomes. Discussions in the forums represent the exchange of messages in postponed mode. With the help of forums in MOOC it is possible to organize discussions, consultations, exchange of scientific experience. Participation in scientific conferences and seminars is a scientific training procedure. The technology of training future engineers is realized with the help of such teaching methods as video lectures, on-line tests, tasks, trainings and presentations of products of educational and scientific activity at webinars, online conferences etc.

Result block. This block of the developed structural model envisages monitoring of educational and scientific training of students in specialty 'Electric Power Engineering, Electrical Engineering and Electromechanics', which is carried out on the basis of a combination of the following criteria: motivational (level of educational motivation and

motivation for research work); integration (defines the degree of integration of individual skills to the educational and scientific training of students in specialty ‘Electric Power Engineering, Electrical Engineering and Electromechanics’ in MOOC); activity and operational (involves the choice of modern technological tools in the process of working with educational and scientific tasks and is defined as the technology of solving research problems); activity-creative (desire and motivation for professional self-development and self-improvement in the aspect of educational training). Monitoring includes assessment, self-assessment and methods for measuring the level of readiness of students in engineering specialties for educational activities in the conditions of MOOC; the ability to control the results of their activities consciously and independently, professional self-improvement, self-regulation and the actual result that meets the needs of society. Controlling measures determine the level of students’ readiness for educational and scientific activity in the conditions of MOOC. The result of the developed experimental model is the readiness of students in engineering specialties for educational and scientific activity.

It should be noted that there is a feedback link between all the blocks of the model, which allows making changes to the content, forms and methods of teaching. According to the implementation of the model in the educational process, an experiment was conducted, in which two groups of the specialty “Electric Power Engineering, Electrical Engineering and Electromechanics” were involved, one consisting of 25 students (control group) and the other of 27 students (experimental group). The experiment was conducted during the 2018-2019 academic year. The control group used a standard learning method. And the experimental group used the method of learning with the proposed model elements. As can be seen from Fig. 2, the learning outcomes of students who took the MOOC are 10-15 points higher than the control group’s indicators for each month. This indicates a positive effect from the application of the proposed model elements.



*Fig.2. Comparative characteristics of the progress of the future engineers in specialty ‘Electric Power Engineering, Electrical Engineering and Electromechanics’ (those who studied in the standard mode and those who studied using the proposed model elements) in 2018-2019 academic year*

### 3. CONCLUSIONS AND FOLLOW-UP RESEARCH

The need for a pedagogical model of training future engineers in specialty “Electric power engineering, electrical engineering and electromechanics” in conditions of MOOC is defined by the increase in the needs for self-improvement and self-training of future engineers during their lifetime in the conditions of European integration, the updating requirements for the training of future engineers of the scientific direction at the technological level and social order for future engineers capable of educational and scientific activities of an innovative

character. While studying in MOOC, future engineers interact with tutors, colleagues and specialists, share experiences, participate in webinars, international online conferences, where they can present their educational outcomes and scientific work. The efficiency of the modeling depends on the initial theories and hypotheses, which indicate the limit of permissible simplifications in modeling. The result of the developed model is the readiness of students for their educational and scientific activities. The prospects for further research include the development of criteria, indicators and levels of readiness of future engineers in specialty “Electric power engineering, electrical engineering and electromechanics” for educational and scientific activities in the conditions of MOOC and the study of pedagogical conditions of educational and scientific training of future engineers.

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## **ПЕДАГОГІЧНА МОДЕЛЬ ПІДГОТОВКИ МАЙБУТНІХ ІНЖЕНЕРІВ СПЕЦІАЛЬНОСТІ «ЕЛЕКТРОЕНЕРГЕТИКА, ЕЛЕКТРОТЕХНІКА ТА ЕЛЕКТРОМЕХАНІКА» З ВИКОРИСТАННЯМ МАСОВИХ ОНЛАЙН КУРСІВ**

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**Анотація.** У статті представлено експериментальну модель підготовки майбутніх інженерів спеціальності «Електроенергетика, електротехніка та електромеханіка» на основі конструювання завдань експерименту і теоретичних підходів до навчальної та наукової діяльності в умовах масових відкритих онлайн-курсів. У статті розкриваються поняття «моделювання», «проектування», «обґрунтованість» в педагогіці. Представлено етапи побудови педагогічної моделі та проекту алгоритму моделювання. Представлено чотири блоки моделі підготовки здобувачів вищої освіти спеціальності «Електроенергетика, електротехніка та електромеханіка» до освітньої та наукової діяльності в умовах масових відкритих онлайн-курсів: мотиваційний, змістовно-процедурний, технологічний та продуктивний. Мотиваційний блок характеризується визначенням основної цілі впровадження педагогічної технології – підготовці висококваліфікованого фахівця. Змістовий та процедурний блок базуються на реалізації педагогічних умов навчальної та наукової підготовки. Технологічний блок складається з трьох етапів: мотиваційного, когнітивно-процесуального та контролюю-оцінного. Виробничий блок забезпечує

моніторинг навчальної та наукової підготовки студентів за спеціальністю "Електроенергетика, електротехніка та електромеханіка". Встановлено, що існує зворотний зв'язок між усіма блоками моделі, що дозволяє за результатами вносити зміни до змісту, форми і методів навчання. Розглянуто принципи побудови та основні конструктивні елементи кожного з блоків. Загальні принципи підготовки майбутніх інженерів за фахом «Електроенергетика, електротехніка та електромеханіка» до навчально-наукової діяльності визначаються в умовах масових відкритих онлайн-курсів; описано форми, методи і засоби навчання. Вважається, що освітня і наукова підготовка здійснюються за допомогою таких форм навчання, як лекції, відеолекції, вебінари, семінари, відеоконференції, обговорення на форумах, участь у наукових конференціях і семінарах. Встановлено, що результатом розробленої моделі є готовність здобувачів вищої освіти за спеціальністю «Електроенергетика, електротехніка та електромеханіка» до навчальної та наукової діяльності.

**Ключові слова:** навчальна та наукова діяльність; педагогічна модель; здобувачі вищої освіти; спеціальність «Електроенергетика, електротехніка та електромеханіка»; масові відкриті онлайн-курси.

## **ПЕДАГОГИЧЕСКАЯ МОДЕЛЬ ПОДГОТОВКИ БУДУЩИХ ИНЖЕНЕРОВ СПЕЦИАЛЬНОСТИ «ЭЛЕКТРОЭНЕРГЕТИКА, ЭЛЕКТРОТЕХНИКА И ЭЛЕКТРОМЕХАНИКА» С ИСПОЛЬЗОВАНИЕМ МАССОВЫХ ОНЛАЙН КУРСОВ**

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**Аннотация.** В статье представлена экспериментальная модель подготовки будущих инженеров по специальности «Электроэнергетика, електротехніка та електромеханіка» на основе конструирования задач эксперимента и теоретических подходов к учебной и научной деятельности в условиях массовых открытых онлайн-курсов. В статье

раскрываются понятия «моделирование», «проектирование», «обоснованность» в педагогике. Представлены этапы построения педагогической модели и проекта алгоритма моделирования. Представлены четыре блока модели подготовки соискателей высшего образования специальности «Электроэнергетика, электротехника и электромеханика» к образовательной и научной деятельности в условиях массовых открытых онлайн-курсов: мотивационный, содержательно-процедурный, технологический и продуктивный. Мотивационный блок характеризуется определением основной цели внедрения педагогической технологии – подготовки высококвалифицированного специалиста. Содержательный и процедурный блок базируются на реализации педагогических условий учебной и научной подготовки. Технологический блок состоит из трех этапов: мотивационного, когнитивно-процессуального и контрольно-оценочного. Производственный блок обеспечивает мониторинг учебной и научной подготовки студентов по специальности "Электроэнергетика, электротехника и электромеханика". Установлено, что существует обратная связь между всеми блоками модели, что позволяет по результатам вносить изменения в содержание, формы и методы обучения. Рассмотрены принципы построения и основные конструктивные элементы каждого из блоков. Общие принципы подготовки будущих инженеров по специальности «Электроэнергетика, электротехника и электромеханика» к учебно-научной деятельности определяются в условиях массовых открытых онлайн-курсов; формы, методы и средства обучения описаны. Считается, что образовательная и научная подготовка осуществляются с помощью таких форм обучения, как лекции, видеолекции, вебинары, семинары, видеоконференции, обсуждения на форумах, участие в научных конференциях и семинарах. Установлено, что результатом разработанной модели является готовность соискателей высшего образования по специальности «Электроэнергетика, электротехника и электромеханика» к учебной и научной деятельности.

**Ключевые слова:** учебная и научная деятельность; педагогическая модель; соискатели высшего образования; специальность «Электроэнергетика, электротехника и электромеханика»; массовые открытые онлайн-курсы.



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