UDC 378.147.111:[37.041:615.15]
DOI: 10.15587/2519-4984.2022.261052

OPPORTUNITIES OF A PERSONAL LEARNING ENVIRONMENT FOR PERFORMING SELF-EDUCATION ACTIVITIES OF THE FUTURE PHARMACY EMPLOYEE

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The issue of the use of information and communication technologies in the education of pharmaceutical students is highlighted. The author pays special attention to the importance of creating a personal educational environment that enables the student's self-education and is the basis for lifelong education. The author provides a detailed interpretation of the phenomenon, approaches to it, and describes four models that are used in foreign pedagogical practice. The analysis of pedagogical studies made it possible to affirm the opinion about the potential of PLE for the development of the self-educational activity of the student, in particular, the future specialist-pharmacist. The author indicated the directions of using information technologies in medical education. The possibilities of certain elements of the personal educational environment through the prism of their involvement in the educational process, the importance of developing skills and actively using a number of information resources at the same time, systematizing and comparing the acquired knowledge, independently creating new sources of information are described. A number of computer and web technologies have been identified that enable the formation of PLE, promote motivation and development of self-educational activity, namely: the use of structuring of the educational space of higher education institutions based on Ms Office365 and Ms Teams services, MSO365 cloud services; social networks Viber, Facebook and YouTube channels; communication platforms Zoom, Skype, Google Classroom, and others; use of computer modeling of physical, biological, chemical, physiological processes, modeling of laboratory work; use of electronic textbooks; use of multimedia educational and demonstration computer programs, learning and informative video films; development of the department's website for placing organizational and learning information on it; use of computer-based testing of students' knowledge and an interactive survey system. The author provides specific examples from pedagogical practice, proving a direct connection between information and communication technologies that fill PLE with the development of self-education activities of the student

Keywords: *personal learning environment, PLE models, ICT capabilities, self-educational activity, future pharmacy employee*

How to cite:
Hnezdilova, K., Barjadze, R. (2022). Opportunities of a personal learning environment for performing self-education activities of the future pharmacy employee. ScienceRise: Pedagogical Education, 4 (49), 17–23. doi: http://doi.org/10.15587/2519-4984.2022.261052

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1. Introduction

The education system is undergoing fundamental changes. Ukrainian realities lag behind those processes, taking place in developed countries, but their development in the field of education is inevitable. Scientific and technical progress requires a person to quickly and qualitatively adapt to the incessant transformations that the world is undergoing, obliges to constantly master new competencies. Society functions in the information space, in which information and knowledge are produced, which opens up many new opportunities for the individual, in particular in the field of education. Students actively use new technologies, gadgets, and tools, activity in the digital world is essential for them. Therefore, education relies on the active use of information and communication technologies in various spheres of activity of the educational institution. They make it possible to create an informational and educational environment that creates conditions for achieving the appropriate world level of implementation of educational technologies and increases the effectiveness of the educational process.

For pedagogical science, the concept of Personal Learning Environment (PLE) is relevant, which can be interpreted as a combination of tools, people and services that make up individual resources and approaches to learning. It focuses on the efforts of the learner to manage his/her own learning and pursue individual educational goals [1].

The term appeared in foreign pedagogical studies in the 1960s and covers a number of resources that a student uses to answer questions, provide an educational context, and illustrate educational processes. It is worth noting, that this term does not refer to a specific service or application, but rather to understanding how people approach an educational task [2].

Directly, the term "personal learning environment" (PLE) needs clarification of all its three components. The "personal" part refers to an individual who is in the process of learning online and has certain goals. In the course of the work, the student determines his/her own "personal" educational goals and, in accordance with them, uses personally determined and selected sources of information and communication. To search, process and create information resources, the applicant of education uses the appropriate web 2.0 social services, which are configured "personally" for specific purposes, sets individual conditions for information search. In addition, web 2.0 social services that students use to perform a certain task also have an individual list, or they can be used in different ways (for searching, or processing, or creating information).

The "learning" element means that the learning process is carried out in the specified environment, that it is formed with certain educational goals, and if a person forms it, then he/she seeks to achieve educational goals by working with relevant information. However, the translation of the word "learning" allows the option "educational" in this context. We believe that the term "learning" somewhat narrows the understanding of the PLE phenomenon, because the environment is formed not only for the purpose of performing a certain educational task, but is used as an approach, a strategy of one's own educational activity. That is why in the future we will use the term "personal educational environment".

The last part – "environment" – defines a certain space, in which learning goals are achieved. This space is formed by a set of conditions that are interconnected in a certain way and affect the individual in his/her activities. From this point of view, the concept of "informational and learning environment" is close to PEE.

2. Literary review

Scientists single out a number of approaches to defining a personal educational environment. The analysis of pedagogical studies proved the existence of the following views on the mentioned phenomenon:

– it is a technology, aimed at the individualization of education, to create conditions to meet the educational needs of students and their self-development [3];

– it is a training system, which is represented by several models, adapted to the needs of each subject of the educational process [4];

– it is a didactic model, focused on personalization, interaction and cooperation in the network [5];

– it is a construct, existing at the intersection of formal and informal learning, which provides the student with many tools and control over them, so that he/she can choose, combine and use them to meet his/her educational needs [6];

– it is the concept of constructing one's own educational goals, managing education with the possibility of organizing one's own educational trajectory. In particular, PLE is formed not only by web 2.0 tools, but also by people, newspapers, magazines, books, attendance at conferences, direct communication between people outside the network [7];

– regardless of whether PLE is a system or a concept, it has a number of criteria for its design, which define it as a "new generation" educational environment, in which students learn and can form their own learning space [8].

In the presented research paper, we adhere to the views regarding the understanding of PLE "… as a tool for organizing educational activities that, on the basis of the student's personal choice of network architecture tools, fully satisfies his/her research, educational and image needs, cognitive learning needs of students" [9].

Ukrainian pedagogical science is actively developing the mentioned topic. The scientific works of researchers [10–13] and others are devoted to the development of PLE, in particular, the formation of PLE in a medical institution of higher education (HEI) [14], which leaves room for research into the issue of its use in the professional training of pharmacists to intensify the self-educational activities of future specialists.

3. The aim and objectives of the research.

The aim of the research is to use the information space in professional training to activate the self-educational potential of the student - the future pharmacist, which is realized through the formation of PLE.

To achieve the goal, the following tasks were set:

1) to clarify the concept of a personal educational environment and distinguish PLE models, used in foreign pedagogical practice;

2) to determine the features of PLE for subjects of the educational process and its potential for the development of self-educational activities of students;

3) to identify information technologies, used in medical education for the formation of PLE;

4) to provide examples of the use of individual electronic educational resources and information space in the professional education of future pharmacists.

4. Materials and methods

The following methods were used for the research:

– analysis and generalization of scientific and pedagogical sources in order to identify the range of possibilities for the implementation of PLE in medical higher education institutions;

– the method of pedagogical observations on the dynamics of realization by pharmacist students of their own self-educational potential;

– methods of comparative analysis, interpretation and generalization of facts.

To define the term "personal educational environment" a theoretical analysis of scientific studies was carried out.

5. Research results and their discussion

Scientific thought connects the personal learning environment mainly with the use of the global information space. In Ukrainian educational practices, this narrows down to learning outside the classroom on the network, and emphasizes the forms and methods of distance or online learning. There are a large number of information tools and Internet services for the provision, creation and development of PLE that deserve to be used in professional training. These include: information search services, information storage, educational services, social networks and communication services.

Foreign educational practice counts at least four widely used PLE models, followed by educational institutions. Each of these models has high expectations for students and aligns their learning with a set of standards. Information sources testify to the existence of the following samples:

1. The first model is used by educational institutions that use personal profiles of students or pupils. They keep a current record and fix the educational dynamics of students. This provides a deeper understanding of individual student strengths, needs, motivations, progress and goals of each of them. Personal profiles are updated more often than a standard report card, which helps teachers make timely and adequate decisions and has a positive impact on the educational process.

In addition, a personal profile helps students track their own educational progress. This gives the teacher, students, and even parents the opportunity to learn about the need to change teaching methods or educational goals before the student fails.

2. The model, in which institutions use personal learning paths. Such educational institutions (EI) help each student to adjust his/her learning path, taking into account his/her own progress, motivation and goals. For example, EI can create a unique schedule for the learner based on weekly updates about their progress and interests. Your own path includes several learning methods, such as: a project with a small group of peers, independent work on certain skills or complex tasks, and individual learning with a teacher.

An individual learning path allows a student to work on different skills at a different pace. But this does not mean that EI allows a student to fall behind in any discipline. Teachers monitor each student's progress and provide additional support as needed.

3. Educational institutions can use the model of educational dynamics based on competencies. Then in EI there is a constant assessment of students to monitor their progress in achieving specific goals. This system allows students to understand exactly what they need to master. Competencies include specific skills, knowledge and thinking. Students are offered opportunities to demonstrate their achievements. For example, a student can work with a teacher to practically use certain mathematical skills in the work of a pharmacy.

A student can work on the development of several competencies at the same time. When he/she masters one, he/she moves on to the next. Each student receives the necessary support or help in mastering skills. With such a PLE model, there is no emphasis on taking the test and obtaining a final grade. Instead, it's about continuous learning and chances to demonstrate skills and knowledge.

4. Educational institutions apply flexible learning conditions. Taking into account the experience gained, they choose the best way to adapt the environment, in which students study. The physical content of the classroom, the structure of the school day and the distribution of teachers, etc. are subject to change.

Since both the student and the teacher are subjects of the educational process, PLE for them has different contents in accordance with the set goals. The student's personal educational environment is a set of components of the educational process (content, forms, methods, means of learning activity and learning communication), obtained from the information and communication educational environment by adapting them in accordance with the goals, content and planned learning outcomes, needs and learning opportunities. It is important, that the student gets to know not only the educational content, but also him/herself in the educational environment.

The personal educational environment of the teacher is a set of components of the educational process that contain the content, forms of educational activity, teaching methods and ones of using information and communication technologies, means of learning and interaction with the personal educational environments of students and colleagues, etc., with the help of which the teacher realizes the achievements of educational institutions goals, and professional types of activity, and is also a means of personification of his/her individuality (personification means teachers' knowledge of themselves in social communications, as a manager of the educational process, positioning themselves as an individual in the surrounding community with fixation of achievements and the primacy of discoveries in a certain field of scientific knowledge).

PLE is built according to the individual characteristics of the student's development, his/her professional interests and needs. It should be emphasized, that personal orientation, personalization, and individuality of educational means mean the teacher's adaptation of the informational (unified) educational environment to the individual psychophysiological characteristics of the student [15].

Important for the presented scientific intelligence is the leading idea of PLE, which is that students should be active and use many information resources at once, systematize and compare acquired knowledge, and even independently create new sources of information. With this approach, the responsibility for learning rests with the students themselves, and they themselves direct its course. It makes learning more meaningful, enjoyable and interesting. Therefore, a personal educational environment gives students the opportunity to develop self-education and self-development skills. This encourages them to pay attention to what interests them, allows them to be equal partners in their own education. PLE enables a shift away from a model, in which students use information, obtained through independent channels, such as a library, textbook, or LMS (learning management system), to a model, in which students make connections with the growing array of resources they choose and organize. In this context, PLE functions as an extension of the historical model of individual inquiry. Because they emphasize relationships, PLEs can promote authentic learning by incorporating expert feedback into learning activities and resources. PLE also makes students responsible for their own learning processes, encouraging them to consider tools and resources that help them learn better. By design, PLE promotes self-management, and places responsibility for the organization and learning outcomes on the student.

The above proves that advanced modern education is integrated with information and communication technologies and enables the personalization of the edu-

cational environment, activating self-development based on self-education, and is also a solution for keeping up with the rapid pace of knowledge change. The introduction of electronic web learning technologies ensures the provision of comprehensive, high-quality, appropriate education for a person in a short period of time and is the technological basis of creating an educational environment. This is in line with the National Strategy for Building a New Health Care System in Ukraine for the period 2015–2025, which established the requirements for the training of students of medical higher education institutions, namely:

– providing access to distance learning;

– implementing online learning technologies, thanks to which the computerization of the educational process is strengthened;

– solving tests online (licensing integrated exams Step 1, 2, 3, M, B); conducting web symposia;

– applying interactive, telecommunication and information and communication educational technologies, computer simulators, active and inclusive learning technologies, etc. [16].

Medical institutions of higher education have been using educational opportunities of ICT for two decades. In addition, the COVID-19 pandemic and military aggression on the territory of Ukraine accelerate these processes, focusing attention on the urgency of developing PLE for students. The dynamic architecture of the information and educational environment moves away from the widespread use of paper media in education (printed editions, notes and visualizations in the form of tables, etc.), the direct interaction of each student with the teacher decreases and the emphasis shifts to independent work, stimulating self-educational activities and providing the opportunity to create PLE. Most scientists pay attention to the fact that information and communication technologies provide opportunities for the development of learning and cognitive motivation of students of medical faculties and attract them to the information and computer space with a focus on further practical activities. At the same time, the ability to formulate a problem using the terms of computer equipment and technology and to correctly explain research results is taken into account.

Pedagogical practice uses the following information technologies for medical education:

– formation of a group and personal learning environment by means of structuring the educational space of higher education institutions on the basis of Ms Office365 and Ms Teams services, MSO365 cloud services;

– social networks Viber, Facebook and YouTube channels; communication platforms Zoom, Skype, Google Classroom, and others;

– applications KROK Plus, K-Test, hostels;

– use of computer modeling of physical, biological, chemical, physiological processes, modeling of laboratory work;

– use of statistical packages (STATISTICS, SAS, STATGRAPHICS, etc.), mathematical programs (MATHCAD, MATLAB, MAPLE, etc.) and MS Excel for statistical processing of research data;

– use of electronic textbooks; use of multimedia learning and demonstration computer programs, learning and informative video films;

– development of the department's website for placing organizational and learning information on it;

– use of computer testing of students' knowledge.

To successfully achieve educational results in classes, in particular, in pharmacy, multimedia technologies are used. They make it possible to significantly increase the effectiveness of classes, make them interesting and increase students' motivation, influence their emotional state. Multimedia learning tools allow you to visualize learning; repeat the most difficult moments of the lesson; increase the availability and perception of information due to the parallel presentation of information in different forms: visual and audio; to organize students' attention in the phase of its biological decrease (25–30 minutes after the beginning of the lesson and in the last minutes of the lesson) due to the artistic and aesthetic design of the electronic resource or due to intelligently applied animation and sound effect; conduct a review (review, short reproduction) of the material of the previous lesson. Thanks to the widespread introduction of computer technologies into the educational process, instead of boring and "dry" traditional essays, it became possible to prepare meaningful multimedia informative and illustrated presentations (including with sound), learning videos.

All electronic educational resources make it possible to present the educational material as a system of bright reference notes, filled with comprehensive structured information. At the same time, each student works at a pace and with those loads that are optimal for him/her, which allows for the best assimilation of the educational material. The use of multimedia in the educational process greatly facilitates the teacher's functions, with the help of which you can conduct terminological dictations to consolidate special medical terminology in both oral and written forms.

Another promising electronic educational technology, widespread in educational institutions of the United States and a number of other countries, is the classroom interactive polling (voting) system. The use of the interactive survey system in the course of lectures significantly intensifies the relationship between the subjects of the educational process. Information communication between them is provided by the TS complex, which includes receivers, remotes or clickers for voting and software. The system provides new opportunities for working with the student audience: the teacher asks questions during the presentation of the lecture material, and the whole group is simultaneously involved in finding answers to it, signaling with the help of remotes. In a short time, the data of their answers are processed and presented in the form of a histogram. Such an interactive survey system [17] allows you to diagnose the situation with the help of a clicker, to assess how understandable the educational material is to students. An obvious advantage of the system is the possibility of wide coverage of the audience, everyone can express their position, discuss different approaches to the problem being studied.

With the help of an interactive survey system, separate opinions of the participants of the briefing are revealed or current testing is conducted during the lesson. Multimedia allows you to significantly save time, immediately discuss unclear questions and mistakes using an unconventional way of conducting test-programmed control of knowledge not only in written, but also in oral form.

Testing can be carried out using the methodical resource of the LMS Moodle system, which is an electronic learning system in the local network of the educational institution. It is a modular object-oriented dynamic learning environment, also called a learning management system (LMS), course management system (CMS), virtual learning environment (VLE), or simply a learning platform, that provides teachers, students, and administrators with an advanced set of tools for computerized learning, including distance learning. Moodle has a built-in editor that allows you to create lectures, surveys, tasks and tests from any discipline, for example, from the educational discipline "Fundamentals of Medical and Pharmaceutical Merchandising" to train students in the field of knowledge 22 "Health care", specialty 226 "Pharmacy, industrial pharmacy". All types of content are formed from texts, images, video and audio files, presentations, tests, dialogue simulators and screencasts, which the administrator-teacher uploads to the platform. Content in Moodle is assembled into courses, which can include any sequence of content units available on the platform. Any course consists of what is filled with ready-made content: lectures, tests, SCORM courses, etc. Topics act as delimiting stages, and with their help you can create a flexible learning trajectory. For example, a course is created where the last topic will not appear if the student does not score the required number of points. Moodle has a built-in analytics system that allows you to generate activity reports on the platform: view courses, comments, entries and exits. In addition, Moodle has a mobile application, Moodle Mobile. In it you can complete tasks, communicate with other users and create Wiki articles. The mobile version also allows you to download tasks to complete offline. Since Moodle is an open web platform, it is possible for a student or teacher to develop an integration with a certain service for organizing webinars or checking text for plagiarism. This organization of educational activities facilitates the student's self-educational activity, structuring it or saving time.

Therefore, the educational electronic system Moodle in medical higher education institutions enables:

1. interaction of students among themselves and with the teacher. Forums and chats can be used for this;

2. transfer of knowledge in electronic form using files, archives, web pages, lectures, presentations;

3. testing of knowledge and learning with the help of tests and tasks. Students can send work results in the form of files;

4. joint student educational and research work on a specific topic, using built-in Wiki mechanisms, seminars, forums, etc.

Crosswords are used as an element of problem-based learning in medical higher education institutions, which can be demonstrated with the help of multimedia. Future pharmacists create crosswords, while studying the topic "Means and methods of sterilization used in medicine" from the academic discipline "Fundamentals of medical and pharmaceutical merchandising", which not only help to learn certain medical concepts and terms, but are also an effective means of differentiated and individualized training, control and self-control, as well as foster perseverance in achieving the goal, develop creativity and promote the manifestation of the student's individuality.

When studying medical and biological physics, pharmacists practice using computer modeling programs, developed by specialists of various specialties (medical doctors, biophysicists, programmers, etc.) and used in medical and educational practice, as well as models, created by medical students and biophysics teachers in the learning process.

With a narrow range of use of computer modeling programs and created models, only the demonstration of various processes, phenomena, parameter dependence, i.e., the possibilities of using modern information technologies in education and in future professional activities, is carried out. In this case, there is a minimal impact on the formation of the professional competence of the future pharmacist compared to the educational process when the student works with the program independently or under the guidance of a teacher.

With the constant use of computer technology, students of medical higher education institutions during preparation for classes learn the educational material more deeply, integrate the professional knowledge, obtained in various disciplines. Students try to explain the reasons for the change in the simulated object, from the initial conditions to the obtained result, from the point of view of physics, chemistry and other natural and clinical disciplines.

For example, when using and working with a computer model of hemodynamics, future pharmacists use the terminology they learn in physics classes (vascular elasticity, pressure, blood flow velocity, etc.). After processing the data, the program gives the result of changes in physical parameters in certain areas of the cardiovascular system (artery, vein, etc.). When entering the values of the initial parameters, students try to explain what caused their presence in an imaginary patient from the standpoint of physiology and household and working conditions. After the introduction of the initial conditions, the student makes a preliminary forecast regarding changes in hemodynamic indicators, taking into account the existing deviations of some of them from the norm. The own hypothesis is substantiated from the point of view of physics and physiology. After completing the data processing, the student tests the hypothesis, developing the ability to analyze, compare, juxtapose, and generalize. Next, the future pharmacist selects the appropriate drug and predicts its effectiveness. The speed of data processing by the program allows you to get five to ten conclusions under different initial conditions during the session. The possibility of such a large number of experiments allows you to research in detail, study, and understand the educational material well. The integration of knowledge from various professional disciplines, elements of scientific research contribute to the development of clinical thinking in students.

As evidenced by research results, in groups where educational material was supported by video material, students not only understand and assimilate information better, but also have a higher rate of motivation to study professional disciplines. The increased interest of students in modern scientific developments, methods of treatment and diagnostics was manifested, in particular, in the desire to watch the relevant video material outside the classroom, in the absence of sufficient time for this during the lesson. In addition, some students take the initiative to independently search, accumulate and save video information of a professional nature, sought to share information and discuss it with others.

The teacher's support of the initiative of pharmacist students to search for professional information and focus this search on a certain professional topic contributes to the development of self-education skills and abilities of future pharmacists. The teacher's management of students' search activity brings the process of unconscious self-education, namely, obtaining information on the initiative of the student based on interest, to the level of conscious study of the material, such as obtaining, processing, presenting professional information in a certain direction, etc.

Self-educational activity with the help of web technologies can be implemented both individually and collectively. Wiki technology is the most advanced form of organization of joint activities of participants in the educational process. The basis of the technology is hypertext, which can be created, recorded and edited by anyone. When creating such a hypertext, a student or a group of students is not distracted by establishing connections between separate parts of the text. This work is performed by a special software agent. This technology is used to work on a joint project of an academic group; to use reference information from the Wiki; creation of a database from various fields of science, in particular pharmacy; as an element of distance learning. It is appropriate to use Wiki-technology when studying certain disciplines in the preparation of a pharmacist-bachelor, namely: "Marketing in Pharmacy", "Pharmaceutical Chemistry", etc.

Teachers and students actively use the Google Classroom service, which allows you to create an electronic environment for a certain discipline or course. This electronic environment enables the teacher to post tasks and set time limits for their completion, to evaluate tasks. Collegial work and interaction of all participants in the educational process is organized with the help of the service. The teacher can develop courses, publish educational and methodological materials and tasks for independent work, evaluate and comment on students' work, and students have the opportunity to communicate with the teacher and each other directly in the course timeline or by e-mail, filter tasks by criteria, perform and send them in the same service, as it is integrated with Google Docs and Google Disk [18].

We conclude that self-educational activities and individual educational results of students depend on the creation of PLE, which should be accessible and effective. A set of PLE tools is an individual matter for each student, depending on the level of his/her ICT competence, which should be constantly growing.

In the conditions of medical higher education, this requires thorough technological and methodical development in the specified direction. The research is limited by the fact that for the effective development of PLE and self-educational activities in the conditions of professional training of pharmacists, it is necessary to develop and create appropriate pedagogical conditions in a medical institution of higher education. Therefore, we define the identification and development of pedagogical conditions for the organization of PLE and self-educational activities of future pharmacy specialists as perspectives for further research.

6. Conclusions

1. The concept of a personal educational environment required clarification of all its components, which led to the clarification in use: we used the word "educational" instead of "learning" environment, which somewhat narrows the understanding of the PLE phenomenon. Four models of PLE, used by foreign pedagogical practice, are described.

2. The peculiarities of the formation of PLE on the part of the teacher and the student and the role of each subject of educational activity in this process are determined.

The teacher provides assistance to the student in the formation of the PLE and its adaptation to the individual educational goals of the student. It is noted, that the formation of PLE contributes to the maximum implementation of self-educational activities of students through personalization and own activity, the use of numerous information resources, systematization and comparison of acquired knowledge, and the creation of new sources of information. The responsibility for learning rests with the students themselves, and they themselves direct its course.

3. In medical education, information tools and Internet services are used to provide, create and develop PLE. These are information search services, its storage, educational services, social networks and communication services. It was found, that the professional education of future pharmacists uses information space and separate electronic educational resources, namely: KROK Plus, K-Test, hostels applications; computer modeling of physical, biological, chemical, physiological processes, modeling of laboratory work; electronic textbooks; multimedia learning and demonstration computer programs, educational and informative video films; statistical packages; communication platform Google Classroom; LMS Moodle system, etc.

4. Attention is focused on the use of the methodological resource of the LMS Moodle system and the Moodle Mobile application for online and offline training of students, the use of computer simulation programs, developed by specialists of various specialties, is practiced, in particular for the study of hemodynamics. The Google Classroom service is actively used in medical higher education institutions, which allows you to create an electronic environment for a certain discipline or course, enables the teacher to post assignments and set time limits for their completion and assessment, organize collegial work and interaction of all participants in the educational process.

The above makes it possible to create a personal educational space for a student, which adapts the educational process of a person to his/her cognitive needs and interests, strengthens educational motivation, develops self-educational activity, turning it into a conscious self-educational competence.

Therefore, the stimulation of future pharmacists' self-education activities with an orientation towards the formation of PLE using new means of information and communication technologies is a natural process, which is especially relevant in the conditions of a pandemic and martial law.

Conflict of interests

The authors declare that they have no conflicts of interest.

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Received date 15.06.2022
Accepted date 05.07.2022
Published date 29.07.2022

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