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The Possibilities of Information Technology in Higher Education: Training of Future Physicians

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Abstract---The conception of modernization of higher medical education in Ukraine is focused on the model of training physicians who have a broad outlook, able to integrate their potential into the activities of all medical workers, meet the current level of medical science and society, capable of self-improvement and self-development using innovative information technologies. The modern health care system is in need of specialists capable of continuous professional growth and self-improvement. The aim of the article is the formation of future physicians self-by means of information technology (IT). In the article review importance of IT in the professional activities of doctors, the prospects for the development of computer technology; formation and development of the knowledge base, skills and abilities necessary for the effective use of modern programs; development of the ability to independently master software and update and integrate the acquired knowledge. In a modern information society that is constantly evolving, it is important to develop the skills of IT skills among future doctors to make important decisions.

Keywords---informatization, IT (information technology), medical education, self-development, students of medical school.

Introduction

Unfortunately, for many physicians the need to be guided in their practice not only by professional standards, but also to update and replenish regularly their own theoretical and practical knowledge is not an integral part of the work ([John,](#)

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2015; Hamidi et al., 2011). The efficiency of a specialist in the field of health care is determined not only by the level of his professional skills, but also largely by the nature of professional self-determination, attitude to the profession, professional identification. Therefore, it is important to develop an attitude to personality-oriented professional self-improvement in the training of future professionals, which is achieved by creating certain conditions for students to know their motives, goals and opportunities for personal properties and qualities (Shandruk et al., 2019). As noted by Haborets (2019), the problem of self-improvement of the individual is widely represented in the philosophical, pedagogical and psychological literature and at the present stage of development of Ukrainian education acquires special significance.

The adoption of the new law “About Higher Education” has led to a number of competency requirements for the modern specialist, as the ability to solve certain problems of the patient through the selection and evaluation of information of medical history taking, examination; the ability to make balanced decisions under emergency conditions, the ability to make early diagnosis in the initial, undifferentiated stages of the disease; ability to prescribe medical and diagnostic interventions rationally, etc. (Ortega-Abente & Ruiz-Flores, 2021). In the context of radical transformations of higher education caused by the emergence of a society of knowledge and information, there are several important aspects, that are crucially important for consideration of the development of research skills in the sphere of the student’s information culture. Firstly, the emergence of information technology has changed the usual process of communication between teacher and student, their role positions: the interpreter of knowledge was the student, and the teacher began to perform only the functions of coordinator of educational information (Ospanova et al., 2019). Secondly, information technology in higher medical education is a set of methods of mastering fundamental natural and humanitarian knowledge and methods of professional and practical activities based on the teacher – student and IT tools interaction aimed at achieving learning outcomes. Their use contributes to the expansion of didactic opportunities in the organization of student’s self-improvement, that is:

- ensuring the flexibility of the educational process through variability;
- transformation of the content, methods and forms of education, organization of educational classes, combination of various methods to ensure a differentiated approach to students (different levels of difficulty and scope of tasks, the pace of their implementation);
- activation of the students educational and cognitive activity with the help of modeling of a qualitatively new type of visualization of the educational material not only real, but also virtual objects, processes and phenomena, game learning (Kabanov et al., 2020);
- intensification the student’s motivation and cognitive interest in learning through innovative methods, individualization of learning;
- mobility based on the implementation of technical capabilities of the computer;
- implementation of pedagogical correction and continuous feedback and communication;

- qualitative changes in educational activities in general and checkup (test checkup with diagnosis, with feedback and evaluation of stages, distance education) (Tsvetkova et al., 2021).

Though information technology is used as a means to increase the effectiveness of student's self-improvement, still their opportunities are much wider, as evidenced by the experience of other countries (Sangrà & González-Sanmamed, 2010). In this regard, the introduction of information technology in the training of modern physicians will promote the formation of professional's mobility in related activities, make them able to think creatively, make decisions independently, develop a culture of business relations, in other words – motivation for continuous self-improvement.

Materials and Methods

The rapid pace of informatization of society, including education, involves the ability to use information technology (hereinafter referred to as – IT) to improve the quality of professional training. The system-subject approach with the development of IT becomes more and more widespread, which radically changes the process of professional training of future specialists (Astika & Dwirandra, 2020; Rinarta et al., 2018). Modern medical-diagnostic process is impossible to imagine without the technical component such as ultrasound, MRI, X-ray diagnostic methods, sensors of medical and biological information, laser and electrotherapy, computer analysis of tomography, ultrasound, EEG, ECG, radiography; system of automated data analysis of microbiological, virological research and the list is endless. No one doubts that the future physician must have basic computer skills and software applications. However, there are still a number of problems in the organization of the educational process and methods of teaching disciplines using modern information technology (IT) in higher medical education:

- lack of knowledge in using traditional IT tools in educational process;
- lack of tools in implementation of IT;
- teaching methods are not worked out in a proper way due to the rapid digital development (Ashilova et al., 2019).

Results and Discussion

Nowadays, the informatization of education is treated as a system of interconnected organizational and legal, socio-economic, scientific and technical, production and management processes aimed at meeting the educational, informational, computing and telecommunications needs of participants of the educational process. According to Velychko (2002), computer technology has the ability to influence the student in various ways: first, he can get much more educational material than in the process of communicating with the teacher; second, the student develops the ability to work with information, make optimal decisions, develop communication skills that is a driving force for self-improvement; third, such technology prepares the student to become a person in the information society.

During the study, the style of communication with the computer can be adapted to the individual characteristics of the student. The dialogic nature of computer learning has a positive effect, where the student of higher education maintains a state of psychological comfort while communicating with a computer (Slutskiy & Blanchard, 2021). Using computer technology, one can actively involve students in the learning process, influence motivation significantly for the chosen profession, expand the set of educational tasks (Kondratenko et al., 2021). It is also possible to assess the effectiveness of the solution, including the unexpected, chosen strategy and constantly monitor the correctness of the solution. Studying in higher education establishment, medical students should understand that the use of modern information technology in the field of health care has become not only convenient, but also usually just a necessary tool for improvement and self-development. It is difficult for a practitioner to follow systematically new scientific publications related to his or her specialty under a variety of circumstances. Therefore, it is advisable to use the Internet as a source of professional information, thanks to which this industry is acquiring completely new features today, as most medical research cannot exist without a computer and special software for it (Rahman et al., 2021; Maemunah & Cuaca, 2021).

Such studies include computed tomography, magnetic resonance imaging, ultrasonography, isotope studies, and more. The amount of information obtained is so large that without special computer programs, the doctor would not be able to perceive and process it. The use of IT is accompanied by significant changes in medical theory and practice, which necessitates the need to adjust the training of health professionals. In our opinion, the integration of professional, natural sciences, humanities and medical informatics will contribute to this efficiency, that provides for further development forecasting of science and technology. The implementation of IT in the future physicians training program requires the use of integrative learning and the search for appropriate methods. Formation of skills at mastering these technologies needs to be carried out purposefully and systematically. Students should be aware of the challenges they will face in implementing computer solutions to real-world medical problems. The teacher has to demonstrate the coordination between the stages of computer use, to form the ability to compose an algorithm of actions while using information technology (Velychko, 2002).

High-quality mastery by future health professionals of the IT leads to effective organization of processing, storage of information and minimization of spatial and temporal barriers to its dissemination. Today, based on the merger of educational and information technologies, should become typical a tendency in training the future doctors, to form fundamentally new integrated learning technologies, including e-learning platforms, that allow to create effective online courses and manage the learning process and common actions through web access. Modern platforms are able to work with a large number of users from different countries and have significant opportunities for training courses. The space of each course contains a number of tools that allow the teacher: to provide a description of the course, provide information in any format (text, images, videos), administer public and private forums, develop learning pathways, group students, prepare for their online tasks (individual, project, group) and manage the deadlines, have continuous feedback from students (Haborets, 2019). In recent years, educational

electronic publications and scientific sources have become quite popular due to the possibilities of rapid modification and interactivity.

The most important advantage of electronic publications is their availability to the student at any time. All fragments of electronic publications can be built on the principle that the consumer is given not the passive role of the reader, but the active role of the participant. One of the manifestations of interactivity is the ability to model and visualize quite complex physiological processes and phenomena, such as the state of cells, atoms, their nuclei and electrons, the passage of electrical pulses and X-rays in different environments and more. Working with the relevant fragments of the electronic edition and independently determining the magnitude of input and output signals or angles of incidence of rays, the future doctor feels like a participant in such a computer experiment, a researcher of processes and phenomena occurring in a living organism. Computer technology greatly facilitates the work of physicians, because the results of the patient examinations, transmitted to the computer, are instantly processed to detect abnormal test results, and in a few minutes, you can get comprehensive information about a possible diagnosis. Today in medicine first of all contact monitors are used for registration of these or those physiological indicators. Two areas that complement each other are considered to be promising. The first one is a non-contact monitoring system based on video processing (for example, technology that allows you to measure a person heart rate with video: the algorithm enhances the smallest changes in complexion associated with the inflow and outflow of blood during each heartbeat). The second area is implanted sensors that detect arrhythmias that cannot be detected during a routine visit to the doctor (Reichard & Johnson, 2011; Laka & Suprasto, 2020).

Methods and means of personal medicine allow individual control of the health of each patient, taking into account the physiological characteristics of his body and living conditions (e.g. diet, sleep, level of exercise, etc.). Not only multifunctional specialized medical devices (Holter ECG monitoring, pulse oximeter), but also devices of “body” electronics (pulse meters, fitness bracelets, watches or mobile applications) are used to ensure long-term monitoring of vital human health indicators (Au-Yong-Oliveira et al., 2018; Zu, 2021). Computer technology is present in any field of modern medicine. In particular, the latest surgery is impossible to imagine without modern technologies, the use of which has led to radical changes in it. One way of technological innovation is to use the capabilities of robots as precision instruments, which are controlled by software by surgeons. When performing surgical interventions, it contributes to the development of medicine in two areas: telesurgery (the physician controls the robot without contacting the patient) and surgery with minimal intervention. An important direction in the development of modern medical chemistry is the development and improvement of theoretical methods for studying the mechanisms of action of drugs, predicting their activity. For this purpose, virtual screening is used – a computer assessment of the affinity or biological activity of a significant number of biological compounds based on modeling their interaction with the corresponding target molecule. By studying the relationship between the structure of known compounds, it is possible to construct a new molecule with predetermined properties (De et al., 2004; Norcini & McKinley, 2007). These methods are used not only to modify known structures in order to improve their

properties, but also to find new compounds in computer databases of molecules. The use of IT in higher medical education contributes to the effective conduct of distance learning, which allows you to independently control the process of acquiring a profession, plan the educational activities without the need for constant help from the teacher. Such training provides freedom of choice of content, forms of presentation of the complexity of educational material (Chang, 2016; Georgina & Olson, 2008).

Modern information technologies help participants of distance learning: fast enough to transmit information of any kind (text, graphics, audio, visual, etc.) and volume over long distances; edit information from your workplace; communicate and consult with various specialists and their teachers via the Internet; quickly interact in real time (participate in operations, training, conferences), which ensures the availability and openness of distance learning, i.e. allows the doctor to study at a convenient time for him almost a lifetime without special trips (Shurygin et al., 2021). It is also worth noting that the capabilities of medical informatics allow for effective computer screening research in the health care system. Conducting them remotely with the help of computer surveys, questionnaires, testing and other methods improves the quality and speed of health assessment of various groups of the population, identification of risk groups and preventive measures. The medical expert systems used in this case are a set of computer software and hardware and are used for the correct adoption of treatment and prevention tactics by a physician. Computerized physicians' workplaces provide information comfort, speed of access and completeness of information. In particular, the use of a computer in diagnostics allows you to remember and store images from the device with their subsequent use for medical practice and educational process; filter images with clear separation of the desired areas and their magnification on the monitor; sort by pathologies with the formation of appropriate databases, etc.

The organization of the educational process with the use of observation of the most realistic picture increases motivation and success in obtaining knowledge, stimulates brain activity. One of the promising educational methods of modern information technology can be virtual reality, which is modeled by a computer and considered as a special information environment in which objects are represented in three dimensions. In order to increase the informativeness of the educational process of the discipline of Human Anatomy, use touch interactive tables with appropriate software that allows you to process blocks of various additional information. As a result, a number of virtual anatomy programs have been integrated into the database, allowing mobile anatomical objects to be operated in 3D mode, as well as the layered structure of the human body (Ward et al., 2001; Makoul & Schofield, 1999). It should be noted that IT is used not only in teaching professional or natural sciences, but is an integral part of the language component, because knowledge of foreign languages, in particular, is the key to successful mastery of a technology, obtaining information from primary sources, and provides the opportunity to be aware of the latest technical and medical developments in the shortest possible time (Akanova et al., 2019). Students who master foreign languages can process current materials from electronic versions of well-known foreign language publications, communicate by correspondence on the websites of international youth magazines. When teaching

a foreign language in a medical school, lecturers try not only use traditionally introduced technologies that have become an integral part of language teaching methods: Internet resources (text, audio and video information, e-mail, forums, chats); electronic lexicographic sources (network and local versions); multimedia textbooks and interactive books, as well as the latest IT, which is the driving force for better learning: mobile applications, online quests, one of the means of IT – BYOD, which means “bring your own device” (for lessons), the essence of which is that the gadget becomes a tool in learning and turns students ideas about the potential of their electronic devices and gives the opportunity to use in the school when learning a language that was previously prohibited; extracurricular activities that integrate the use of IT with natural sciences, humanities and vocational subjects (Sobchenko, 2021).

In the process of learning professional communication in a foreign language, different types of work with modern information technologies are used, which help to increase motivation, and thus independent after classroom work. Implementation of modern IT communication training with future professional activities, allows students to realize the importance of a foreign language in professional development, teaches them to improve their knowledge and apply them in practice – to search and analyze foreign language media and the Internet, prepare messages and research on professional topics (Haborets & Pyshnohub, 2020). A number of elective courses, including the “European Standard for Computer Literacy”, are taught alongside medical informatics to provide sufficient IT knowledge in medical school. The program of this discipline is developed in accordance with the approximate curricula of undergraduate training of masters of higher education in the field of knowledge “Health” for the specialty “Medicine” is taught to form and develop basic competencies of information technology to ensure the rational use of modern general purpose software data.

The main tasks of studying the discipline are:

- formation and development of knowledge, skills and knowledge bases necessary for effective use of modern general-purpose applications in educational and cognitive activities and everyday life;
- acquainting students with the role of new information technologies in professional activities, with the prospects for the development of computer equipment and the importance of continuous self-improvement;
- developing the ability to independently master various software tools and update and integrate the acquired knowledge. The study of this course provides the development of basic competence in the field of IT in future physicians and lays the foundation for the study of disciplines “Medical Informatics” and “Biostatistics”.

Conclusion

Thus, the integration of natural sciences, humanities and professional skills by means of modern information technologies ensures the development of self-improvement in the context of the professionalism of a future physician and creates conditions for the education throughout all practical activities. At the present stage of development of higher medical education institutions there is a

tendency to use fundamentally new integrated technologies of educational activities, which allow lecturers to effectively manage the learning process. The use of IT in the training of future physicians affects the formation of their professional competence and motivation for self-improvement, which provides top-notch skills while making important decisions, including in critical situations.

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