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## COMPUTERIZATION IN HIGHER MEDICAL EDUCATION OF THE USA AND UKRAINE

*The article researches the development of computer-oriented learning and information and communication technologies implementation in the USA, describes the state of computerization and modernization at higher medical educational institutions of Ukraine, analyzes the experience of Danylo Halytsky Lviv National Medical University (DHLNMU), and the department of Latin and foreign languages in particular, in the sphere of new educational and Internet technologies usage for study. As the result of the study the first computerized programs used for the future physicians training have been characterized. It has been stated that for the first time computer technologies in higher medical education were used in the USA and served accessory learning function aimed at facilitating and improving pedagogical instruments and methods. Furthermore, the paper proves that information and communication technologies are commonly used as accessory learning tools by Ukrainian medical students. The process of computerization and ICTs implementation in the scope of higher medical education has been developing rapidly and has a big potential according to the results of the survey carried out at DHLNMU that are described in this paper.*

*Keywords:* computer *technologies, information and communication technologies, higher medical education, computerization, Ukraine, USA, future physician;*

**Introduction.** The primary task of the health care development, improvement and reforming includes the design and implementation of innovative approaches based on the use of information and communication technologies (ICTs) into the learning process of higher medical educational institutions. Modern technologies as well as current global educational processes in the society encourage the training of highly-qualified and competitive physicians with a high level of knowledge, able to adapt in the changeable professional environment both in Ukraine and abroad.

The analysis of the masses of information on this theme indicates the significant interest of Ukrainian and foreign scientists to the problem of computer-based learning emergence and development [1; 2; 5; 13;14; 15], methodical and pedagogical problems of the future physicians professional training and the usage of new technologies in this process [3; 4; 11; 12; 16; 18]. Such technologies, in particular information and communication technologies (ICTS), are commonly used in the system of higher medical education abroad. The USA is the outstanding example in this direction as the computerized learning emerged in this country [2; 15]. Higher medical educational institutions (HMEI) of our country have initiated the computerization of all scopes of learning, scientific and clinical activities [5]. However, the attention of Ukrainian researchers and educators has been focused on the theoretical and practical recommendations concerning the usage of ICTs for learning purposes. Unfortunately, there is the gap in knowledge about the first specialized computer-based and Internet technologies developed especially for the clinical and communicative skills training as well as the information on the experience of Ukrainian HMEI in this direction.

The paper aims to research the background for the development of ICTs-assisted learning in higher medical education, to describe the first computerized learning programs implemented at higher medical institutions in the USA, to analyze the primary efforts and achievements of Ukrainian HMEI in the process of computerization and modernization of higher medical education, to characterize the experience and the state of ICTs usage in future physicians training at Danylo Halytsky Lviv National Medical University (DHLNMU).

**Computerization in the US higher medical education.** Computer and information technologies have been used in the medical education and practice for a long time. Long before the emergence of the Internet they were used for the medical information collection and storage, and thus they influenced the development of medical education. In the late 1970s they were predicted to be irreplaceable in the learning process as the tools of student-oriented approaches and in clinical practice as the tools of diagnostics and decision making [15]. Nowadays the computer technologies are implemented almost in all branches of health care, necessary and required as the components in undergraduate and postgraduate medical education. However, despite the numerous advantages of computerized learning programs, the process was characterized by the slow growth rhythm. The developing countries faced a lot of challenges linked with computerization. Furthermore, the developed countries where the information progress occurred much sooner had to undergo a lot of computerization barriers as well.

The first efforts of computer-assisted learning in the branch of medicine were made at the end of 1960- s in the USA. The three main establishments pioneering in this direction were Ohio State University, Massachusetts General Hospital and the University of Illinois [13; 14; 15].

In 1960-1970s the researches of the laboratory of computer sciences of Massachusetts General Hospital created the primary computerized learning programs for the clinical situations modeling. The computerized clinical encounters helped the students to build hypotheses, receive and interpret information from the patient and to practice diagnostic and treatment procedures. In a five years term 30 model programs of clinical encounters with various signs and symptoms were designed by the educators [12].

The programs were developed in different authorized languages: BASIC (Dortmund colleage), COURSEWRITER (Ohio State University), FORTRAN (IBM, USA), MUMPS (Massachusetts General Hospital), TUTOR (University of Illinois) [11]. The emergence of new and improved authorized languages and software undoubtedly influenced the development and the spread of computerized learning.

At the beginning of 1970s the US medical schools commenced the research of the computer technologies implementation in education. The studies carried out in 1974 identified 362 computerized programs used in medical education. In the next years their number was increasing in 60% per year. The number of computerized learning courses (CLC) in basic and clinical disciplines accounted 351. The examples of such programs were: CASE, CATS, GENESIS, INDEX, MATRIX, Mac Path, PLATO, Sim One, TES etc. These programs were created for the imitation of real patients and medical encounters. Nowadays they are known as "virtual patients" [15].

"Sim One" was the first learning manikin, three-dimensional virtual patient model which was able to imitate various dangerous conditions and was widely used for different clinical manipulations. Such "virtual patients" were equipped with the special programs and permitted programming of required scenarios in the typical problem situations. World famous corporations, specialized in the medical equipment production, including the equipment for learning purposes, have been working on the manikin improvement, attempting to model the greater number of critical conditions [11].

In 1965 Computer-Aided Simulation of the Clinical Encounter (CASE) was developed at the University of Illinois. After the brief review of patient description on the monitor, the student interacted with the program printing the natural questions and commands. The program provided logical responses for most questions. The students appreciated the use of CASE as such interaction was rather realistic and interesting [14; 15].

Programmed Logic for Automated Teaching (PLATO) is the system designed at the University of Illinois which was the best among the existing systems developed to promote the computerization of medical education. The institution research and PLATO with the authorized language TUTOR, formed the background for the computer-oriented syllabus. The classes in the system included the compulsory and accessory learning materials, exercises on the basis of CASE, social consulting, differential diagnostics, communication with the patients with deadly diseases and traditional clinical situations. The system used the unique plasma terminal display with high

possibilities of separate and complex texts, graphics and photo expression. The special technical features were used for the illumination of the areas with the student's grades on the screen. Till 1981 the number of computerized academic hours designed in 150 disciplines accounted 12 000 The PLATO system was widely used at the University of Illinois and other institutions that had the access to the courses. However, the high price and the requirement of specialized terminals and other computer tools restricted its spreading [15].

The authorizing language MUMPS has been still used in various programs in the branch of health care. The PLATO system was disconnected in 2006 after 40 years of its use. It initiated the use of such basic notions as "forum", "online testing", "e-mail", "chat", "remote desktop", and "instant massage" [5].

The biggest amount of available CLC were developed and implemented at the medical college of Ohio State University. A computer was an essential component of undergraduate education, nurses training, postgraduate education, ancillary medical staff training, and the training of non-medical staff of health care institutions. It was used as the main and accessory element of education. Every student of the establishment used the computer for studying and spent at least 25 interactive hours in front of the monitor for the course. The physiology was the most popular among the medical subjects. Its syllabus included classroom hours and training CLC. Starting from 1973 the institution was using the CASE program [15].

The implementation of the computers in the Ohio State University started in 1967 when the Tutorial Evaluation System (TES) was initiated. The system included the typical knowledge evaluation tasks: correct/incorrect, multiple choice questions, etc. The student's answers were instantly checked. In case of positive result the student reached the next task, otherwise the correcting reference-back occurred and the students received one more chance to answer correctly. If the student was not successful, the computer program suggested additional training exercises or directed him/her to revise the required learning material [13; 15].

In 1969 the TES was included in the experimental Program of Independent Learning which included the syllabus of pre-clinical subjects and was designed to learn the basics of medical science. The program was very popular among the students who used it for training the skills, self-control and self-estimation. Till the mid 1970s, the TES was used for more than 350 interactive learning hours in the curricula.

The Computer-Assisted Instruction Regional Education Network (CAIREN) was developed for the post-graduate education. A total of 29 medical institutions of different size and categories had the access to the CLC that were accredited especially for the post-graduate education. The membership in the CAIREN occurred on the paid basis. The costs were used for the investment into the development of new CLC. The learning materials were transmitted in two ways, namely: on-line, that was rather complicated in this time due to the low connection ability, and off-line, in which the data were copied to the user's computer [15].

In 1975 the department of surgery at Washington University School of Medicine launched the experimental implementation of computerized learning systems to provide the individualized instructions on general surgery in the undergraduate and postgraduate medical education. In the beginning the classes were carried out as the additional components in the syllabus of "General surgery" for the third-year students. While the usage of computerized learning materials was not compulsory, two thirds of students estimated the experiment positively and preferred using new technologies in the learning process. The learning materials were stored on the floppy discs [16; 18].

The research of the artificial intellect application in the medicine stimulated the development of systems based on the models of clinical situations and the computerized consulting systems. The GUIDON system was one of the most outstanding examples of intellectual training systems. The researchers from the Wisconsin University applied another approach to the clinical thinking modeling. In this system the student estimated the effectiveness of the study. As the result, the research demonstrated the practical clinical significance of the modeled diagnostics, proved the

productivity of such learning activity, grounded the similarities of physician's behavior in the modeled and real situations [15].

The Computer-assisted Teaching Systems Consortium (CATS) was created with the aim of stimulating the educators to develop new educational approaches, educational theories, exchange of the experience of using the traditional and computerized educational programs and plans and to encourage the innovative teaching. However, the educators preferred using CATS mainly for computer testing [14].

In 1979 the group of scientists of the Office of Technology Assessment in Washington made the first true predictions and prognoses of the importance of computer and information technologies use in undergraduate and postgraduate medical practice, researched the technologies and strategies of computerized learning of future and practicing doctors, discussed and described the mentioned above schemes of the learning material designing and developing the learning based on the use of information technologies, determined the outstanding medical education institutions which implemented the computerized systems and syllabi [15].

The similar analysis was carried out in 2002 by P.O. Ozuah, who is the prominent figure in the branch of pediatrics and innovative teaching. The Dr. Ozuah claimed that the educators did not adequately use information and communication technologies in the learning process [17]. He also suggested that by the 2020 the computers may fully substitute the teacher and may be the main educational tools. The students would use the computer for self-study which will become student-oriented. In this type of educational approach the learner is responsible for the study process. The student can choose the time and place for study, direct and evaluate his/her learning activities while the teacher will perform a role of tutor and consultant. The time has shown that the educator's predictions were correct as the listed above points characterize the electronic learning that is being realized at the US medical education institutions with the help of ICTs and Internet technologies, distance courses, e-testing, etc. [12].

**Computer use in the system of Ukrainian higher medical education.** In the last few decades the HMEI of our country have been making much effort in the process of computerization of educational scientific and clinical activities. All of the Ukrainian medical universities and academies implement the computer-based techniques, materials and courses on humanities and clinical matters into the learning process. The first institutions to implement the ICTs-based material were DHLNMU, Bukovinian State Medical University, Shupyk National Medical Academy of Post-graduate Education, Horbachevsky Ternopil State Medical University, Uzhorod National Medical University, etc [6]. In the abovementioned institutions Web-sources are used as the accessory learning tools, the required learning information is found on the official university web-sites or the platforms for distance learning. Recently, the amount of generally useful and learning materials has increased. Such materials include the methodological guides for teachers and students, audio and video illustration materials, multimedia lectures, self-study guidelines [4].

In general, the state of computerization in the system of higher medical education is satisfactory and characterized by the tendencies to improvement. All of the HMEI of Ukraine have the official web-pages and on-line entrance registration. The establishments have been implementing the web-based distance courses, using information and communication technologies in learning, teaching and research [5, p. 113]. However, the significant number of the information platforms at HMEI still require modernizing and unification. There is the need in the development of special Concept of national HMEI computerization. For this reason The Ministry of Health of Ukraine has determined the list of required tasks for the improvement and computerization of higher medical education. The strategic goals of the development of HMEI of Ukraine are the following: the development of typical model of computerization, the provision of the functional technical equipment and the information portals, organizing the conditions for educational staff and student mobility, WiFi implementation, creating the services for the mobile access to the information, designing the specialized classrooms equipped with the technologies necessary for video conferencing, developing the unique medical educational portal, with the open access to educational information, implementation of the cloud technologies of the virtual classes and

courses, creating the model of typical information system of university library, using the library potential in the university activities, provision of learning courses in computer science for teachers, development of the model of continuous monitoring and generalization of new learning methods based on the use of computers and the Internet [5].

Shupyk National Medical Academy of Post-graduate Education is one of the main institutions where the technologies of distance learning are implemented. The Academy cooperates with national and foreign educational establishments in solving learning and methodical matters, monitors the state of educational modernization at HMEI of Ukraine, applies the innovations in the learning process, promotes the ICTs usage, provides professional training in the branch of electronic distance learning, etc [8]. The scientific and methodical centre of distance education at the institution – "Unified Medical Portal" functions to demonstrate the latest medical and scientific news and the learning material. The portal serves the informative, teaching, scientific and consulting functions. It has a significant practical value. The site presents the information on the Law of Ukraine, Health Care regulations, upcoming medical exhibitions, innovations and approaches of computerization in the sphere of medicine. Thematic distance learning, webinars, virtual seminars, consulting and experience exchange are performed through the Unified Medical Portal.

With the aim of improvement and the development of the health care and the application of ICTs in this branch the Shupyk National Medical Academy, Zaporizhzhia State Medical University and the Ministry of Health of Ukraine conduct the annual scientific and methodical video-conference "Current Issues of Distance Education and Telemedicine". The number of participants sharing the knowledge on distance learning and ICTs implementation into health care is growing each year which indicates the importance and popularization of this direction.

The Zaporizhzhia State Medical University carries out the research of distance education. The educational and scientific staff of the institution develops distance courses of the pre-clinical and clinical subject matters of undergraduate and postgraduate education. The university organized the three-month distance courses on the subjects: "Chemistry", "Biology" and "Ukrainian" for the applicants. The courses were created as the pilot project and proved to be effective and positively evaluated by the high school graduates as helpful and highly useful tools of preparation to the entrance examinations.

The Horbachevsky State Medical University has also been promoting the new educational techniques. Such techniques include: the technology of "Unified Day", "Z-system", Objective Structural Clinical Examination", etc. The institution cooperates with the South Carolina University in the USA, and it is the member of International Scientific and Educational Innovation and Technology Consortium of Medical Education Institutions and the Institutions of Physical Education and Sports. Such status aids the efficient and qualitative implementation of new ICTs-based systems and programs [9].

In the end of 2012 the Horbachevsky State Medical University added a new functional module to the system of daily distance knowledge control that was performed on the learning management system Moodle. The Module permits making arrangements for extra classes and consultations. It has the possibilities for arranging and editing the time for individual meetings with the students, as well as marking their presence and estimating their knowledge online. Respectively, the students receive the possibility of registering and controlling their academic success. The University has the strong material and technical base and meets the world standards on the information and communication technologies implementation in education.

Other medical universities [5] of our country make the contribution to the state of computerization of medical education as well. The departments conduct studies in the sphere of distance electronic learning in undergraduate, post-graduate and continuous education, design distance courses, apply multimedia and Internet technologies for learning purpose, and implement open public cloud technologies that enhance the usage of ICTs for professional training of future physicians.

Danylo Halytsky Lviv National Medical University is characterized by the advance in the direction of computers and ICTs usage for educational purposes. Its department of medical informatics cooperates with other university departments in developing and implementing distance courses in many subjects. The pharmaceutical departments play an important role in the sphere of computer use at the institution. The stuff of the departments transforms the learning material into the digital form making it available online, designs the learning material, distance courses and perform distance testing for the students studying on the part-time basis at the pharmacy faculty. Contrary to other distance courses developers the department of medical informatics prefers the learning management system "Claro Line" to "Moodle". The WiFi technologies function on the whole territory of the University making the 24-hour open access to learning information available on the university official web-site. The learning material includes audio- and video-materials, online encyclopedias, dictionaries, official electronic social media pages, etc [5].

There is much information available in scientific papers as well as on the web-sites, web-portals, and social media pages concerning the state of ICTs and Internet technologies implementation in higher medical education institutions. However the information is general and does not provide the precise knowledge about the experience of new technologies usage, the types of these technologies for learning and the attitude of medical-students towards this innovative educational approach. The mentioned above aspects formed the basis for the research at DHLNMU [7]. The research encompassed the $1^{st}$-$6^{th}$ year students of medical faculties by the specialties: "General medicine", "Pediatrics" and "Medical and "Preventive care". The syllabi of these specialties are integrated and are similar for all specialties with the aim of improving the learning results and professional competency, facilitating study and enhancing the general quality of higher medical education. The survey was conducted in the form of anonymous questioning. The aim of the research was checking the hypothesis that the medical students use the Internet technologies as the main tool of searching for learning information.

In general 139 students participated in the survey. No criteria concerning the academic performance, gender or age were applied in the process of selection. The protocol of the study was discussed at the meeting of the department of Latin and foreign languages at DHLNMU (Minutes No.3 dated $19^{th}$ October 2015).

The questionnaire was self-designed especially for the following study. It included 11 closed and open questions aimed to determine: demographic information about the participants (age, gender, year, and faculty), ways of Internet usage for the self-study, experience in using Internet during the face-to-face classes, types of Internet sources used for learning purposes, clinical procedures learned through the Internet, the state of sharing useful learning material from Internet with the colleagues and teachers, the level of trust to the information from net, general usefulness of Internet sources for study and students' actions in case of receiving contradictory information from Internet sources.

The results of the study prove that all students who filled in the questionnaire use Internet technologies with the learning purpose as all participants gave at least one answer to the question No 1: "For what learning activities do you use Internet?". Moreover they defined "search for additional information" as the most common one (119/139, 86%). Out of total 139 medical students 92 (66%) mentioned using Internet for self-study. Almost equal number of participants 69 (50%) and 67 (48%) used Internet for learning about and overviewing clinical procedures. Only 31% (43/139) of future doctors marked using Internet during practical classes. The fifth- and sixth-year students were the most active in the usage of Internet for their studies, while the freshmen were the most passive users. The results of second-, third- and fourth-year students were approximately equal. Activity was determined on the basis of medium number of responses.

According to the responses in the questionnaire 41% (57/139) of participants confirmed the usage of Internet-technologies and resources during classes and 59% (82/139), which is larger share, denied it.

The carried out study aided to define the kinds of classroom learning activities with the usage of Internet. Demonstration of clinical procedures has the leading position in the chart (72/139,

52%) and is followed by presentation of new topics (69/139, 50%) – the second place, e-testing and communicating with colleagues (38/139, 27% and 28/139, 20%) – the third and fourth positions respectively. Some students (5/139, 3.5%) added their own responses, namely: search for additional information (4/139) and social media with entertaining purpose (1/139). One of the students replied that Internet was not used during the classes.

From all available Internet resources which can be used with the learning purpose most students of Danylo Halytskyi LNMU highlighted the university's web-site (107/139, 77%). Other sources placed in accordance with the popularity are: You Tube (91/139, 65%), social media (63/139, 45%), forums / chats (22/139, 16%), e-mail (29/139, 21%), search engines (11/139, 8%), encyclopedias (6/139, 4%), medical web-sites (5/139, 3.5%), scientific web-sites (5/139, 3.5%), medical articles (4/139, 3%), e-libraries (3/139, 2%), dictionaries (2/139, 1%), foreign medical web-sites (1/139, 0.7%).

The fifth question was designed to identify medical manipulations/procedures searched or acquired in Internet. Among 139 responders – 83% (116/139) defined 20 medical procedures learned through the Internet, 3% (4/139) did not determine any procedure, however stated that used Internet for learning clinical procedures many times. Moreover, carried out study determined that 14% (19/139) of medical students never used Internet to learn about clinical procedures.

The study also aimed to find out a state of sharing useful learning information from Internet with colleagues and a teacher. The results prove that the students are more likely to discuss the information with their friends (96%, 134/139) than with their teachers (65%, 90/139). In addition, 35% (49/139) never addressed their teachers with such purpose and other 4% (5/139) – do not have any experience of discussing interesting data from the Web with their colleagues.

The authenticity of Internet sources was estimated by medical students as 7.6 points within a 10-point scale. The level of confidence is approximately similar in all years of study, however the second- and fourth-year students tend to trust Internet more than other students. The level of trust is the lowest in sixth-year students.

With the help of the students' responses to the 9th question it appeared possible to determine the general usefulness of Internet-sources. By the following criterion from the maximum number of 10 points the fourth-year students granted the highest point – 9, and the sixth-year students – 7.8, which is the lowest result. The medium point for all students is – 8.4.

The responders estimated the learning usefulness of Internet as 8.45 by the 10-point scale that is the medium index among all participants. The highest index belongs to the second-year students and the lowest – to the sixth year students, who, on the basis of their answers to the 8th, 9th and 10th questions, appeared the most suspicious to the information from Internet.

If the data in the web is different than the information from the lecturer, 63% (87/139) of responders would discuss the information with their colleagues, 60% (83/139) – would check the authenticity of data with the lecturer, 37% (52/139) – would continue the search, 15% (21/139) – will trust the information from Internet and the lowest result is – 3.5% (5/139) who would ignore the information. Some students in such situation would prefer checking information in the printed sources (3.5%, 5/139), compare with other sources (1%, 2/139), believe the lecturer (≥1%, 1/139), or discuss the issue with the lecturer (≥1%, 1/139).

The described above results of the carried out questionnaire force the suggestion that the global process of computerization influenced Ukrainian higher medical education. The modern learning process is impossible without at least partly ICTs implementation. A lot of new sources of information and educational technologies appeared with the emergence and possibilities of the Internet. The distance, electronic and blended learning are becoming more and more popular. Despite the fact that, these notions are cautiously used in the sphere of medical education, and the ICTs-assisted learning is more commonly associated with postgraduate medical education [3], the results of the survey demonstrate the future potential of using the ICTs in the learning process, as all of the questioned students confirmed the use of Internet technologies in addition to the traditional face-to-face ones.

The generalized results of the carried out survey may be taken into account in promoting e-learning at HMEI and designing the e-learning sources. Such useful data include the following:

1. All medical students use the Internet and web-based technologies in study. Moreover, they positively estimate their impact on learning outcomes and general development
2. Searching for additional information is one of the most common Internet learning activities
3. The official DHLNMU university web-site was indicated as the most available source of learning matters
4. The Internet tools are used during the face-to-face learning, however the degree of its usage is unsatisfactory
5. The students frequently search the Internet for clinical procedures
6. Some students expressed a high level of trust to the information in the World Wide Web and there are few of them who do not check the authenticity of the information with their teachers even if it contradicts the knowledge the students received during the face-to-face class.

Thus, the hypothesis concerning the use of the Internet and Internet sources as the main tools of searching for professional information for learning purposes proved to be true. The survey confirmed the suggestion that "Google" is the primary "advisor, consulter and teacher" of Ukrainian medical students in case of problematic learning situations. Due to this the development of electronic data bases of learning issues and subject matters, the professional selection of learning material and recommendation of correct and verified e-sources of learning information, distance courses designing, usage of social media for the purpose of learning should be the foreground tasks in the process of educational modernization.

With the aim of matching current educational trends the educators at the department of the Latin and foreign languages administer the learning group "More English for medical students" in one of the most popular social media sites Facebook . The department has been designing distance courses in English for the 1$^{st}$-4$^{th}$ year students of medical, dentistry and pharmacy faculties. The courses are being developed for the discipline "English for professional purposes" as the main and elective courses. One of such courses is being developed by us for the 3$^{rd}$ year medical students.

Due to the modern tendencies of educational development, English language is characterized by the dominant role in the sphere of professional activity and research. Thus, the development of ICTs-based courses is one of primary educational tasks. Unfortunately, there is a lack of information about such courses in English for medical students, while many educational and medical centres, proprietary and non-proprietary organizations arrange the distance courses in medical English which confirms the interest and requirement in this direction [6].

The distance course (DC) "More English for medical students" is developed as the accessory learning tool for the full-time 3$^{rd}$ year medical students. The course is expected to promote blended (combination of traditional and distance education) and e-learning at DHLNMU, and facilitate learning the subject "English for professional purpose (elective course)". It is designed on the basis of the DC model introduced by B. Shunevych. However, we adapted it according to the objectives of the subject. The structure of the DC consists of the lessons which include six sections, namely: 1) Aural Comprehension; 2) Use of Applied Grammar; 3) Use of Vocabulary; 4) Developing Speaking Skills; 5) Reading and Writing; 6) Home Reading. The learning material in all sections is medicine-based and developed on the basis of the course-book "More English for medical students", in contrast to the DC model of B. Shunevych in which only the last section is professionally oriented. The structure and the content of the course are described in detail in the following papers [6; 10].

The suggested option of the DC for the medical students has many benefits. The usage of traditional learning techniques combined with computer technologies increases the quality of professional communicative skills in English through modern methods and equipment. In addition, students receive the possibility to use the technologies in learning, which are proved to upgrade the perception and interpretation of large texts, develop the ability of memorizing significant amount of learning material, improve the creativity and interest during the face-to-face classes and outside the

classroom. The tasks used in the sections aid learning the lexical and grammatical material of the lessons. As the result the students improve listening, speaking and writing skills, gain the skills required for interpreting any professional texts in English. The complex interaction of the exercises in the sections helps to reach practical goals of English language learning, namely: the development of linguistic and cognitive skills and formation of communicative competence in English for medicine.

**Conclusion**. The carried out research determines the following:

1. Computer technologies were used for the first time in the higher medical education institutions of the USA. Three institutions, namely: Ohio State University, Massachusetts General Hospital and the University of Illinois were characterized with the most significant advance in this direction. They developed many learning computerized programs and implemented them in the leaning process. The computerized learning courses were used to facilitate, modernize and improve the existing ones. The USA is still one of the leading countries in the sphere of educational computerization, promoting new educational trends and ICTs usage in medical education.

2. In our country computer technologies are also incorporated into the system of higher medical education. However, this direction is still being developed. It is worth mentioning that the rate of computerization is high and has a potential, despite the complicated social and economic conditions.

3. Danylo Halytsky Lviv National Medical University realizes new educational methods and makes an enormous contribution in the scope of computers, ICTs use and promotion in the branch of medical education.  In addition to the clinical departments the ICTs are implemented at the theoretical departments. The department of the Latin and foreign languages incorporates distance courses and the tools of social media into the learning process of the academic discipline "English for professional purposes".

4. Higher medical education of Ukraine has the strong background for the development of computer and ICT-based learning. The presence of highly-informative web-sites, official pages and learning groups in social media as well as the basic technological equipment aid the development of these technologies use to meet the educational objectives. The increased students' interest towards this means of study and Internet incorporation in the learning process should enhance the computerization rate at HMEI.

The perspective direction of further research is the study of modern computerized learning courses in the system of future physicians training in the USA and Ukraine.

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**КОМП'ЮТЕРИЗАЦІЯ У ВИЩІЙ МЕДИЧНІЙ ОСВІТІ США ТА УКРАЇНИ**

У статті досліджено розвиток навчання із використанням комп'ютерних технологій та інформаційно-комунікаційних технологій (ІКТ) у США, окреслено стан інформатизації у закладах вищої медичної освіти України, проаналізовано досвід Львівського національного медичного університету (ЛНМУ) імені Данила Галицького у сфері використання новітніх технологій та Інтернету для навчання, і зокрема кафедри латинської та іноземних мов згаданого вище ВМНЗ на шляху до модернізації та інформатизації навчального процесу. В результаті проведеного дослідження охарактеризовано перші комп'ютеризовані навчальні програми, що застосовувалися під час підготовки майбутніх лікарів. Стверджується, що комп'ютерні технології у медичній освіті були вперше використані у США та використовувалися як допоміжні інструменти навчання з метою полегшення, покращення та оптимізації існуючих педагогічних засобів та методик. Доведено, що у нашій країні

комп'ютерні та інформаційно-комунікаційні технології також активно використовуються як допоміжні елементи навчання студентів-медиків, а процес інформатизації галузі вищої медичної освіти стрімко розвивається та має великі перспективи, що засвідчено результатами проведеного анкетування студентів ЛНМУ імені Данила Галицького, результати якого висвітлені у цій праці.

**Ключові слова:** комп'ютерні технологій, інформаційно-комунікаційні технології, вища медична освіта, інформатизація, Україна, США, майбутній лікар.

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**КОМПЬЮТЕРИЗАЦИЯ В ВЫСШЕМ МЕДИЦИНСКОМ ОБРАЗОВАНИИ США И УКРАИНЫ**

В статье исследовано развитие обучения с использованием компьютерных технологий и информационно-коммуникационных технологий (ИКТ) в США, обозначено состояние информатизации в учреждениях высшего медицинского образования Украины, проанализирован опыт Львовского национального медицинского университета (ЛНМУ) имени Даниила Галицкого в сфере использования новейших технологий и Интернета для обучения, и в частности кафедры латинского и иностранных языков упомянутого выше ВМНУЗ на пути к модернизации и информатизации учебного процесса. В результате проведенного исследования охарактеризованы первые компьютеризированные учебные программы, которые применялись при подготовке будущих врачей. Утверждается, что компьютерные технологии в медицинском образовании были впервые использованы в США и использовались как вспомогательные инструменты обучения с целью облегчения, улучшения и оптимизации существующих педагогических средств и методик. Доказано, что в нашей стране компьютерные и информационно-коммуникационные технологии также активно используются как вспомогательные элементы обучения студентов-медиков, а процесс информатизации отрасли высшего медицинского образования стремительно развивается и имеет большие перспективы, что подтверждается результатами проведенного анкетирования студентов ЛНМУ имени Даниила Галицкого, результаты которого освещены в этой работе.

**Ключевые слова:** компьютерные технологии, информационно-коммуникационные технологии, высшее медицинское образование, информатизация, Украина, США, будущий врач.