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ANALYSIS OF GENESIS OF PROBLEMS IN FORMATION OF IT-COMPETENCE OF FOREIGN STUDENTS IN THE HIGHER MEDICAL EDUCATIONAL SYSTEM

The article analyzes the essence of IT competence of medical workers, outlines it urgency and marked ways of its improvement. A distinction made between the structure of IT-competence and the criteria that characterize it. The issue of informatical training foreign students who have studying in the specialty "Medical Treatment" in the second year and studying the subject "Medical Informatics" researched. In the general system of medical training, the discipline "Medical Informatics" placed in the cycle of natural science training.

Levels of computer science knowledges determination by the results of learning students from the countries of Asia, Africa and the Middle East regions has carried.

Based on the curricula and strategic learning aims, a comparative description of educational systems and the levels of effectiveness of computer science education in secondary schools in Asia, Africa and the Middle East.

The results of the survey of foreign students have demonstrated the heterogeneity in the skills of working with information technology, which related to the level of pre-university training. The causes of problems of the in the informational disciplines training system of the foreign students are determined and the approaches to intensification of the process of their education highlighted. Comparison of the results of beginning control of foreign students experience in the discipline "Medical Informatics" showed a different levels of the owning by learning material. In particular,

this is due to the peculiarities learning of the computer sciences in secondary schools of the countries of Asia, the Middle East and Africa.

Found that certain features in the process of teaching computer science are overcome by making appropriate adjustments to the content of training, which should be formed taking into account the countries of origin of students. Students as additional tasks in the process of distance learning should learn the proposed additions.

*Key words***:** IT competence; digital competence; education system; medical informatics; computer science training; foreign students.

Introduction. The development of information technology (IT) and its implementation in the medical sector and health care necessitates the acquisition of appropriate practical skills by medical workers in the analysis of patient morbidity, medical records, processing of medical and social data [1]. Therefore, one of the components of the professional skills of a modern medical worker, apart from the professional, is IT competence [2]. As the experience of practical work with foreign students shows, the personality with a formed IT-competence is able to use effectively the latest achievements of science and technology in professional activity and to feel perfectly well in the information environment [3]. Therefore, the formation of practical skills that foreign students should learn during the study of the subject «Medical Informatics» needed. As resultants need be: mastering of computer-aided processing of medical and biological data using application software, designing solving medical and biological tasks algorithms, the use of IT for the receiving, processing, transmission and visualization of medical and biological data, interpretation of the classification principles and coding medical and biological data. Skills of using database management systems, basic skills of using the main medical resources of the Internet, the skills of using statistical functions and criteria for the analysis of medical and biological data need too. Requirements and the ultimate goal of the training are standardized for all students, despite their previous informatics training, which causes difficulty with choosing teaching methods. In different regions of Asia and Africa, the systems of secondary education differ from one another, which is reflected in the computer training of students. IT competence is not very substantive, therefore, building a model for its formation and development is needed, which would best ensure the readiness of foreign students to apply information technology in their future professional activities.

The aim of the article is to analyze the genesis of the problems of forming the IT competence of foreign students in the specialty "Medical Treatment", as well as to conduct a comparative description of the levels of teaching of informatics subjects in the general educational institutions of Asia, Africa and the Middle East.

Methodology of Research. For the conducted investigation, a set of methods was used, in particular, overview and analysis of scientific literature and state legal documents on the content of the concepts of "digital competence", "IT competence", etc. To disclose the effectiveness of the introduction of the course "Medical Informatics" and the discovery of significant differences in the level of development of IT competencies of foreign students (115 people), methods of questioning, testing.

Background. The work of a number of scientists of is devoted to the question of formation and development of computer competence M.O. Antonchenko [4], V.Y. Bykov [5], N.V. Morse [6], Y.S. Ramskyy [7], O.M. Spirin [8] and other researchers.

The following authors studied methods and means of forming information culture and IT competence of medical specialists (I.Y.Bulakh [9], A.M. Dobrovolska [10], V.P. Martsenyuk [11] [12], M.R. Mruga [13]

The term "Information technology" (IT) is interpreted as a computer application used to store, study, search, transmit and manipulate data (Daintith J. [14]), in the international standard ISO/IEC 38500: 2015, IT is defined as the resources needed to build, process, store and disseminate data (https://www.iso.org/). In scientific and pedagogical works, competence defined as a complex

of knowledge, skills, experience, the purpose of which is to achieve certain goals, attitude to the process and the results of this activity.

In the scientific and pedagogical writings of authors Borodkina I. [15], V.Y. Bykov [16], A.M. Dobrovolska [17], Ilomäki L. [18], Rokenes F. [19] differenced names and formulations of the concept of computer-related competence, for example: digital competence, information competence, IC competence, information technology competency (IT competence). It is the last name that we will use in our study.

Alma Zh. Murzalinova N. IT competence considered as an integral characteristic of the person. IT competitions is the result of the transformation processes, selection, assimilation learning information into a special type of subject-specific knowledge, contributes to the formation of experience information and communication activities, systematic updating of acquired experience in the educational process, motivates readiness and ability of students to transform information into knowledge with the prospect of self-education, self-improvement and self-realization of personality in modern in the information society [20].

A.M. Dobrovolska in his works analyzes the meaning of the concept of "IT competence" and considers its structure; in particular, it notes that IT competence is simultaneously one of the key and sector-wide competencies that are envisaged by the general content of higher education standards [17].

In his part of the collective monograph, O.V. Bilous defined IT (ICT) competence as a person ability to navigate the information space, operate data based on the use of modern ICTs in accordance with the needs of the labor market and for the effective performance of professional duties [21].

Information Literacy Competency Standards for Higher Education developed by the American Association of Colleges and Scientific Libraries states that information literacy is a set of abilities aimed at finding, evaluating and effectively using the necessary information (http://www.acrl.org/). In the Recommendations of the European Parliament and the Council, digital competence involves the confident and critical use of information society technologies for work, leisure and communication, based on basic ICT skills, namely the use of computers for obtaining, evaluating, storing, producing, presenting and sharing information, communicating and collaborating across the Internet (http://eurlex.europa.eu/). In the publication of the European Commission's Science and Knowledge Service's Joint Research Center, digital competence defined not only as the ability to use the latest digital technologies, but also as an opportunity to use these digital technologies in a critical, collaborative and creative way (Stephanie C. [22]).

Results of Research. Studying the skills that influence the formation of IT competence we can distinguish the most important of them, namely: the ability to navigate the information space; search, process, organize, store and submit information using IT; assessment of process and results of technological activity; understanding the technical limitations of using IT to solve socially important tasks. The IT competence of a doctor is an internal characteristic of a person that is limited in the field of activity and is a set of acquired knowledge, skills and abilities with using the resources necessary for the collection, processing, storage and dissemination of data for the performance of activities in the medical sector.

IT competence, which is laid out in the preparation of foreign medical students, can be divided into two components: theoretical (IT knowledge system and methods and forms of their application in professional activities) and practical (a set of skills and abilities of IT use). In studying the discipline "Medical Informatics" in accordance with taxonomic levels, the final and specific aim of training (table 1), in the form of certain skills that provide the formation of IT competence of the future medical worker are formed.

Achievement of the goal of teaching the discipline "Medical Informatics" should promote the formation of IT competence of future medical professionals and ensure the possibility of successful and effective use of skills with solving problems in future professional activities. The structure of IT competence can be divided into four levels: low, adaptive, reproductive and productive.

The low level of IT competence in future medical professionals characterized by superficial knowledge in medical informatics, occasional IT use, lack of systematic data quality analysis, and understanding of the importance of using IT in training and future professional activities. Considering the adaptive level, one can distinguish the following criteria: knowledge focused on solving typical informational tasks, periodic use of IT, partial formation of knowledge of the normative basis on means of obtaining and processing data, incomplete knowledge about tools, methods and algorithms of data quality analysis, IT use at user level. The reproductive level of the formation of IT competence characterized by the ability to solve complex integrated information tasks, systematic data analysis, the use of IT at a high user level, the formation of abilities to work in the information environment. The latest productive level characterized by the availability of knowledge about the principles of building a unified information space of the medical industry, the construction of appropriate algorithms and critical thinking in the analysis of data, the use of IT at a high level, creative decision of information tasks, ethical legal literacy and computer science.

Table 1

The ultimate and specific aim of the discipline "Medical Informatics"

The ultimate aim	Content module	Specified aim
to determine the possibilities of using IT and PC in medicine; to explain the principles of formalization and algorithmization of medical tasks; principles of modeling in biology and medicine; to demonstrate basic computer skills; to demonstrate the ability to search medical data using IT; to use methods for processing medical data.	*Basic concepts of medical informatics. Computer in the work of the future doctor*	to interpret the basic concepts of medical informatics; to interpret the peculiarities of the use of PPP for the processing of medical data; analyze the role of computer technology in medicine; interpret the basic principles of telemedicine; demonstrate the skills of using the database in the processing of medical-biological data; demonstrate the basic skills to use medical resources of the Internet network.
	Medical data. Methodology for processing and analyzing information	interpret the principles of data classification and coding; interpret the principles of applying statistical methods in processing the results of medical-biological research; demonstrate the skills of using statistical functions and criteria for the analysis of medical and biological data; interpret the methods of processing and analysis of medical images.
	Medical knowledge and decision making	to interpret the basic formal models of presentation of medical knowledge; to analyze the principles of constructing and functioning decision support systems in medicine; interpret the basic concepts of mathematical logic; demonstrate the ability to represent the conditions of medical and biological tasks in a formal way.
	Patient-directed systems and institutional information systems in health care.	to interpret types of information systems in the field of health care; demonstrate the skills of working with electronic medical cards; demonstrate the ability to use IT to search medical data.

Considering the content of IT competence that foreign students need to acquire during the course "Medical Informatics", and taking into account the fact that students should have a basic level of computer science training, we will give the results of the input questionnaire to determine the level of ownership of IT. 115 respondents have interviewed during the questionnaire, distributed by geographical region: Asia, Middle East and Africa. The age range of students of the second year, the specialty "Medical Treatment", ranged from 18 to 25 years that 69% were men and 31% were women. To the question: "Have you had previous experience with the computer", 94% said "yes", 6% indicated "no". Answering a question regarding the amount of time spent on a computer: 50% indicated from 1-2 hours, 24% – more than 4 hours, 21% – 2-3 hours, 5% – 3-4 hours a day. The vast majority of respondents, namely 66% use computers at home, 28% use them at the university and 6% in other places designated for this purpose.

Students have asked to self-assess their own level of IT possessions (Fig. 1). The results of the survey indicate that 49% of the interviewed students have skills in working with text editors, 21% have formed the skills of working with table processors, 24% - are able to work with multimedia tools, 91% - have the skills of working with e-mail and 100 % - are experienced users of the global Internet network. None of the respondents mentioned the skills of computer modeling and knowledge of programming languages. Thus, there is a difference between the level of computer science preparation in secondary school and higher education institutions, as students must have at least skills in working with application software and office suite.
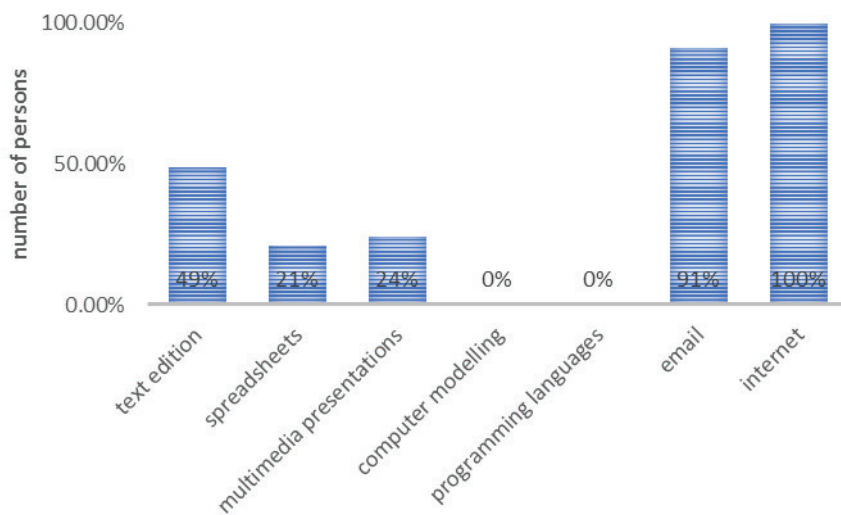
Fig. 1. Results of the survey about the basic skills of IT work of foreign students

The distribution of the percentage of foreign students studying in the specialty "Medical Treatment "during the survey was: Asia – 52%, Africa – 30%, Middle East – 18%. Since the highest percentage of students interviewed go to India and Nigeria, let us consider the historical aspects of IT implementation in the secondary education system in these regions. Let us consider the preconditions for informal training of foreign students depending on the region of residence. The first steps in introducing IT technology into the Indian secondary education system began in 1984, launching this process from the Computer Literacy and Research (CLASS) project. It covered 42 resource centers and 2582 schools. According to the assessment, the project had certain disadvantages, which needed for closer interaction between resource centers and schools, better teacher training and equipment settings. The project had limited success and renewed only after the reconstruction in 2000. The purpose of the project "CLASS 2000" was the formation of computer literacy among schoolchildren in 10,000 schools. The implementation of this project had a significant

impact on the education system of India, but he kept on his own ingenuity and initiative of educators, and most schemes failed even on a conceptual level.

The purpose of the next program formed as "Computer literacy – not only knowledge, but also the skills of meaningful use of PC". The TelNet group from the Indian Technological Institute in Madras conducted the program. However, the implementation of the project was complicated by the lack of a number of provisions and coherence between the sponsors of the program. None of the issues was discussed and no relevant decisions were made. In view of these failures, most international corporations and organizations in India have limited goals with the introduction of IT into the education system.

In other periods, other programs for informatization of the education system of India (Vijaya M., 2006 [25]) operated:
– The Azim Premji Foundation has helped to provide more than 10,000 schools with computer equipment.
– The Mahiti Sindhu program, launched in Karnataka in 2000, is being implemented in about 1000 secondary schools in India. The state government has entered into an agreement with private institutions (NIIT, Aptech, EDUCOM), which assumed responsibility for teacher training, equipment provision and computer classroom support. Similar events are also held in the schools of Andhra Pradesh, Kerala, Delhi, Madhya.
– The "Head Start" program, initiated in Madhya Pradesh, currently covers 2718 schools. Their activity is to train teachers to use educational CDs effectively in class.
– School IT project - started in Kerala in 2003. The project implemented in 2,735 schools. Within the framework of the project, about 25700 computer systems were provided to schools.
– Intel Corporation's Teach to the Future Program – Intel Corporation initiated a computer-training program in 12 states. The training aimed at professional development programs. The course aims to help teachers use technology to support project-based learning.
– The Microsoft's Project Shiksha program has designed to accelerate the development of computer literacy in India, providing comprehensive training for teachers and students.

Student's computer training for a long time remained outside the framework of state institutions, although some universities and accreditation agencies are involved in the standardization process. A number of private institutions (NIIT, Aptech) provide a wide range of IT training courses. The system of training consists of multilevel courses, which allows both new users of software and experienced ones to choose their own trajectory of training. The private sector demonstrates the ability to respond quickly to change by introducing courses with the certification mechanism.

Nowadays, computer science education in India has been adopted at a rather serious level by many states and private sector initiatives. The curriculum provides the study of a particular set of software, but its lack of Indian language catalyzes the process of developing the system of informatics education.

Exploring the historic way of introducing IT into secondary education in African countries we can noted that this process was supported by a national policy of the World Bank (World Links for Development Program) and the Center for International Development Studies (Acacia Program). Created by the World Bank, the African Virtual University (AVU), which has planned as an alternative to traditional education, from 1997 to 2003, trained about 40 thousand people.

The aim of the World Links for Development Program (2003-2010) was to increase knowledge and professional development through information and communication technologies. The Acacia program (2008-2011) was designed to develop a plan for intensive training and analysis of the gender issue in Africa. Within the framework of the New Partnership for Africa's Development program, an initiative to create e-Schools for the development of Africa has launched, with the participation of 16 African countries.

The development of digital or e-learning in Africa is very slow. If we consider the context of school education, then most of all this concerns the development of the content of digital training programs. In addition to print media, there are also examples of video, audio, and computer multimedia formats related to technology, since 2010 mobile devices and tablets are increasingly used in educational institutions (Fig. 2) (http://www.infodev.org).

The results of the analysis on informatization of secondary education in India and Nigeria indicate that in both cases this process began at late twentieth century, however, due to the intensive promotion of foreign organizations and programs, the computer science culture is experiencing positive dynamics. In fig. 3.there is given a comparative description of the countries whose representatives participated in the survey, according to the index of development of IT (http://gtmarket.ru/ratings/). It is India, Nigeria and Pakistan that are at the lowest level in the development of IT, among the countries represented. For example, the IT development index of Ukraine is 5.23, while the Republic of Korea has the highest index of 8.93.
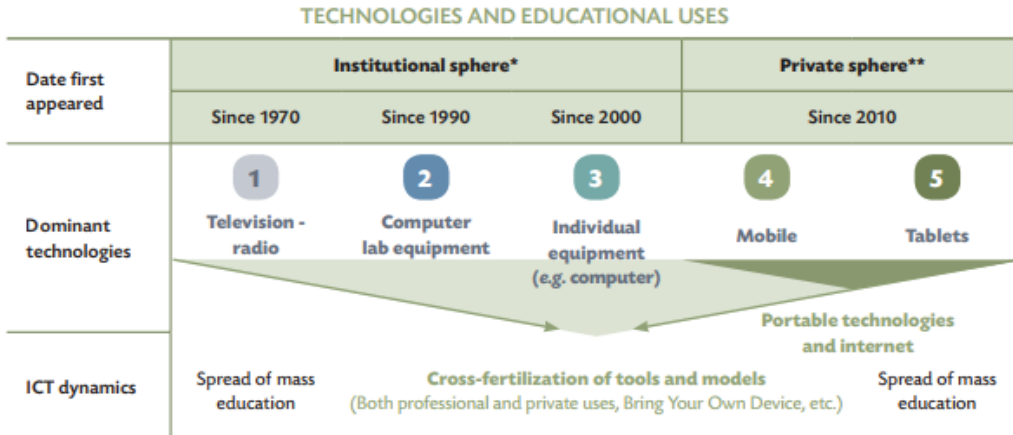
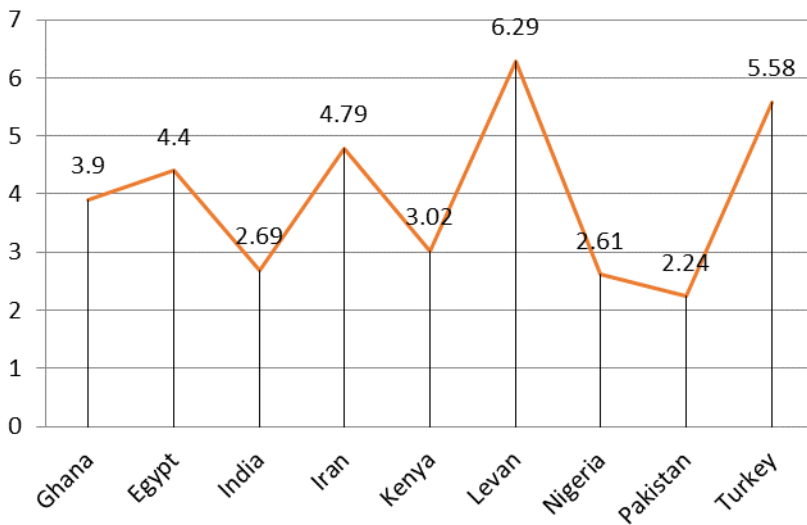**Fig. 2. Development and dynamics of IT implementation**


Fig. 3. Index of IT development

Since the groups in which foreign students studying in the specialty "Medical Treatment" are formed by ethnicity, it is expedient to take into account their peculiarities, the level of knowledge of the IT work skills of individual students and groups when choosing the educational material and tasks. It should also be noted that while studying for the second year, foreign students still undergo a process of

ethnic, social and professional adaptation, during this period; mental activity is directed and focused on objects which have a certain importance individually. In the process of informational training of foreign students, there is a problem with a low incoming level of knowledge, which necessitates an individual approach to each of the groups and the organization of a person-oriented learning system, depending on the geography of student's residence. This approach promotes rapid adaptation and professional growth, as the requirements for acquiring IT competence of health professionals in the specialty under consideration are identical. The formation of IT competence need be based on the use of methods and techniques, taking into account the levels of development of their abilities.
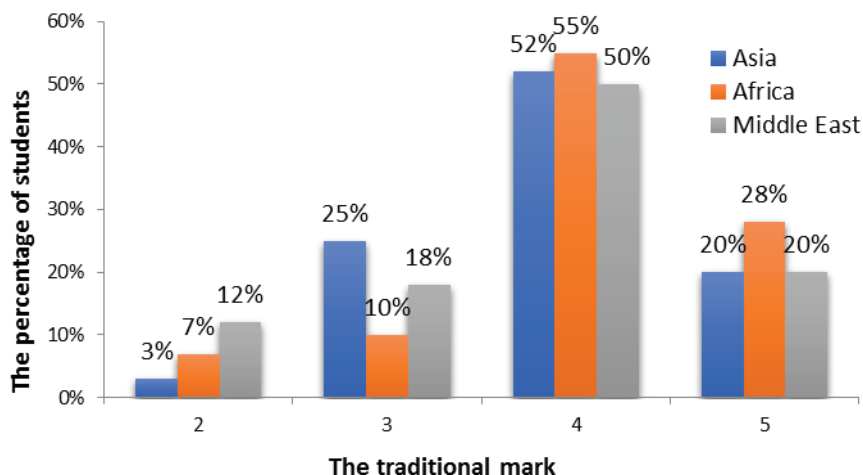
Fig. 4. Levels of formation computer knowledge of students from the different geographical regions (2016-2017)

By comparing the analysis of the formation informative knowledge of students (115 people), depending on the geographical region (2016-2017), by percentage ratio, one can state that the lowest results of the educational activity show students from the Middle East (12% - unsatisfactorily), while students from Asia and Africa are 3% and 7% respectively (Fig. 4). The largest number of students who mastered the study material is "excellent" in Africa (28%), Asia and the Middle East by 20%.
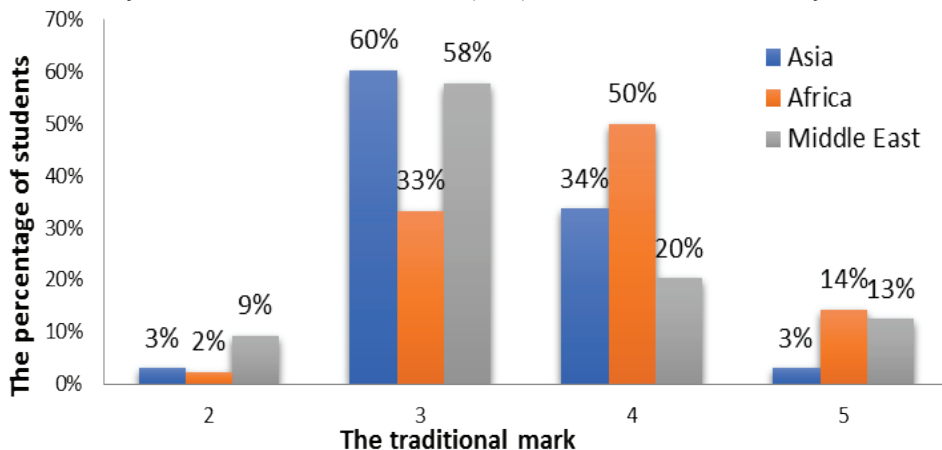
Fig. 5. Levels of formation computer knowledge of students from the different geographical regions (2017-2018 years)

Comparing the data obtained for 2017-2018 With regard to the formation of computer science knowledge of foreign students (204 people), it can be stated that students from the Middle East (9% - unsatisfactorily), Asia and Africa (3% and 2% respectively) have the lowest educational results (Fig. 5). Distribution according to the "excellent" score is as follows: Africa (14%), Middle East (13%) and Asia (3%).

Discussion. Modern academic and pedagogical literature stresses the necessity of formation of IT competence of future specialists different branches and described many ways of realizations (Borodkina I. [15], Dobrovolska A.M. [17], Alma Zh. Murzalinova N. [20], Hurzhii A. M., Kartashova L. A., Lapinskyi V. V. [23]). However, there is no clearly defined definition of IT competence. One reason for the missing definition of IT competence is the limited amount of studies that measure the digital competence (Røkenes F. [19]). As van Deursen [24] note, the studies are often limited in their definitions, sample sizes and methods of data collection. This means that there is not enough empirical data to validate the structures and the content of IT competences or skills.

Our experience, as well as other studies (Dobrovolska A. M. [17], Bulakh I. Ie. [9]), provide evidence that formation of IT competence of medical students continues to be the actual problem. In the course of the research, we have been refined final and specific aim of the discipline "Medical Informatics", also, we have defined the content of the IT competence of a doctor.

Overall, it should be noted that the problem of forming the IT competence of foreign students is due to the peculiarities of studying computer science subjects in secondary schools, which is confirmed by national informatization programs (Vijaya M. [25], Farrell [27]). Students also have a different level of ICT skills, as evidenced by an analysis of their success from the discipline "Medical Informatics" during 2016-2018.

Our research is aimed at establishing a precise sense of the IT competency of the medical staff and the skills to be acquired by students, as well as identifying the challenges of developing IT competence and further development of such methods and means, which would allow eliminating the contradictions in the study of students.

Conclusions. The content of the teaching material in all groups is the same, but there is a significant difference in the academic achievements of foreign students. It testifies to the need to create appropriate pedagogical conditions to ensure the successful formation of IT competence of students, regardless of their level and peculiarities of studying computer science subjects in secondary schools. Prospects for further research are the development of personality-oriented learning systems in order to form the IT competence of future healthcare professionals, organization of practice-oriented training with a view to revealing the links between the knowledge gained and future professional activities. In particular, some aspects of work relate to the development of forms and methods of quality control training and the integration of medical informatics with other disciplines.

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АНАЛИЗ ГЕНЕЗИСА ПРОБЛЕМ ФОРМИРОВАНИЯ ИТ-КОМПЕТЕНТНОСТИ ИНОСТРАННЫХ СТУДЕНТОВ В СИСТЕМЕ ВЫСШЕГО МЕДИЦИНСКОГО ОБРАЗОВАНИЯ

В статье анализируется сущность ИТ-компетентности медицинских работников, выделяется ее актуальность и обозначаются пути ее совершенствования. Описана структура ИТ-компетенции и критерии, которые ее характеризуют. Исследованы проблемы обучения на втором курсе информатике иностранных студентов специальности «Лечебное дело» и изучающих предмет «Медицинская информатика». Указано, что в общей системе медицинской подготовки дисциплина «Медицинская информатика» помещена в цикл естественнонаучной подготовки.

Уровни знаний по информатике определены по результатам обучения студентов из стран Азии, Африки и Ближнего Востока. На основе учебных планов и стратегических целей обучения дано сравнительное описание систем образования и уровней эффективности обучения информатике в средних школах Азии, Африки и Ближнего Востока.

Результаты опроса иностранных студентов продемонстрировали неоднородность в навыках работы с информационными технологиями, что связано с уровнем довузовской подготовки. Определены причины возникновения проблем в системе обучения информационным дисциплинам иностранных студентов и сформулированы подходы к интенсификации процесса их обучения. Сравнение результатов входного контроля иностранных студентов по дисциплине «Медицинская информатика» показало разные уровни владения учебным материалом. В частности, это связано с особенностями обучения информатике в средних школах стран Азии, Ближнего Востока и Африки.

Установлено, что определенные сложности в процессе обучения информатике преодолеваются путем внесения соответствующих корректировок в содержание обучения, которое должно формироваться с учетом стран происхождения учащихся. Студенты в качестве дополнительных заданий в процессе дистанционного обучения должны усвоить предложенные дополнения.

Ключевые слова: ИТ-компетенция; цифровая компетенция; система образования; медицинская информатика; обучение информатике; иностранные студенты.

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АНАЛІЗ ГЕНЕЗИ ПРОБЛЕМ ФОРМУВАННЯ ІТ-КОМПЕТЕНТНОСТІ ІНОЗЕМНИХ СТУДЕНТІВ У СИСТЕМІ ВИЩОЇ МЕДИЧНОЇ ОСВІТИ

У статті проаналізовано сутність ІТ-компетентності медичних працівників, окреслено її актуальність та окреслено шляхи її вдосконалення. Описано структуру ІТ-компетенції та критерії, що її характеризують. Досліджено питання інформатичного навчання іноземних студентів, які навчаються за спеціальністю «Лікування» на другому курсі та вивчають предмет «Медична інформатика». У загальній системі медичної підготовки дисципліна «Медична інформатика» розміщена в циклі природознавчої підготовки.

Визначення рівнів знань з інформатики здійснено за результатами навчання студентів з країн Азії, Африки та регіонів Близького Сходу.

На основі аналізу навчальних планів та стратегічних цілей навчання подано порівняльний опис освітніх систем та рівнів ефективності навчання інформатики в середніх школах Азії, Африки та Близького Сходу.

Результати опитування іноземних студентів продемонстрували неоднорідність у навичках роботи з інформаційними технологіями, що визначається рівнем довузівської підготовки. Визначено причини проблем у навчанні інформаційних дисциплін іноземних студентів та описано підходи до інтенсифікації процесу їх навчання. Порівняння результатів початкового контролю ІТ-компетентності іноземних студентів з дисципліни «Медична інформатика» показало суттєво різний рівень володіння навчальним матеріалом. Зокрема, це пов'язано з особливостями навчання інформатики в середніх школах країн Азії, Близького Сходу та Африки.

Встановлено, що визначені складнощі в процесі викладання інформатики долаються шляхом внесення відповідних корректив у зміст навчання, які потрібно формувати з урахуванням країн походження студентів. Студенти повинні вивчити запропоновані доповнення як додаткові завдання в процесі дистанційного навчання.

Ключові слова: ІТ-компетентність; цифрова компетентність; освітня система; медична інформатика; навчання інформатики; іноземні студенти.