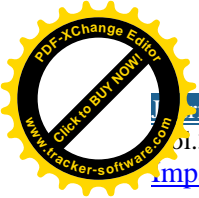




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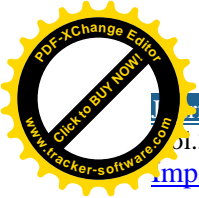
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## **Improving the competence of personnel training in medical education through digitalization of medicine**

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### **Resume**

This article presents the possibilities of using information and digital technologies when studying the course of information technologies in medicine in medical institutions of higher education. Digitalization of education and the use of digital technologies will make it possible to modernize and develop education, improve the quality of training of future specialists and adapt them to the labor market, bring education closer to science, and the education system will meet the requirements of the digital economy and digital technologies.

**Keywords:** digital competence, information technology, instrumental, information and communication, video lectures, electronic textbooks, self-paced learning, control tasks, test questions.

### **Introduction**

Modern society is characterized by a large flow of information and the introduction of innovations in various fields of activity, which requires a person not only a certain amount of knowledge and professional skills, but also digital literacy, for example, communication, computer, information. It is necessary for the educational system to ensure the development of digital competences and digital socialization of students. This article provides opportunities for the use of information and digital technologies in the study of the information technology course in medicine in medical institutions of higher education. Formation and improvement of digital competences will greatly help not only the development of fundamental knowledge, but also their application in solving future professional problems. In our opinion, digitization of education and the use of digital technologies will modernize and develop education, increase the quality of training future specialists and their adaptation to the labor market, bring education closer to science, and the educational system meets the requirements of the digital economy and digital society. The introduction of new digital technologies is an urgent direction for further scientific research.

### **Material and Methods**

The information technology module program and a number of other documents in the biomedical engineering, informatics and biophysics department of the Tashkent medical academy are related to the use of information and communication technologies in the educational system, the development of criteria for evaluating students' knowledge by using the Moodle platform, the improvement of ICT competencies and the digital socialization of students. It clearly requires significant restructuring. The documents define the prospects for the development of digitization



of the educational system. Instrumental in this - equipping educational institutions with high-quality software and information systems that allow the use of modern educational resources:

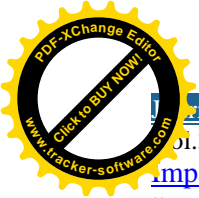
- changes in requirements for teachers and students;

- inevitable changes in the usual forms and methods of teaching by reviewing existing approaches to educational activities; harmonizing with the best traditions of household education, improving the quality of education, as well as anti-corruption. Methodologically, the digitization of the educational system is based on new educational standards, actively using a competency-based approach. Digitization of education implies a change in competency models and educational programs, approaches and evaluation of the work of professors and teachers and the quality of teaching. As a result of the formation of competencies in the context of the use of digital technologies, students can use the "Moodle" platform to improve their knowledge of the principles and rules of operation of digital technologies and digital platforms, artificial intelligence for their future professional activities and professional information search, and effective use of information.

In the process of digitalization of education, significant changes are expected both in the educational structure and in the organization of the educational process. Digitization of educational environment can take different forms. This is the translation of existing teaching and methodical materials into the electronic environment (video lectures, electronic textbooks, assignments for independent study and control, test questions, etc.), updating of basic and additional educational programs, development of students' skills in the wide use of information technologies by developing their individual components. . One of the priority elements of digitization of education is digital literacy - it increases the possibility of using the necessary content using digital technologies, using computer programming, computer graphics, graphic visualization methods, communication with teachers and students. Successful formation of professional and digital competences in the study of information science at the Medical Academy can be done using the following digital platforms and educational resources: interactive tables, educational platforms Moodle, Zoom, Skype, Learning Apps, Microsoft Teams, CoreApp.

Using these resources, you can deploy a complete educational-methodical set: video lectures, questions, tasks, tasks, independent work and tests for preparing for classes, colloquiums, tests, exams. Feedback with students can be done using digital Kahoot, Quizizz tools, Trello, Miro interactive whiteboards. With their help, you can create tasks on various topics, organize questionnaires, tests and homework.

The ability and skills to conduct physico-chemical experiments using digital educational tools, practical training in the science of information technology are used in the practical training of the course to perform the following laboratory work on spectral methods of analysis. "Algorithm expression methods and their types. Creating algorithms for problems related to linear medical processes.",



"Fundamentals of text editing using Microsoft Word. Working with table and graphic information in Microsoft Word.

Work with and edit hyperlink objects in the Microsoft Word text editor.", "Electronic health care complex information system. Statistical processing and evaluation of medical biological experiment results using Microsoft Excel spreadsheet editor. Using the "Patient" information system - (for employees of institutions treating patients with various diseases)", "Calculation of mean values, variance, confidence interval, t-student (F-Fisher) criterion, confidence level and Determination and evaluation of the r-correlation coefficient.", "Working with graphics (diagrams and pictures), tables, video objects, animation and hyperlink elements in the MS Power Point program."

In the preparation of research protocols, students should acquire the skills of statistical processing of experimental data using Microsoft Excel and statistical programs, which will be needed in the future in the study of clinical sciences. ChemDrawdirect, JChemPaint, IsisDraw and XWinNMR programs are used to visualize spatial structures of physicochemical compounds. Universal skills and knowledge defined by professional standards, such as mastering information and computer programs, the ability to analyze and interpret the obtained data, are developed and improved by students in the course of research activities. While working on the selected topic, students get acquainted with PubMed and Medline information search systems. They master PowerPoint and Prezi programs when preparing presentations. The increase in the number of students using digital resources indicates their increasing interest in modern digital technologies, which gives an additional impetus to the digitization of education.

According to the Dublin Declaration on Human Resources for Health, there will be an estimated 18 million shortage of health workers worldwide by 2030, which is undoubtedly the key to achieving the strategic goal of the global health system. barrier and ensure that everyone who needs it has access to high quality care.

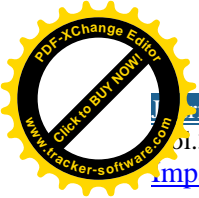
- providing quality medical services without the risk of financial difficulties. One of the solutions to this problem is the digital healthcare system and its components;

- introduction of digital medical education. If until recently the initiative to create digital medical education raised doubts among researchers, professors and politicians, now the cooperation of experts in various fields of activity related to medical education and the health system in general is getting big. It has an international character, and within its framework, the world community is developing effective measures to change the education of health professionals.

## Results

The research was carried out in two main stages. As part of the first phase of the study, we conducted a systematic review of the research literature from databases such as Medline, Web of Science, and RSCI. The literature reviewed included





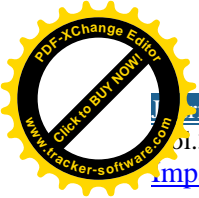
completed dissertations, articles, systematic reviews and systematic review protocols published on the International Prospective Systematic Review Register (NIHR) website. To select authors' works, we used the online application Rayyan QCRI, which allows you to view abstracts according to predefined parameters. The purpose of the second stage of the research was to evaluate the level of digital literacy and the level of development of digital competencies of the professors of the medical academy as an assessment of the academy's readiness for digital transformation. We used tools developed by scientists at the Multidisciplinary Think Tank, which allow us to assess different components of digital literacy and digital competencies:

- information literacy, including the skills of collecting and analyzing information necessary for solving professional problems, as well as presenting them in convenient formats, indexing and archiving for later use;
- computer literacy, "knowing the technical components of a computer and the principles of their interaction, the ability to comfortably use digital devices regardless of the platform/interface, and understand the purposes of the computer and use it in professional activities";
- communicative literacy as communication skills in social networks, development of the Internet communication network as a professional network, as well as awareness of special ethics and norms of communication in the digital environment;
- media literacy, including knowledge about "diversity of information sources, forms and channels of its dissemination (knowledge)";
- knows how to search for news in various sources, check their completeness and reliability (skill).
- reacts critically to information messages, news (relationships);
- attitude to innovation, which describes the attitude of the respondent to digital technologies, gadgets and applications and readiness to master these technologies and solve professionally important problems with their help. The assessment of each of the five dimensions of digital literacy leads to the calculation of the digital literacy index: information (percentage), computer use (percentage), media literacy (percentage), communication (percentage), innovation (percentage), innovation (percentage) are used to calculate the index. shib, the index can be calculated by dividing the result by 6.

### **Discussion**

Summarizing the opinions of experts in various disciplines allowed us to pay special attention to digital medical education. Using well-known approaches to the definition of the concept, by indicating the closest necessary and sufficient properties, we were able to identify groups of definitions, in which the authors indicate the following as specific properties:

- 1) virtual and expanded database;

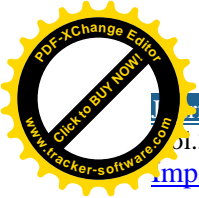


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- 2) the importance of distance learning technologies in providing digital services and efficient use of applications;
- 4) use of online courses and various forms of lessons in online format;
- 5) development of the ability to solve situational problems implemented with the help of a virtual Internet program;
- 6) the ability to transfer social networks and messengers (mobile communications).

It should be noted separately that more than 7.6% of the definitions of this concept analyzed by us use the concept of "educational environment" as the closest attribute (type). For example, in the research conducted by Greek scientists Mikropoulos T.A., Natsis A., digital medical education is defined as "an educational environment based on a clear pedagogical model, containing or implying one or more didactic goals and providing users with their own experience. It is impossible not to experience it in a natural process. Perhaps this approach makes sense, but in our research, we preferred to use traditional approaches to defining concepts without expanding the boundaries of the concept being defined. In addition, regardless of what types of features are included in the concept of "digital medical education", it is clear that digital education is education carried out with the help of digital technologies. It is an umbrella term for a variety of evolving educational approaches, concepts, methods, and technologies. It is impossible not to agree with a group of scientists such as Carr J., Karlstedt-Duke J., Tudor Carr L., Posadzki P., Whiting P., Zari N., Atun R., Majid A., Campbell J. "Digital education can be characterized by specific pedagogical and teaching methods, provisioning conditions, and technical and software capabilities. Digital learning options range from simple conversion of content to digital format (eg, books to PDF or HTML) to complex deployment of digital technologies (eg, mobile learning, serious games, virtual patients, and virtual reality).

Thus, digital health education is an educational system based on digital technologies, Big Data analytics and artificial intelligence technologies, which covers all aspects of education and leads to professional training in the field of health and ultimately, has the potential to have a great impact on human health. However, in our opinion, digitization or digital transformation is a very difficult period for medical institutions of higher education, especially regional universities, and representatives of the health system, professors and teachers of medical institutions of higher education, As the public and political figures have pointed out, there are several challenges that need to be addressed in the demand for digital medical education. Among the identified problems faced by higher education institutions of medicine as part of the digital transformation described in various sources, we considered that it is possible to identify several groups. The first group includes so-called moral problems. One of these problems can be evaluated as the following integration of the missions of medical higher education institutions:



a) value guidelines defining the function and structure of the medical higher education institution;

b) valuable instructions on gathering scientific knowledge and innovative experience, transferring them to future and practicing doctors;

c) value guidelines for the development of clinical thinking, critical and objective assessment of one's own professional activity and the activity of colleagues;

d) value guidelines that form the information and educational space of the higher education institution aimed at self-development and self-determination of students and professors. Clearly, digitization of medical education can help and hinder the development and establishment of value guidelines. "The second ethical problem of the digital transformation of the higher education institution is related to the determination of the normative basis of conscientious professor-teaching in the conditions of network and remote work." It cannot be denied that there are various rules that regulate the ethics of communication in all people of the educational process in a medical institution. However, the implementation of distance education and the implementation of online interaction in blended learning for medical students requires a rethinking of the ethical standards of interaction. The third problem is related to the changing role of the medical school teacher - he becomes not a source of knowledge, but a navigator who introduces the database, develops practical tasks, offers the optimal trajectory for the goals of this course.

The second group of problems of digitization of medical education is related to the implementation and development of IT infrastructures and hardware and software systems. This group includes the following issues:

1) revision of traditional business processes in all spheres of activity of educational organizations (education, research, spirituality and enlightenment, economic affairs and economic) and Big Data and artificial introduction of equation systems based on intelligence technologies;

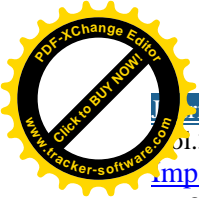
2) providing students with digital educational resources based on online educational technologies, distance education, virtual and augmented reality, as well as digital (digitized) information-library resources and others;

3) creation of a digital campus or "smart campus" as a system that ensures the creation of safe and comfortable living conditions in student residences by automating dormitory access control, electronic dormitory registration, temperature control, heat saving. Placement of temperature sensors to monitor leakage, etc.

4) creation of a "Digital (virtual) university" as a system for applicants, students (students, residents, doctors - students of professional development and retraining courses) and professors and teachers with the possibility of presenting documents; obtaining certificates, attending lectures, informing about the events of higher education institutions, etc.;

5) to create digital files of teachers as researchers, to create a scientific project management system, to visualize the results of scientific activities, to introduce





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software products that allow creating statistics of scientific research, infographics, as well as to analyze data to predict the development of fundamental research. However, at present, the conservatism and technical unpreparedness of most regional medical higher education institutions do not allow them to fully step into the world of digital technologies.

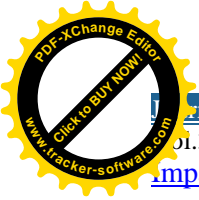
### Conclusion

We did not form the conclusion by chance, for example, the comparative "Age" of information and educational portals of higher educational institutions showed that technical universities are 10-11 years old, and classical universities are 8-9 years old, which is a significant "young" medical higher educational institutions educational portals and information-educational environments available for technical higher education institutions are low-tech, less functional, mostly non-interactive, their content is static, and teaching-methodical materials are has its own characteristics. It is the same as the one used in full-time education. In addition, the existing IT infrastructures are not sufficiently developed, higher education institutions have patched software products that allow automation of management processes. The third group of problems of digitalization of higher medical educational institutions can be called educational or educational-methodical, that is:

1) changing (updating) the goals of medical education in education - focusing on training personnel for future medicine; knows how to solve professional problems using digital technologies that can be a "conductor" for patients in the world of digital services and applications in the field of medical services;

2) changing (updating) forms of educational activity - "depressurization" of education, expanding it beyond the auditoriums and laboratories of higher education institutions, as well as libraries;

3) changing (updating) the content of medical education - forming final digital competencies in the implementation of educational programs. It is impossible not to agree with the authors of a number of works that these problems require regulatory solutions at the state level. Nevertheless, are medical institutions of higher education ready for digitization, are the digital literacy level and digital competences of professors and teachers sufficient? To answer these questions, comprehensive research is needed to assess digital literacy and digital competencies. In this regard, there is a need to find effective assessment methods (tools). To assess digital literacy, the tools developed by the multidisciplinary analytical center can be used based on "International approaches to assessing the level of digital literacy and digital competences of professors-teachers". "The approach is based on the assessment of indicators of information, computer, communication literacy, media literacy and attitudes towards technology. Each of the listed indicators is evaluated in three dimensions: cognitive (knowledge), technical (skills) and ethical (attitude), as a result of which the digital literacy index can be calculated on a scale from 0 to 100. We will focus on the remaining information in our next work.



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