

SECTION 2. EDUCATION

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2.1 Use of cloud technologies in teaching internal medicine in medical universities

The rapid development of technology has recently changed the practice of teaching and learning in all fields, including medical education. Cloud technologies are gradually becoming an integral part of this process, contributing to the development of the study of internal medicine in medical universities. In this paper, we will investigate how exactly cloud technologies affect the teaching and learning of internal medicine and how they facilitate the process of acquiring knowledge by students and teachers [45].

Cloud technologies involve remote data processing and storage. This technology provides users of the Internet, access to computer resources of the server and the use of software as an online service. That is, if there is an Internet connection, you can perform complex calculations, process data using the capabilities of a remote server.

Cloud services that allow you to transfer computing resources and data to remote Internet servers have become one of the main trends in the development of IT technologies in recent years [49].

One of the main aspects of using cloud technologies is the ability to share information. Thanks to cloud services, students and teachers can easily exchange materials, documents and educational resources. For example, students can upload unified lecture notes, videos, presentations, and other supplemental materials directly to cloud storage, where they are available for viewing and downloading from any location and device with an Internet connection.

In addition, cloud technologies provide the possibility of using specialized medical programs and tools that allow to conduct diagnostics, analyze patient data and develop treatment plans. Teachers can demonstrate these programs and tools to students directly in lectures or offer their use as part of self-study. This allows students

to generalize the acquired theoretical knowledge and implement it in practical work, obtaining the necessary skills for future medical practice [47].

In addition to educational materials, cloud technologies also facilitate the preservation and organization of student projects and research. They enable students to work as a team on joint projects, communicate, share files and complete assignments online. This facilitates cooperation and contributes to more efficient implementation of projects related to internal medicine.

In addition to the above advantages, the use of cloud technologies also allows students and teachers to implement elements of distance learning. Recordings of lectures, webinars and e-tests can be made available to students at any time and place convenient for them. This approach allows students to independently control the time and pace of learning, providing a more flexible schedule and parallel work with other subjects.

Continuing, the use of cloud technologies in the teaching of internal medicine in medical universities allows students to have wide access to educational materials, facilitates the implementation of specialized programs and tools, facilitates the organization of projects and research, and also provides the opportunity to implement distance learning. These advantages make cloud technologies an invaluable tool in the practice of teaching and learning internal medicine [46].

The development of cloud technologies leads to the expansion of opportunities for collaboration between doctors and teachers in the field of internal medicine. Group projects, joint research and data sharing are becoming more accessible thanks to cloud services. Teachers can create virtual groups to communicate with students or colleagues from other universities, exchange ideas and provide assistance in understanding complex medical issues.

Cloud services also allow doctors and students to store and share clinical data and patient images. This allows doctors and consultants to quickly access X-ray, CT or MRI images. Teachers can use this data to prepare teaching materials, conduct exercises and case studies.

Cloud technologies also facilitate the development of online courses and learning platforms, giving students the opportunity to learn at their own pace and manage their own learning. Teachers can create interactive modules, video lessons, and quizzes that make it easier for students to adapt to new concepts and help teach important practical skills [50].

The use of cloud technologies also facilitates the creation of mobile applications and platforms that allow students to access educational material from their mobile devices. This makes learning more flexible and convenient, as students can study at any time and place convenient for them.

The increasing use of cloud technologies in the teaching of internal medicine in medical universities today serves as an advantage for students and teachers. This increases access to learning materials, improves communication, facilitates learning in a practical context, and creates conditions for independent study and research. The growing interest and use of these technologies in medical universities opens up new opportunities for improving the quality of education and training of future doctors in the field of internal medicine [50].

Historical reference.

The concept of cloud computing appeared back in 1960, when the American scientist, specialist in computer theory John McCarthy suggested that someday computer computing will be provided like a public utility. The spread of high-capacity networks, the low cost of computers and data storage devices, as well as the widespread adoption of virtualization and service-oriented architecture have led to a huge growth in cloud computing. End users may not worry about the operation of the equipment of the technological infrastructure "in the cloud" that supports them. An analogy of computing "clouds" from everyday life can be power plants. Although a homeowner can buy an electric generator and take care of its operation on their own, most people prefer to receive energy from centralized suppliers [52] .

Almost all the current characteristics of cloud computing, its comparison with electricity and the use of private, public and public models were presented by Douglas

Parkhill in the book "The Challenge of the Computer Utility" in 1966. According to other sources, cloud computing dates back to the 1950s, when scientist Herb Grosch argued that the entire world would run on terminals controlled by about 15 large data centers.

The term "cloud" itself comes from telephony because telecommunications companies, which until the 1990s mainly offered dedicated point-to-point transmission schemes, began to offer virtual private networks (VPNs), with comparable quality of service, but at much lower costs.

By switching traffic for optimal use of channels, they were able to use the network more efficiently. The cloud symbol was used to represent the delineation between user and provider.

Amazon played a key role in the development of cloud computing by modernizing its data centers, which, like most computer networks, use only 10% of their capacity at a time to ensure reliability during load spikes. After learning that the new cloud architecture provided significant internal efficiency gains, Amazon began new research in product development to provide cloud computing for external customers, and launched Amazon Web Service (AWS) based on distributed computing in 2006 [51].

In early 2008, Eucalyptus became the first API-compatible open source platform for private cloud deployment. In early 2008, OpenNebula became the first open source project to deploy private and hybrid clouds.

Types of cloud storage.

A private cloud is a cloud infrastructure that is intended for use exclusively by one organization, which includes several users (for example, divisions). A private cloud can be owned, managed and operated by the organization itself or by a third party (or some combination thereof). Such a cloud can be physically located both in and outside the owner's jurisdiction.

A public cloud is a cloud infrastructure that is intended for free use by the general public. A public cloud can be owned, operated and operated by commercial, academic

(educational and research) or government organizations (or any combination thereof). The public cloud is under the jurisdiction of the cloud service provider.

A hybrid cloud is a cloud infrastructure consisting of two or more different cloud infrastructures (private, public or public), which remain unique entities, but are interconnected by standardized or private technologies that enable data portability and application programs (for example, using public cloud resources for load balancing between clouds) [45].

Advantages of using cloud storage.

- Powerful computers are not required;
- less costs for the purchase of software and its systematic updating;
- unlimited amount of data storage;
- accessibility from different devices and no attachment to the workplace;
- ensuring data protection against loss and implementation of many types of educational activities, control and evaluation, online testing, openness of the educational environment;
- saving money on maintenance of technical specialists.

In the modern practice of internal medicine, much attention is paid to contact with the patient and the extrapolation of theoretical knowledge to real clinical practice. Given the restrictions caused by the COVID-19 pandemic, student access to the clinic is not just severely limited, but completely non-existent. This situation prompts the search for the most rational methods of teaching students using the maximum amount of visualization.

In order to bring the student closer to real clinical practice, clinical scenarios are used, which must be supplemented with additional material. In our case, these are ECG diagnostic data, X-ray data, results of spiral computer tomography, spirometry, pneumotachometry, magnetic resonance imaging, coronary angioventriculography, ultrasound, results of laboratory examination methods and many others. Such a large amount of diagnostic data should be placed in a service that is able to ensure not only the preservation of educational materials, but also to be easy to use and possess the properties of free use by the general public. Given that the listed diagnostic methods

are stored in the form of documents with various extensions (.pptx, .doc, .txt, .jpg, .pdf, .mpg, .avi, etc.), the company's Google Drive cloud service meets the listed requirements Microsoft [48].

Necessary components for working in cloud storage:

- Internet;
- computer (tablet, mobile phone, netbook);
- browser;
- a company that provides cloud technology services;
- skills in working with the Internet and web applications.

The institution or teacher creates an account on the www.gmail.com platform, which has Google Drive as an additional service. In the future, educational materials will be uploaded, including diagnostic and treatment methods for clinical scenarios with the further possibility of open access to the group of students who are currently studying in the cycle [52].

Google Drive is a powerful tool that can be used for teaching medical students. An example of using Google Drive for this group of students is as follows:

Collaborate on projects: Google Drive allows students to work together on group projects. They can create a shared folder that holds all of their materials, including Google Docs, Google Slides, and Google Sheets. It is convenient for joint writing of essays, presentations or conducting research.

Data organization and storage: Google Drive can be used to store student data such as homework and work files. They can upload their work to their own folders, conveniently organize them and track their progress. It also allows teachers to track and grade homework in a way that is convenient for them.

Save different file formats: Google Drive supports a wide range of file formats, which means students can upload and save different types of documents, such as PDFs, images or videos. This allows learning materials to be available in a variety of formats.

Create forms for testing: Google Drive has a built-in form creation feature that allows teachers to create tests or surveys for students. They can create different types

of questions (multiple answers, open questions) and easily collect answers. This can be useful for conducting knowledge tests or evaluating student performance.

Google Drive provides an efficient and easy-to-use system for saving, collaborating and accessing materials for medical students. This helps ensure convenient and effective learning.

The next steps in the development of the use of cloud technologies in the teaching of internal medicine may be:

1. Expanding access to specialized medical databases: cloud technologies can allow students and faculty to access a large number of clinical studies, medical journals, and databases. This will help students update their knowledge and deepen their understanding of internal medicine.

2. Implementation of virtual implementations: the use of virtual reality and augmented reality can contribute to the improvement of learning and the development of practical skills. With the help of special devices and applications, students can get a feel for working with patients and conduct virtual diagnostics and treatment.

3. Application of artificial intelligence: the use of cloud technologies together with artificial intelligence can improve the processes of diagnosing and predicting diseases. Using machine learning algorithms, systems can be created to help recognize symptoms and choose the best treatment for a particular patient.

4. Development of cooperation with specialists from other countries: cloud technologies enable teachers and students to communicate and cooperate with medical specialists from all over the world. This enhances the sharing of knowledge, research and best practices in the field of internal medicine.

5. Ensuring cyber security: given the importance of medical data, great attention should be paid to ensuring cyber security and protecting patient privacy. The development of cloud technologies must go hand in hand with the use of reliable methods of encryption and data protection.

In the future, the widespread use of cloud technologies in the teaching of internal medicine can lead to an improvement in the quality of education, an increase in the availability of up-to-date data, the development of cooperation and the creation of

innovative methods of diagnosis and treatment. This guarantees higher training of students and facilitates the transition to practical applications in the field of internal medicine, which in turn will contribute to the improvement of medical care and public health.

6. Development of interactive simulations: the use of cloud technologies enables the creation of interactive simulations that help students gain practical skills without direct contact with patients. This may include patient care exercises, procedures, or even surgery.

7. Use of video streams and webinars: cloud technology enables video streams and webinars where instructors can deliver lectures and demonstrate important procedures in real time. This allows for greater interaction, the opportunity to ask questions and discuss the material, even on a remote basis.

8. Improved data analysis: cloud technologies enable the processing of large volumes of data and the application of analytics that help understand trends, identify deviations and improve learning strategies. Teachers and students can use this information to optimize the learning process and develop personalized learning plans.

9. Development of mobile applications for learning: cloud technology can be used to develop mobile applications that help students learn the material at any time and place convenient for them. This may include knowledge testing, video lessons, interactive exercises, and more.

10. Implementation of e-learning systems: cloud technologies allow building e-learning systems where students can access learning materials, tasks, tests and other resources. It helps organize the learning process, track student progress, and promotes more effective communication between students and teachers.

The development of cloud-based technologies for teaching internal medicine continues to expand opportunities for students and teachers. These new capabilities simplify learning, provide access to relevant information resources and facilitate interaction between colleagues. The increasing use of cloud technologies in internal medicine has the potential to change the approach to education and to make a significant impact on the quality of training of future doctors.