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# TEACHING OF THE SUBJECT «HUMAN ANATOMY» - A REVOLUTION IN MEDICAL EDUCATION IN MEDICAL SCHOOLS

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**Annotation.** Human anatomy is traditionally considered the cornerstone of medical education: knowledge of the topography of organs, systems and their interrelationships is the basic competence of every doctor. Over the past decades, the ways of teaching anatomy have undergone significant changes: from classical anatomical dissections, mockups and atlases to digital models, virtual and augmented reality (VR/AR), «virtual tables» and tools using artificial intelligence (AI) capabilities.

The purpose of this article is to analyze whether modern developments and strategies in teaching the subject of anatomy are really capable of revolutionizing medical education, assess the advantages and risks of their implementation, and identify the difficulties for students and teachers.

**Key words:** human anatomy; medical education; teaching anatomy; digital educational technologies; virtual reality (VR); augmented reality (AR); artificial intelligence; virtual anatomical tables; innovative teaching methods; medical pedagogy.

**Relevance.** From the point of view of modern approaches to training medical specialists, the transition to hybrid and digital methods was due to several factors: in particular, when conducting the subject of anatomy, there was a shortage of cadaveric material, an increasing increase in requirements for clinical relevance of training, the availability of powerful computing and visualization technologies, as well as the emergence of adaptive training systems and tools with artificial intelligence (AI). As a result of the COVID-epidemic, digitalization of learning products have been introduced and accelerated, revealing both opportunities and gaps - from problems with access to hands-on classes to the growing demand for interactive and personalized resources.

Current state of affairs in the study of anatomy in medical universities. Classical training and teaching of the subject of anatomy includes lectures, practical classes with layouts and sections.

In many Russian medical universities, this structure remains the basis of the discipline, reflected in work programs and curricula. In recent years, virtual digital technologies with AI support for adaptive learning have been actively implemented. These technologies can improve the accessibility, visibility, and clinical relevance of teaching anatomy. Educational standards indicate that anatomy courses are mandatory in the structure of medical training. At the same time, a number of universities actively began to integrate digital components - virtual laboratories, training simulators, and case platforms.

According to the curricula for medical training areas, they are based on the current federal training standards, which determine the total volume of pre-clinical training disciplines. Global Standards (WFME) recommend integrating the clinical context into training, which encourages digital adoption.

Advantages of integrating modern electronic technologies and AI

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1. Increase the availability and scalability of training.
2. Improve visualization and spatial thinking.
3. Interactivity and clinical relevance.
4. Individualization of training.
5. Ethical and organizational advantages.

Disadvantages and risks:

1. High cost of implementation and operation.
2. Risk of superficial learning without tactile experience.
3. Uneven content quality.
4. Problems with the verification and evaluation of AI tools.
5. Ethical and legal issues.

Difficulties in studying anatomy on the part of students.

Students face the volume of material, cognitive overload, gaps in spatial perception, uneven access to modern resources, as well as problems of motivation and self-organization.

Difficulties in teaching anatomy on the part of teachers: retraining is needed to work with VR/AR and AI, the role of the teacher is changing (from lecturer to facilitator), new challenges arise in assessment, logistics and technical support.

In order to overcome the existing difficulties with the widespread introduction of digitalization and AI by teachers, the following should be recommended for teachers:

1. Implement a hybrid learning model, combining traditional autopsy and digital tools;
2. Conduct pilot projects and investigate the effectiveness of implemented technologies;
3. Invest in retraining teachers and improving their digital literacy;
4. Create and verify local digital modules in accordance with existing and approved State standards;
5. Develop ethical regulations and local regulations on the use of AI;
6. Actively involve students in the development and testing of digital tools;
7. Use mixed formats of knowledge control.

In recent years, the Republic of Uzbekistan has also actively pursued a consistent State policy to reorganize the system of training medical personnel and modernize medical education. The key document that set the vector of transformation was Decree of the President of the Republic of Uzbekistan No. PP-4666 dated April 7, 2020 "On measures to introduce a completely new system of training and continuous professional development of personnel in the medical and sanitary sphere", which defined a set of measures to review the structure of professional education in healthcare, introduce new educational mechanisms and strengthen practical training of specialists.

Within the framework of this decree, several concrete steps were taken, which are reflected in subsequent orders and program documents:

* transformation of the network of secondary medical institutions (medical colleges) - starting from the 2020/2021 academic year. Thus, the transformation of 47 medical colleges into Public Health Technical Schools named after Abu Ali Ibn Sina is planned and started, which is aimed at creating a step-by-step system of training secondary medical personnel with a more pronounced practical orientation. At the same time, the task was set to reduce "irrelevant" disciplines and strengthen the clinical and practice-oriented part of the curriculum;

* revision of the curricula of higher medical institutions: a number of orders and draft regulations (including as part of the reform package prepared in 2021-2022) indicate the intention to tighten the requirements for practical skills, clarify the structure of classroom and extracurricular workload, and increase transparency in the admission and distribution of students to clinical units, as reflected in the directives relevant ministries.

At the level of individual universities, pilot projects are being implemented to bring the learning environment closer to international standards. Thus, Tashkent Medical Academy is involved in updating educational programs and introducing new forms of practical training for

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students: clinical and educational centers are being developed, the material and technical base is being updated, and teacher training programs are being implemented. At the same time, pilots are being developed to adapt international standards (including elements of the WFME) in separate training areas.

A number of initiatives had a pronounced "social and organizational" character: reducing the share of general education/irrelevant subjects in the curriculum, strengthening modular and practice-oriented blocks, as well as creating mechanics for targeted training of personnel for the regions (contracts and distribution of graduates).

Despite the adoption of global measures, today a number of problems of practical significance remain:

1. Material and technical base and resources for practice. Despite investment projects and assignments, many departments of fundamental disciplines (including anatomy) lack natural cadaveric material, modern educational collections, and laboratory infrastructure. This limits the possibility of full-fledged practical training of students in those areas where real anatomical experience is needed.
2. Personnel issue. As in a number of other countries in the region, there is a need in Uzbekistan to update the teaching staff, to retrain and motivate young teachers. The existence of instructions to increase the transparency of recruitment and promotion of young people in higher and secondary vocational education indicates a systematic attention to this problem, but its solution requires time and sustainable funding.
3. Regulatory and organizational implementation. State resolutions and decrees provide the legal basis and vectors for reforms, but their practical implementation depends on coordination between the Ministry of Health, the Ministry of Higher and Secondary Special Education, and local executive authorities. In some cases, this leads to a "gap" between the reform declarations and the resource capacity of specific institutions.

**Specific measures taken and documents defining the implementation of the tasks set:**

✓ Decree of the President of the Republic of Uzbekistan No. PP-4666 dated 07.04.2020 "On measures to introduce a completely new system of training and continuous professional development of personnel in the medical and sanitary sphere". The document outlines the main directions of transformation of the medical staff training system with the introduction of key organizational measures to reorganize middle-level educational institutions and update curricula.

✓ A number of publications and explanatory materials covering practical steps to transform 47 medical colleges into technical schools named after Abu Ali Ibn Sina (implementation from 2020/2021 academic year). This transformation is declared in the text of the presidential decree and announced in the national media.

✓ Regulatory initiatives in 2021-2022 regulating the transparency of student admission, distribution, and certification, as well as measures to improve funding and organizational management.

Uzbekistan is currently demonstrating a pragmatic approach to reforming medical education: a regulatory framework has been formed, major structural changes have been initiated, and pilot projects are being implemented in leading universities. At the same time, the implementation of these goals requires sustainable financing, strengthening the material and technical base (including providing educational anatomical material and modern methods of its conservation), systematic support for the revival and retraining of teaching staff, and closer coordination between central and regional educational and health authorities.

Only with an integrated approach to resources, management, training content and modern technologies that are being introduced everywhere in our education system will anatomy, as a fundamental discipline, be able to maintain its central place in the training of competitive doctors who meet international standards.

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