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OPTIMIZATION OF THE METHODOLOGY OF TEACHING BIOPHYSICS IN MEDICAL EDUCATION: COMPETENCE APPROACH AS METHODOLOGICAL BASIS

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Abstract
Modern medical education faces the challenges of digitalization, globalization and rapid technological changes, which requires rethinking the content and methods of teaching fundamental disciplines. One such discipline is biophysics, which provides an interdisciplinary link between physics, biology and clinical practice. The article considers the role of competence approach as a conceptual basis for modernization of teaching of biophysics in medical schools, analyzes international educational models and national reforms in Uzbekistan. Methodological guidelines for the implementation of innovative learning technologies capable of ensuring the formation of professional competences of students are determined. Emphasizes the need to develop adapted pedagogical solutions that integrate active forms of learning and digital tools, on the basis of which the ground is created for the application of modern technologies to optimize the educational process.

Keywords: Medical education, biophysics, competence approach, pedagogical methodology, digitalization, educational reforms.

Introduction:

Global medical education has undergone significant changes in the past two decades, driven by global digitalization trends, accelerated scientific and technological progress and changing socio-professional requirements [1], [2]. Traditional knowledge-based learning models are no longer able to fully provide the training of professionals capable of acting in conditions of clinical uncertainty, quickly adapt to new technologies and interact effectively in inter-professional teams.

In these circumstances, the competence approach becomes the leading methodological paradigm in the medical education system [3], [4]. He focuses not only on the acquisition of knowledge, but also on the formation of the ability to apply it in real professional practice. This is particularly relevant for fundamental disciplines such as biophysics, which lay the foundations of clinical thinking and work with medical technologies [5].

International context of competence approach: International educational frameworks - Tuning, OECD Key Competencies, CanMEDS, ACGME Core Competences, WHO Global Competency Framework - demonstrate a systemic transition from knowledge transfer to the development of sustainable professional competencies in students [2], [3], [6]. In Europe, the Tuning model structured learning plans by outcomes; in Canada, the CanMEDS system identified seven key physician roles, each of which is described through competencies; in the US, the ACGME model consolidated a step-by-step competency development with a formalized evaluation system; The WHO framework has provided universal guidance for countries with different levels of resources.

Common to these approaches is the focus on practice-oriented learning, system feedback, use of digital technologies and flexible forms of assessment [6], [7]. Competencies are seen as the integration of knowledge, skills, attitudes and values rather than a set of formal exam results. These principles are being successfully implemented in clinical disciplines and gradually extended to fundamental courses.

National educational reforms and the role of biophysics: The reform of the higher education system in Uzbekistan since 2017 (PP-2909, PP-2956, PKM-3151, PKM-769) has set the task of training new generation of personnel possessing not only knowledge but also modern professional and digital competences [8]. In medical education, special attention is paid to the integration of basic sciences with clinical practice, the introduction of active teaching methods and digital platforms.

Biophysics occupies a special place in this system. It provides an understanding of the physical mechanisms of biological processes underlying diagnosis and therapy: from bioelectrical phenomena and tissue mechanics to optical and ultrasound imaging [5],[9],[11]. Mastering these principles at the competency level is critical for future doctors, especially given the widespread use of high-tech diagnostic and therapeutic tools.

Problems of traditional methods of teaching biophysics: Despite the strategic objectives of the reforms, the teaching of biophysics in medical schools remains largely knowledge-oriented. Typical problems include:

- Fragmented use of active learning methods and simulation technologies;
- Limited relationship between theoretical material and clinical objectives;
- Insufficient development of competence assessment tools;
- Lack of pedagogical strategies adapted to the digital educational environment [9], [10].

As a result, students form isolated knowledge, weakly related to practice, and key competences (analytical, communicative, clinical) develop unevenly. This reduces the effectiveness of training and hinders the integration of biophysics into the professional thinking of future doctors.

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Methodological guidelines for innovation: To overcome these problems, there is a need for systematic, pedagogically sound solutions that integrate the competence approach, digital technologies and active forms of education. Such decisions should be based on the following principles [4], [6], [11-28]:

- Focus on competency outcomes related to clinical tasks;
- Integration of digital and simulation tools into the course structure;
- Organizational realism;
- Reflective and evaluative components;
- scalability and adaptability.

It is on this basis that modern pedagogical technologies are developed, aimed at optimizing the teaching of biophysics. One of these technologies is the new author model, which focuses on students' scientific-debate activity and content personalization through digital tools. Detailed description and results of its implementation will be presented in a separate publication.

Conclusion:

The transition to competence-oriented learning in medical education is a strategic direction for both international and national educational space [1]-[4],[12]. Fundamental disciplines, in particular biophysics, play a key role in the formation of clinical thinking and analytical skills, but require methodological modernization. The competence approach sets clear guidelines for such modernization: practical orientation, integration of digital means, formative evaluation, development of communication and reflection. On this methodological basis, it is possible to create innovative pedagogical solutions capable of ensuring the sustainable development of professional competences of students.

The development and implementation of one such technology - a pedagogical model focused on personalized scientific-debating activity of students - will make it possible to fill methodological gaps and increase the applied importance of the course in biophysics. This opens up prospects for further research, empirical evaluation of effectiveness and scaling up experience in medical schools.

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