SOME ASPECTS OF DEVELOPING STUDENTS' PRACTICAL COMPETENCIES IN HUMAN ANATOMY AND PHYSIOLOGY THROUGH INTERACTIVE TEACHING METHODS

Kaljanov Damir Maxsetbayevich *
Trainee Lecturer at the Department of "General Biology and Physiology,"
Karakalpak State University.*

ANNOTATION: This article is devoted to the issues of developing students' practical competencies in the study of human anatomy and physiology through interactive teaching methods. The study analyzes the pedagogical potential and effectiveness of methods such as peer teaching, case studies, problem-based learning, and interactive visualization in the educational process. It also highlights the role of interactive methods in enhancing students' independent work, critical thinking, and integration of theory and practice. The results presented in the article provide recommendations for organizing lessons in an interactive format and applying modern pedagogical technologies in higher education institutions.

KEY WORDS: Interactive methods, human anatomy, physiology, practical competencies, peer teaching, case study, problem-based learning, concept maps, interactive visualization.

INTRODUCTION

Today, one of the key pedagogical tasks in higher education is to ensure the competitiveness of specialists by effectively linking their theoretical knowledge with practical activities. Human anatomy and physiology, in particular, hold significant importance as fundamental subjects for students studying medicine, biology, and pedagogical fields. These subjects serve to provide a deep understanding of the structure and functional activity of the human body, forming the scientific foundation necessary for future professional practice.

Main Body. In higher education institutions, the process of mastering anatomical and physiological knowledge requires not only theoretical preparation but also the development of students' practical competencies. Practical competencies reflect students' ability to apply acquired knowledge in real-life situations, analyze physiological processes, draw conclusions, and independently solve problem-based tasks. Therefore, the formation of these competencies remains a pressing challenge in higher education. Traditional teaching methods often rely on passive student participation, which limits the development of independent thinking and practical skills. From this perspective, there is a need to introduce interactive teaching methods into the educational process. Interactive methods enhance students' engagement during lessons, strengthen communication and collaboration, and allow for the integration of theoretical knowledge with practical exercises. As a result, students gain a deeper understanding of the material and acquire the competencies necessary to effectively apply their knowledge in practical activities.

The aim of the study is to scientifically and pedagogically analyze and substantiate certain aspects of developing students' practical competencies in the teaching of human anatomy and physiology through interactive teaching methods.

To achieve this aim, the following tasks were set:

- to define the concept of practical competencies in human anatomy and physiology and determine their pedagogical significance;
- to analyze the theoretical foundations and didactic potential of interactive teaching methods;
- to describe certain types of interactive methods used in teaching anatomical and physiological topics;
- to identify the possibilities for developing students' practical skills and abilities through interactive methods;

– to develop methodological conclusions and recommendations for the use of these methods in higher education institutions.

In the modern education system, a competency-based approach implies evaluating learning outcomes not merely as a collection of knowledge but as the ability to apply this knowledge in practical activities. The concept of practical competence refers to an individual's ability to perform specific tasks based on theoretical knowledge, to solve problems quickly and correctly, and to make independent decisions in professional activities [1]. This competence is formed through the integration of knowledge, skills, abilities, and personal qualities.

In the context of human anatomy and physiology, practical competencies are manifested in students' ability to connect their knowledge of the structure and functional processes of the body with real biological and clinical situations. According to researchers, practical competence consists of several key components: scientific (theoretical knowledge), operational (practical actions), analytical (thinking and drawing conclusions), and communicative components [2]. The harmonious development of these components is crucial for preparing students for their future professional activities.

Figure 1. Key components of practical competence in the context of human anatomy and physiology

Anatomical and physiological knowledge provides the scientific foundation necessary for understanding the structure of the human body and the functional interrelationships of organs and systems. In the process of studying these subjects, students not only acquire factual knowledge but also develop skills in analyzing bodily processes, identifying cause-and-effect relationships, and evaluating functional changes [3].

During practical sessions, students consolidate their knowledge through the use of anatomical specimens and models, as well as by analyzing physiological experiments. This enhances their ability to connect theoretical knowledge with practical activities. Understanding the mechanisms of physiological processes, such as assessing the function of the cardiovascular or respiratory systems, is crucial for preparing students for future scientific or professional activities [4].

In teaching human anatomy and physiology, it is essential to develop a range of important practical skills and competencies in students. These include identifying and describing anatomical structures, observing and analyzing physiological processes, and evaluating experimental results, all of which strengthen professional preparedness [5]. Additionally, students should develop skills in solving problem-based situations, working with scientific data, drawing conclusions, and providing evidence-based reasoning. Interactive teaching methods serve as an effective tool for developing these skills, encouraging students to actively participate in lessons, think independently, and work collaboratively[6]. As a result, practical competencies formed on the basis of anatomical and physiological knowledge contribute to improving both the quality of education and students' professional readiness.

Interactive teaching methods are a fundamental component of modern education, aimed at knowledge formation through active collaboration between students and teachers. These methods motivate students to participate actively, shaping them not as passive recipients but as subjects who seek knowledge, analyze information, and apply it in practice. Interactive methods not only facilitate the assimilation of theoretical knowledge but also contribute to the development of independent thinking, creativity, and problem-solving

skills.

In the teaching of human anatomy and physiology, interactive methods allow students to understand complex biological processes and apply them in practice. Among these methods are problem-based learning, case studies, concept mapping, as well as simulation training, peer teaching, and interactive visualization-some of which are still not widely used in our country:

- *problem-based learning (PBL):* students study a topic in the context of a specific problem or situation. This approach develops critical thinking, problem analysis, and independent conclusion-drawing skills;
- *case studies:* by analyzing real or theoretical professional situations, students gain an in-depth understanding of the topic in context and connect theoretical knowledge with practice;
- *concept maps:* help organize knowledge visually, making it easier to understand complex physiological processes and the interrelationships of organ systems;
- *simulation training:* provides opportunities for safe and practical experience by simulating biological processes in laboratory settings or virtual environments.
- *peer teaching:* students explain topics to each other, which reinforces their own knowledge and develops communication skills;
- *interactive visualization methods:* using 3D modeling, animation, and interactive software to study complex anatomical and physiological processes visually.

Interactive methods enhance the effectiveness of the educational process, transform students into active participants, and foster their creative thinking. Through these methods, students learn to apply their knowledge in real situations, analyze complex scenarios, and draw independent conclusions.

Although certain types of interactive methods, such as simulation training or peer teaching, are not yet widely implemented in higher education in our country, they create new pedagogical opportunities for students: making lessons more interactive, engaging, and practice-oriented.

In traditional teaching methods, knowledge is presented in a ready-made form, and the student participates as a passive listener (Table 1).

Table 1

Comparison of Traditional and Interactive Teaching Methods

Experimental Aspect	Traditional Methods	Interactive Methods
Teacher's Role	Primary source of knowledge, leads the lesson, explains passively	Guide, facilitator, turns students into active participants
Student's Role	Passive listener, receiver of knowledge	Active participant, seeker of knowledge, applies learning in practice
Knowledge Acquisition	Memorization and reception of theoretical information	Analysis of theoretical knowledge, connection with practical exercises
Learning Process	Lessons mostly based on listening and note-taking	Conducted through problem-based situations, discussions, experiments, and simulations
Analysis and Critical Thinking	Limited; students rely on teacher's conclusions	Students independently analyze, provide opinions, and draw conclusions
Teamwork	Rarely used; usually individual work	Mandatory; students collaborate with each other
Motivation	Low; based on passive learning	High; based on active participation and creative approach
Knowledge Retention	Learned material is quickly forgotten; practical skills are	Knowledge is long-term; practical skills are well developed

	underdeveloped	

In traditional methods, students only receive information explained by the teacher, and their opportunities to apply this knowledge independently in practical sessions are limited. In interactive methods, however, the student is placed at the center of the learning process, actively participating in searching for knowledge, analyzing it, and connecting it with practical exercises. This approach allows for a deeper understanding of anatomical and physiological knowledge, comprehension of complex processes, and the development of professional skills. At the same time, interactive methods also guide students in developing teamwork, critical thinking, and creative problem-solving skills (Table 1).

In teaching human anatomy and physiology, interactive methods enable students to integrate theoretical knowledge with practical competencies, understand complex processes, and develop independent thinking skills. These methods engage students as active participants rather than passive recipients and encourage collaborative work and creative approaches in the learning process.

In the *peer-teaching method*, students explain the topic to each other, creating a collaborative learning process while reinforcing their own knowledge. This approach helps students deepen their understanding, improve communication skills, and increase their responsibility in the learning process. In human anatomy and physiology, peer teaching can be applied to complex topics such as the mechanism of muscle contraction, spinal reflexes, or the cardiac cycle. In this way, students are able to connect theoretical knowledge with practical exercises and reinforce it through mutual discussion.

The *case-study method* involves students analyzing real or hypothetical professional situations and attempting to solve associated problems. In human physiology, this method can be used, for example, to analyze a patient's clinical condition, relate the course of a disease to organ systems, or study conditions related to blood and cardiac function. Case studies help students integrate theoretical knowledge with practice, draw independent conclusions, and develop skills in collaborative discussion. Through this process, students learn to analyze complex professional situations and practice critical thinking.

Concept maps allow students to organize complex information visually. This method helps students understand the interconnections between organ systems and physiological processes, see cause-and-effect relationships, and better comprehend complex physiological mechanisms. In anatomy and physiology, concept maps are effective for systematically presenting the nervous system, digestive system, sensory systems, and metabolic processes. When students visualize the topic as a map, they not only memorize knowledge but also develop skills in analysis and systematization.

In *problem-based learning (PBL)*, students study a topic within the context of a specific problem or situation. This approach allows for critical analysis of anatomical and physiological processes, solving complex problems, and integrating theoretical knowledge with practical exercises. For example, analyzing the effects of physical exercise on the cardiovascular system, studying conditioned reflexes, or identifying pathologies of the reproductive system can be accomplished through PBL. This method develops independent thinking, analytical skills, and decision-making abilities.

Using *modern technologies*, anatomical and physiological processes can be studied visually through 3D modeling, animation, and interactive software. This approach enables students to observe the three-dimensional structure of organs, analyze relationships between processes, and safely conduct experiments. For example, visualizing the topography of internal organs, neuromuscular preparations, or endocrine and digestive system processes allows students to understand complex topics more quickly and accurately. Thus, interactive visualization methods not only reinforce theoretical knowledge but also contribute to the development of practical competencies.

Interactive teaching methods serve to engage students in the learning process and develop their practical competencies. In the context of human anatomy and physiology, these approaches are expressed in several key aspects:

1.Enhancing student engagement in the learning process. Interactive methods prevent students from remaining passive listeners. Methods such as peer teaching, case studies, and problem-based learning (PBL)

encourage active participation in the learning process. Students independently search for, analyze, and discuss topics, which allows for deeper comprehension of knowledge. This is particularly effective when studying complex anatomical structures or physiological processes.

2. Developing independent work skills in practical sessions. Interactive methods guide students to work independently during practical activities. For example, in laboratory exercises, reflex studies, or analysis of organ systems, students test their knowledge, evaluate experimental results, and draw conclusions. This approach helps develop experimental skills, problem identification, and problem-solving abilities.

3. Analyzing physiological processes and drawing conclusions. Through interactive methods, students learn to analyze complex physiological processes and determine cause-and-effect relationships. For example, when studying the cardiovascular, respiratory, or endocrine systems, students observe, compare, and draw evidence-based conclusions. These skills are essential for future scientific research or professional practice.

4. Integration of theory and practice.

Interactive methods allow students to connect theoretical knowledge with practical exercises. While learning a topic, students not only memorize information but also learn to apply it in practical contexts. Peer teaching, case studies, and 3D visualization help students visualize theoretical concepts and apply them in real-world situations. This enables students to gain not only knowledge but also the ability to use it effectively in their professional activities.

Conclusion. Teaching human anatomy and physiology using interactive methods allows students to deeply master theoretical knowledge while significantly developing their practical competencies. The study shows that peer teaching, case studies, problem-based learning, and interactive visualization methods increase students' engagement in the learning process, develop independent work and analytical thinking skills, and enable the integration of complex physiological processes with practical applications.

The practical effectiveness of interactive methods lies in their ability to shift students from passive knowledge reception to active learning, where they search for, analyze, discuss, and integrate knowledge with practical exercises. Additionally, these methods foster teamwork, critical thinking, and creativity, which strengthen students' professional readiness.

Recommendations for higher education institutions:

- regularly use interactive methods in teaching human anatomy and physiology.
- structure lessons to integrate theoretical knowledge with practical exercises.
- employ modern visual and interactive tools to enhance student engagement.

Such approaches contribute to the development of students' professional skills and competencies, preparing them as independent, creative, and competent specialists.

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