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DEVELOPMENT OF STUDENTS' DIGITAL DIDACTIC COMPETENCE THROUGH VIRTUAL EXPERIMENTS IN TEACHING SPECIAL HISTOLOGY IN MEDICAL EDUCATION

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Annotation: This article discusses the didactic possibilities of using digital laboratories and virtual experiments in medical education, their role in developing digital-didactic competence in students, and the methodology for applying them to the teaching process. The impact of tools such as virtual experiments and microscopy on the learning process in teaching histology, cytology and embryology is scientifically analyzed. An experimental design model is proposed based on methodological stages.

Keywords: digital laboratory, virtual experiment, biology education, digital-didactic competence, simulation, 3D modeling.

Introduction.

Relevance of the research topic – Today, the rapid development of digital technologies in the medical education system requires the introduction of new approaches to the educational process. In particular, in the teaching of disciplines requiring complex theoretical and practical knowledge, including private histology, being limited to traditional methods prevents the formation of sufficiently solid knowledge and practical skills in students.

In the special science of histology, the study of the microscopic structure of tissues and organs requires great attention and spatial thinking. In practical training, the limited availability of real laboratory conditions, the lack of biological preparations, and the lack of time and technical capabilities reduce the effectiveness of training. Therefore, the use of virtual experiments, digital microscopes, 3D models, and interactive platforms is of great importance.

Also, a modern medical specialist is required not only to have knowledge of the subject, but also digital-didactic competence, that is, the skills of effective use of digital tools, information analysis, independent learning in a virtual environment and professional decision-making. However, insufficient attention is paid to the systematic development of these competencies in the current educational process.

The strategic documents adopted by the Republic of Uzbekistan on the digitalization of education, the "Digital Uzbekistan – 2030" program, and reforms aimed at the modernization of higher medical education

Make it an urgent task to conduct scientific and methodological research in this area.

In this regard, the development of a methodology for developing students' digital-didactic competence based on virtual experiments in teaching private histology in medical education, its scientific and pedagogical substantiation and implementation in practice are of significant scientific and practical importance.

Social and practical significance of the research

The results of this study:

To improve the quality of teaching histology in medical education;

To develop students' competencies in working in a digital environment;

To develop methodological recommendations for the effective use of virtual laboratories and experiments;

To improve the professional training of future doctors based on modern requirements.

The results of the study can be used in higher medical education institutions, in pedagogical practice, and in the development of digital educational platforms.

THEORETICAL AND BASIC ASPECTS OF TEACHING SPECIAL HISTOLOGY

1.1. The subject, tasks and role of histology in medicine

Histology is a fundamental biological and medical science that studies the microscopic structure, stages of development and functional properties of tissues of living organisms. This science serves to explain normal and pathological processes occurring in the body by determining the structure-function relationship between cells, tissues and organs [1].

The main tasks of histology are:

— Study of the morphological structure of tissues;
— Determination of the laws of tissue development;
— Analysis of the functional adaptation of cells and tissues;
— Creation of a morphological basis for clinical sciences [2].

In medical education, histology is inextricably linked with the sciences of physiology, pathology, anatomy and pharmacology, and plays an important role in the formation of clinical thinking of future doctors. Therefore, in-depth and systematic teaching of histology is one of the factors determining the quality of medical personnel training [3].

1.2. The content of special histology and its importance in education.

1.3. Special histology studies the structure of individual organs and systems (respiratory, digestive, cardiovascular, nervous, endocrine systems) at the tissue level. It deepens and systematizes the knowledge acquired in general histology on the example of specific organs [4].

The importance of teaching private histology is that it enables students to: — differentiate the microscopic structure of organs;

— Identify morphological differences between the norm and pathology;
— Develop clinical thinking and analysis skills [5].

In modern medicine, the effectiveness of diagnosis and treatment is largely based on morphological knowledge. Therefore, the quality of teaching private histology directly affects the level of professional training of the future doctor [6].

Today, the digitalization of the educational process is leading to fundamental changes in the teaching of biology. Through virtual experiments and digital laboratories, it is possible to teach complex histological processes safely, economically and visually. By learning to use modern technologies, students acquire not only theoretical knowledge, but also digital-didactic competence. The educational standards of Uzbekistan also define teaching biology based on information technologies as one of the priority areas.

The concept of digital-didactic competence

Digital-didactic competence is the ability of a student to use digital tools in the educational process in a purposeful, conscious and effective manner, to analyze, visualize, present educational information and organize digital experiments. It consists of the integration of the following components:[1]

Technical competence – skills to work on digital platforms.

Didactic competence – using digital tools in accordance with the content of the lesson.

Experimental competence – creating a virtual experiment algorithm and analyzing the results.

Communicative competence – online teamwork, presenting results.

Reflective competence – evaluating and analyzing the learning process.

Competencies developed in students through digital experiments

Digital competencies

Creating a digital experience;

Data analysis;

Critical thinking;

Problem solving; Teamwork; Scientific communication. Digital experiments in medical education and their potential Digital experiments create a number of didactic advantages in teaching histology, cytology and embryology: 1. Safe environment: no risk associated with chemicals, microorganisms. 2- Regular repetition: the ability to repeat the same experiment many times. 3- Time and resource saving: demonstration of complex processes without expensive equipment and reagents. 4- Visual modeling: viewing histological processes in an animated form. 5- Independent learning: the student can conduct experiments at his own pace. Digital and virtual experiment platforms for histology The following platforms are widely used in teaching histology: Virtual Microscope – virtual microscopy lessons. AR/VR applications – realistic visualization of complex processes. Histology teaching methodology: In order to organize a lesson based on a digital experiment and effectively use histological preparations in practical training in histology, cytology and embryology, the lesson is organized in the following methodological stages: 1. Setting a problem on the topic, presenting a real-life histological process, arousing interest in the student through questions related to the experiment. 2. Introducing the digital tool, explaining the platform's functions, parameters and safety rules. 3. Independent virtual experiment The student examines and applies experimental conditions, sets parameters, records measurements, and creates graphs. 4. By analyzing the results, compare virtual results with histological laws; 5. Prepare a digital presentation or report – a scientific report based on slides, diagrams, and graphs; Display objects modeled through AR/VR. 6. At the end, the student summarizes the analysis based on questions such as "What did I learn?", "What skills were formed?", "Which parameter affected the result?"

Conclusion. The use of virtual experiments in the process of digitizing medical education is one of the most effective ways to form students' digital-didactic competence. This not only improves the quality of the educational process, but also adapts students to the requirements of modern science. Through digital laboratories, students' scientific research culture, experimental thinking, data analysis, and skills in using digital tools for didactic purposes are strengthened. Also, time efficiency, realism of the result, visual inspection of the process, the technique of performing the processes, and a number of works that satisfy the human factor are improved.

Therefore, the need to further improve the methodological system of using digital tools and experiments in teaching histology, cytology, and embryology in medical education remains an urgent issue.

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