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## ***СВІТ ДИДАКТИКИ: ДИДАКТИКА В СУЧАСНОМУ СВІТІ***

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## ІННОВАЦІЙНІ ПІДХОДИ, ТЕХНОЛОГІЇ, МЕТОДИКИ, МЕТОДИ, ПРИЙОМИ І ЗАСОБИ НАВЧАННЯ

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### INNOVATIVE METHODS OF TEACHING HISTOLOGY, CYTOLOGY AND EMBRYOLOGY AT MEDICAL UNIVERSITY IN THE HYBRID FORMAT OF THE EDUCATIONAL PROCESS

The war in Ukraine has deeply affected all areas of society, including education. Following COVID-19 restrictions and the imposition of martial law, distance learning became the safest and most accessible option for students, regardless of their location, and has remained prominent. In a relatively short time, educators made significant efforts to create and adapt teaching materials and assessment methods for the online format (Popovich & Aliyeva, 2023), (Zviahina, Pototska & Makyeyeva, 2023). They employed modern technological innovations to establish a comprehensive virtual learning environment. As in-person classes resume, these valuable advancements can be incorporated into traditional learning, making education more engaging, flexible, and tailored to individual needs.

“Histology, Cytology and Embryology” is a basic biomedical discipline in medical education, and, along with other basic subjects, is part of the integrated test exam Krok 1 of the Unified State Qualification Examination. Traditionally, histology was taught using microscopes and slides, which has become a big problem in the distance and blended format of the educational process. To address these challenges,

educators are adopting innovative methods to enhance engagement, improve comprehension, and foster active learning in histology courses. Methods such as virtual microscopy, 3D visualization, interactive models, gamified learning content, the flipped classroom approach, AI tools, collaborative online platforms, social media, and augmented and virtual reality (AR/VR) technologies can be effectively utilized in both online and offline learning. These methods encourage active learning and enable students to apply their knowledge instead of simply absorbing information passively.

Virtual microscopy involves digitizing tissue slides at high resolution, allowing students to view them on a computer or mobile device. This approach eliminates the need for physical slides and microscopes, giving students access to an entire library of specimens. Platforms like “Histology Guide” and “WSU SOM Virtual Microscopy” have made these resources accessible and user-friendly (Sorenson & Brelje, 2014), (Braun, n.d.). Virtual platforms often include interactive features, enabling zooming, labeling, and annotations. Students can easily collaborate, review materials outside the lab.

3D modeling software and tools are now being used to convert flat, two-dimensional images of tissues into interactive three-dimensional structures. These models give students a better spatial understanding of tissue architecture, allowing them to explore cellular layers, pathways, and organ structures from multiple angles. This hands-on approach bridges the gap between microscopic and gross anatomy and is especially beneficial for learners.

Augmented and Virtual Reality (AR/VR) technologies provide immersive experiences where students can "enter" a cell or tissue structure. With VR headsets, learners can navigate through different tissue environments and study the relationships between various cell types and structures. AR, on the other hand, allows for overlaying digital tissue models onto physical spaces, which can be used for in-class demonstrations. These methods make abstract concepts more tangible and interactive, significantly enhancing retention and understanding.

Gamified learning through quizzes, puzzles, and simulations makes histology more interactive and fun. Apps and platforms like “Kahoot” or “Labster” create engaging learning environments where students can test their knowledge in real time, compete with peers, and receive instant feedback (*Kahoot! | Learning games | Make learning awesome!*, n.d.), (*Labster | Virtual Labs for Universities and High Schools*, n.d.).

However, their use is subject to a fee, which limits their implementation in the learning process. applications like "Ehistolab - Histology Slides", "Histology And Embryology", "Histology Quiz", "Medical Histology + AI Tutor" encourage students to test their knowledge by identifying tissue types, cellular structures, or matching diagnostic results based on histological images. These tools improve retention and motivation by breaking down challenging concepts into manageable, interactive tasks.

In the “flipped classroom” approach, students review histological content, such as recorded lectures or readings, before coming to class. Classroom time is then

dedicated to interactive discussions, problem-solving, and hands-on activities, like virtual labs. This method promotes active learning and allows students to apply knowledge rather than passively receiving information. The flipped model also promotes peer learning and collaborative group work.

Artificial Intelligence (AI)-powered platforms can quickly identify specific cell types, offering students instant feedback on their assessments. This reduces grading time for instructors and gives students more immediate insights into their strengths and areas for improvement. AI can also help create personalized learning pathways, adapting to individual students' progress and proficiency levels.

Online platforms like Slack, Discord, as well as social media, or specialized educational forums enable students to work together, ask questions, and share resources, even outside class hours. These communities promote peer-to-peer learning and provide access to a wide array of learning materials, including videos, articles, and case studies, fostering a deeper understanding of histology.

Innovative teaching methods in histology are reshaping the learning experience by making it more interactive, adaptable, and focused on the student. Techniques such as virtual microscopy and AI-powered tools not only improve understanding but also promote greater engagement, making histology more accessible and engaging. Nonetheless, we believe that the most effective approach is to combine both innovative and traditional methods in the educational process.

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#### ACTIVE TEACHING METHODS IN FORMING A STUDENT'S MULTICULTURAL PERSONALITY

A multicultural personality is viewed as a socioculturally adapted subject of a polylogue of cultures, who is capable of effective interpersonal interaction in different cultural contexts. The methodological basis of the formation of such a personality, the orientation of his/her behavior and worldview is both his/her own