

TSIFROVIZATIYA MEDITSINSKOGO OBRAZOVANIYA I INNOVATSIONNYE PODKHODY V PREPODAVANII HISTOLOGII

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Introduction

In the 21st century, obrazovanie preterpevaet deep changes, vyzvannye stremitelnym razvitiem tsifrovyykh tekhnologiy. Medical education, kak odna iz naibolee otvetstvennykh i nauchnoyomkix oblastey, zanimaet osoboe mesto v etom protesse. Tsifrovizatsiya stanovitsya ne prosto instrumentom, a strategicheskim napravleniem modernizatsii uchebnogo protsessa.

Histology, a fundamental discipline that studies the microscopic structure of human tissues and organs, is also included in the process. Traditional methods of training - working with microscopes, making preparations, analyzing original images - are supplemented with modern digital instruments: virtual microscopes, interactive atlases, 3D models and artificial intelligence.

Tsel dannogo doklada — rassmotret znachenie tsifrovizatsii v meditsinskom obrazovanii i eyo vliyanie na process prepodavaniya histologii, vyyavit preimushchestva, problemi i perspektiv dalneyshego razvitiya tsifrovyykh tekhnologiy v dannoy oblasti.

1. Tsifrovizatsiya v kontekte sovremennogo meditsinskogo obrazovaniya

Ponyatie "*digitalization of education*" includes the use of digital technology, platforms and instruments for the optimization of educational processes, expansion of access to knowledge and improvement of the effectiveness of education.

In medical education, digitalization includes a few things:

- introduction of **electronic training resources** (electronic training, basic training, simulators);
- ispolzovanie **distantsionnykh obrazovatelnykh technological** ;
- development of **virtual laboratories** and simulators of clinical situations;
- formirovanie **tsifrovoy kompetentnosti** budushchih vrachey.

Eti izmeneniya osobenno actualny v epokhu postpandemiynogo obrazovaniya, kogda hibridnye formi obucheniya — sochetanie online i offline — stali normoy.

2. Significance of histology and preparation of the doctor

Histology is one of the key basic disciplines of medical education. Ona forms the student's understanding of the microstructure of organs and tissues, which is essential for the study of pathology, physiology and clinical disciplines.

Traditsionno izuchenie histologii stroilos na mikroskopicheskom analize gotovykh preparatov, chto trebovalo bolshogo kolichestva materialov, oborudovaniya i vremeni. Odnako takie metody imeli ryad ogranicheniy:

- Ogranichenny dostup k rare preparations;
- slojnost odnoremennogo obucheniya bolshogo chisla studentov;
- zavisimost ot tekhnicheskogo sostoyaniya mikroskopov;
- nevozmojnost sokhranit i ispolzovat result analysis v tsifrovom vide.

Imenno poetomu tsifrovizatiya otkryla pered predovavetelyami histologii novye vozmojnosti.

3. Digital technology and training histology

Sovremennye digital instruments pozvolyayut sushchestvenno povysit effektivnost obucheniya histologii. Naibolee znachimymi napravleniyami yavlyayutsya:

3.1. Virtual microscopy and digital preparations

Virtual microscopies allow my students to examine tissue and high resolution through a computer and tablet. Such platforms (for example, *PathPresenter*, *Virtual Microscope*, *Histology Guide*) dayut vozmojnost masshtabirovat izbrazhenie, delat pometki, sravnivat normalnye i patologicheskie struktury. Eto polnostyu replaces the traditional microscope and conditions for distance training.

3.2. Interactive histological atlasy

Electronic atlases contain digital images of fabrics with annotations and explanations. Oni pozvolyayut studentam samostoyatelno izuchat material i kontrolirovat uroven usvoeniya znaniy.

3.3. 3D visualization and augmented reality (AR/VR)

With the help of 3D-models, it is possible to visualize tissue structures in volumetric format, which facilitates the understanding of the spatial organization of cells and organs. The application of technological **augmented reality** allows "pogrujatsya" in micromir tissue, and also modelirovat pathological processes.

3.4. Iskusstvennyy intellekt i mashinnoe obuchenie

Sovremennye sistemy iskusstvennogo intellekte primenyayutsya dlya avtomaticheskoy klassifikatsii i analiza histologicheskikh izobrazeniy. Students can use this system for the training of diagnostic thinking and morphological analysis skills.

4. Preimushchestva tsifrovogo podhoda

- **Naglyadnost and interaktivnost** - digital images of high quality make learning more visual and understandable.
- **Availability** - students can discuss material at any time and in any place.
- **Individualization of education** — every student can work in a self-paced manner.
- **Bezopasnost i sokhrannost dannyx** — tsifrovye preparaty ne portyatsya, ne trebuyut spetsialnogo hraneniya.
- **Razvitie tsifrovoy kompetentnosti** — navyki raboty s tsifrovymi instrumentsami stanovyatsya vajnoy chastyu professionalnoy podgotovki racha.

5. Problemy i ogranichenia tsifrovizatsii

Nesmotrya na mnogochislennye preimushchestva, tsifrovizatiya obrazovatel'nogo protsessa soprovojdetsya ryadom problem:

- vysokaya stoimost oborudovaniya i programmnoy obespecheniya;
- neokhodimost podgotovki prepodavateley k ispolzovaniyu novykh tekhnologii;

- risk understanding practical skills working with real microscopes;
- I teach "living" and I teach students.

Vajno ponimat, chto tsifrovizatiya ne doljna polnostyu zamenyat traditsionnye metody obucheniya, a lish dopolnyat ix.

6. Perspective developmental digital histology

Budushchee histologicheskogo obrazovaniya svyazano s integratsiey tsifrovyykh tekhnologii edinoe obrazovatelnoe ustanovleniye. V perspective ojidetsya:

- razvitiye **natsionalnykh baz tsifrovyykh preparatov** ;
- ispolzovanie **iskusstvennogo intellekta** dlya otsenki znaniy studentov;
- implementation of **virtual internships** and simulated pathological processes;
- razvitiye **mezhvuzovskikh tsifrovyykh platform** , obedinyayushchikh studentov i pedovateley iz raznykh stran.

Takoy podhod pozvolit make the process of training more flexible, modern and effective.

Conclusion

Tsifrovizatsiya meditsinskogo obrazovaniya yavlyetsya neot'emnym elementom sovremennoy pedagogiki. Ona sposobstvuet obnoveniyu metodov prepodavaniya, povysheniyu kachestva znaniy i razvitiyu professionalnykh kompetentnykh budushchikh vrachey.

And the teaching of histology and digital technology is not only for visualizing the space and analysis of tissues, but also for the students' new forms of thinking - analytical, systematic and research.

Optimum podhodom yavlyetsya **sochetaniye traditsionnykh i tsifrovyykh metodov** , chto pozvolit sokhranit prakticheskuyu napravlennost i pri etom ispolzovat vse preimushchestva tsifrovoy epoxi.

LIST OF LITERATURE (primary)

1. Borovkov A.I. Digitization of education: trends, technology, perspectives. - M., 2022.
2. Grigoreva N.V. Modern technologies and teaching histology. // Medical education and professional development. - 2023.
3. World Health Organization. Digital education for health workforce development: WHO guidelines. – Geneva, 2021.
4. Alsharif , N. et al. Virtual microscopy in medical education: A review of current status and future prospects. *Journal of Medical Education* , 2022.
5. Petrova E.A. Virtual microscopic kak instrument digital training. // Morphology human, 2024.