

# Study the Morphological and Physiological Disciplines in Pedagogical Universities with the Use of Information and Communication Technologies

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doi:10.56397/RAE.2023.01.01

## Abstract

The directions of the educational process organization in the pedagogical university for studying biological courses “Morphology and Physiology” are presented in the paper. Various forms of organization of this process with the use of information technologies are proposed. They include the following forms: electronic textbooks, videos with lectures and experimental practical works, histological preparations, atlas of embryology and histology, electronic manuals and workbooks, electronic dictionaries, tests for self-controlling knowledge. The use of the above components allows to individualize the learning process, to increase the interest of students in the study of these disciplines and the efficiency of the educational process; to eliminate the psychological barrier among students with different level of knowledge; to provide students with modern necessary learning material, and by this way to prepare them for future pedagogical work.

**Keywords:** educational process, information technology, electronic didactic teaching aids

One of the leading directions in reforming the educational process is the informatization of education based on the creative implementation of modern information technologies including the teaching of biological disciplines (Chernaya L.V. & Aktushina G.A., 2019).

Digitalization of various areas of society's life as a way of more efficient and high-speed processing and transmission of great volumes of information online makes the availability of new knowledge regardless of where the person is living.

To apply the advanced technologies in the field of higher education, first of all, it is necessary to use the modern information and communication techniques, based on new methodological principles and developed educational methods of psychological and pedagogical researches. It primarily includes various multimedia products, electronic manuals, etc., applicable as visual materials to ensure the providing of lectures and practical classes in a remote format (Ananchenko I.V. & Chepikova V.N., 2020).

From the point of the characteristic features of digital pedagogy and the digitalization of the educational process directly, the following advantages can be found:

(1) Participation of students or viewing recordings of online conferences which involve speakers located in different cities of the Russian Federation and other countries of the world. It ensures the most effective interaction and data exchange between universities in different countries;

- (2) The use of a personalized approach that forms the student as a subject of the educational process and largely determines his own route and pace of studying the disciplines;
- (3) The development of cognitive and psychophysiological mechanisms of educational activity, contributing to a fruitful cognitive process in students with the help of additional methods of activating the psychological and behavioral activity;
- (4) Parallel development by students of various types of software and hardware skills that expands further the range of possible areas of professional activity;
- (5) The trend in the development of educational materials due to the transition from the using of printed materials to electronic versions and other types of Internet resources including multimedia tools represented by a variety of video lectures, various forms of digital modeling, etc.;
- (6) Introduction of online courses as the most accessible form of obtaining educational information at any convenient time for students;
- (7) The appearance of new generation communication platforms and electronic educational resources (<https://lektsii-org.turbopages.org/lektsii.org/s/13-33073.html>).

The pedagogical understanding of the problem for using information and communication technologies in the educational process at the university makes possible to reveal a number of contradictions between:

- the need to use the information technology in higher education and the insufficient development of this problem in pedagogical science (in particular, technologies, methods and pedagogical conditions for their use);
- the need to organize such work and the insufficient level of providing the educational process with methodological materials;
- the real (insufficient) and the necessary level of pedagogical activity of university and school teachers to use the information technologies in the educational process (Shakhov Yu.A., Vilyavin D.A. & Gerasimenko T.L., 2019).

At the same time the implementation of information technologies in the educational process at the universities solves the following tasks:

- providing relevant and extensive information to students in the educational process;
- formation of key general pedagogical and professional competencies of students;
- integration of basic and additional education;
- increasing students' motivation for learning, etc.

Unfortunately, currently there is a significant shortage of prepared didactic materials for morphophysiological courses with the use of computer technology for pedagogical universities. Based on this, we have developed educational and methodological complexes with computer support for the disciplines "Histology with the basics of embryology" and "Human and animal physiology" for students of the biological profile.

The list of educational and methodical (electronic) materials developed on the subject "Histology with the basics of embryology" includes the following (Iglina N.G., 2011):

- (1) A textbook on the subject, consisting of two parts: the embryology and histology. This textbook is used by students in laboratory lessons, in preparation for classes and for the exam. Separate materials can be applied in specialized and extracurricular classes, as well in medical colleges.
- (2) Lectures on the course in multimedia form (18 lectures). This multimedia course together with the textbook allows to give information about the most important biological processes within the framework of the subject using computer graphics, video, animation, hyperlinks. All these elements affect the emotional sphere of students and thereby contribute to increasing the involuntary attention, the activation of educational and cognitive activity and the intensification of the educational material assimilation.
- (3) Laboratory - practical lessons on the course (13 lessons). In preparation to the lessons the students can view and complete tasks for each work, a list of which is available in the methodological recommendations that provide complete information about the purpose, volume of the lesson, questions to the lesson, description of micropreparations, etc. For a more in-depth study and microscopic examination of special structures the demo photos of micropreparations are presented, and situational tasks are proposed.
- (4) Online course on histology with the basics of embryology, including 13 modules. Each module contains theoretical, educational, and didactic materials, tasks for a laboratory lessons, and control tests. The course has been created on the basis of Moodle and allows someone to carry out the training and remote control of

knowledge via Internet; to organize interactive communication between teacher and student, to collect heterogeneous statistics on the educational process, etc.

(5) Electronic manual “Human Embryology”, containing the learning material of human embryonic development.

(6) Dictionary of concepts including 298 course definitions and 275 illustrations. The terms are listed in alphabetical order that gives possibility to move from one concept to another. In the dictionary almost every definition is illustrated with an image. It helps students to study the content of the concept more detail and determine the scope of the concept.

(7) An electronic library that includes the author’s textbooks that available on the Internet, atlases, additional sources, bibliography and educational Internet resources on the subject. The students have the opportunity to study the proposed resources independently, to solve a creative task or to prepare an essay. This type of work stimulates the development of students’ cognitive and creative activities and independence.

(8) Virtual office containing photos of all tables and wet preparations available in the office. It allows students to use the material and technical assistance of the classroom during independent work at home. Students could also use the virtual classroom, since each lesson folder contains visual aids from the histology room related to this topic.

(9) Atlas of embryology and histology containing photos of all preparations that are studied in the classroom. During preparing for classes or an exam students can use the electronic atlas at home. This provides a visual representation of the studied objects.

(10) Reader including electronic didactic materials have prepared jointly with students: the structure of germ cells; spermatogenesis; oogenesis; fertilization; acrosome reaction; etc. Elements of animation are used, which allow students to consider in dynamics the processes underlying embryogenesis. These manuals arouse interest among students and help to increase the concentration of attention in the classroom. It also includes tasks for independent work, a list of creative tasks for the course, crossword puzzles, and control materials.

(11) Embryology and histology via eyes of students. This module contains photographs of all studied histological preparations made by students through a microscope.

(12) A workbook recommended for use in specialized classes and for university students, containing a set of educational tasks on embryology (35) and histology (29), creative tasks, questions for preparing to exams and tasks on embryology and histology to preparing students for Olympiad in morphology.

At the next stage, biological students begin to study the course “Human and Animal Physiology”, which also contains a number of opportunities for online learning thanks to the developed electronic didactic tools. This course was developed jointly with the staff of the department (<https://mooc.nspu.ru/course/view.php?id=5>)

In particular, this course includes:

(1) The work program of the discipline.

(2) 34 video lectures on all topics of the course being studied. Recorded lectures allow students in case of missing face-to-face classes or additionally, at any convenient time, to watch online lectures, to hear the position and reasoning of the teacher on various controversial positions and theories of the discipline. Each lecture is equipped with video presentations that reveal the content of the presented material and could also be used independently.

(3) Video workshop containing recordings of 49 practical experimental works on all sections of physiology and a film about the house-museum of I.P. Pavlov. The video workshop includes recordings of the following topics: 1) The skeletal-muscular system which includes 4 films; 2) Physiology of blood including 6 films; 3) Physiology of respiration contains 3 films; 4) Physiology of the cardiovascular system consists of 9 films; 5) Physiology of digestion includes 5 films; 6) Physiology of the kidneys containing 2 films; 7) Physiology of the endocrine system contains 3 films; 8) Properties of excitable tissues containing 14 films; 9) Properties of nerve centers which contains 3 films; 10) Higher nervous activity, including 1 topic. All recorded practical exercises allow students to see the dynamics of the experiment and draw the appropriate conclusions.

(4) Five basic textbooks and manuals for the entire course and its individual sections, namely: 1) Human and animal physiology; 2) Molecular basis of human physiology; 3) Age physiology and psychophysiology; 4) Physiological bases of mental activity; 5) Manual for additional classes of students - future teachers “Anatomy, physiology and human hygiene: questions and answers” 6) Workshop on the course “Human and Animal Physiology”. 7) Psychophysiology (6–12).

(5) A test task for the course “Human and Animal Physiology” that includes a test containing about 320 questions on all topics of the course being studied which allows teachers to assess the degree of theoretical

readiness of students and can also be used by them to self-test their knowledge.

In general, the online course on “Human and Animal Physiology” allows, on the one hand, due to a shortage of teaching hours for studying the course to supplement full-time and part-time classes on the subject; on the other hand, to provide students with high-quality material for self-study of the subject.

Summing up, it should be said that the use of information technology in education provides:

- the multidimensional development of students;
- to preparing university graduates for life in the information society;
- implementation of the social order caused by the processes of global computerization.

This technology allows teachers to solve several problems at the same time:

- to stimulate the completion of home tasks on time;
- to eliminate the psychological barrier among students with insufficient knowledge;
- to provide students with necessary knowledge for future work;
- to achieve the effect of individual training.

The use of the above components of the complex allowed us to:

- (1) individualize the learning process when the learning history of each individual student is taken into account during choosing a learning impact (explanation, hint, praise). At the same time, the so-called reflective learning is carried out focused on the individual characteristics of the cognitive processes of students: perception, thinking, memory;
- (2) increase the interest of students to study these disciplines;
- (3) increase the efficiency of the educational process;
- (4) make the learning process more intense and dynamic, etc.

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