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USE OF THE VIRTUAL LABORATORY FOR TRAINING SPECIALISTS IN THE FIELD OF LABORATORY DIAGNOSTICS

Summary. The ways and possibilities of using the virtual laboratory at the classes in microbiology, virology, immunology with the techniques of microbiological researches for students major in laboratory diagnostics were discussed in the article. Given the limitations of the impromptu laboratory within the classroom, we have compared all aspects of the rational obtaining the practical skills by the students. We have analyzed the criteria that determine the use of electronic resources for the educational purposes to teach students at the department of microbiology and virology.

Key words: virtual laboratory, students, laboratory diagnostics, practical skills, microbiology, virology, immunology with the techniques of microbiological researches.

Introduction

Nowadays the training of an educated, creative and competitive person and also the development of his physical and mental health is the most important task of the educational reform in Ukraine. The solution of this problem is based on the psychological and pedagogical study of the content and methods in the educational process. Today higher education is ready to implement modern teaching technologies, among which the most popular are e-learning, interactive teaching methods, teaching using the training technologies and etc. [1, 2].

The reform of high school and the requirements, which are set to the graduates of the universities, academies, institutes, should substantially change the approaches to the process of teaching in high school. Now we can observe the transition from the authoritarian pedagogics to the humanist development of a person, from the accumulation of knowledge — to the ability of applying them, from the «one-time» education — to the continuous one, from the general organization of teaching — to the individual one. The new paradigm of education has led to the renewing of the professional education. This process is especially actual for the essential changes in the education, which are taking place in near and far abroad [1, 6, 7].

In recent years, the number of publications, devoted to the implementation of the electronic tools into the educational process, has dramatically increased [3–5]. New educational resources appear on the Internet, new pedagogical software has been evolved in the higher educational institutions, among which are interactive courses, electronic textbooks and virtual laboratories.

Under the status of modern teachers, working at the state higher educational institutions, we can expect the qualitative and quick orientation in the forms and means of information

transfer. Besides, the access to the informational resources gives an opportunity to optimize the professional work of a teacher, both in preparing for the class and in students' knowledge evaluation. The main task of the department of microbiology and virology is to form the qualitative model of the future specialist in laboratory diagnostics, as this subject, being taught at the department, is the base for the development of the students' knowledge, abilities and practical skills.

Main part

The classes in microbiology, virology, immunology with the techniques of microbiological researches for the students of 3–4 years of the specialty «Laboratory diagnostics», expect the development of skills in bacteriological, microbiological, virological, serological and other researches in order to find the causative agent, its identification and antibiotic sensitivity. Due to this aim, visual aids of such researches are prepared before each class and they also correspond to the topics of the curriculum. Following the operating mode and safety rules, it's not always possible to show the real microorganisms for students, that's why only non-pathogenic or conditionally pathogenic microbes are used at the classes, and sometimes the whole experiment is limited by recording the results of the research, even unreal, or only its imitation.

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When it refers to the students of any other specialties, it is perceived positively, but when it concerns the students of the specialty «Laboratory diagnostics», it's not acceptable to make a gap in the development of safety skills and the techniques of the conduction of microbiological researches, because future laboratory assistant will work in the microbiological laboratory and will do all the work himself.

The curriculum of microbiology, virology, immunology with the technology of microbiological researches for the students of the specialty «Laboratory diagnostics» includes 540 hours (lectures — 70 hours, practical training — 208 hours, topics for self-study — 262 hours). This division of in-class and extracurricular topics has already made serious difficulties in the achievement of qualitative skills in many topics. In order to optimize the students' preparation for practical training in microbiology, virology, immunology with the techniques of microbiological researches, they can use server of the distant education «MOODLE», which is based on the Bukovinian state medical university platform. The teachers of the department have prepared and combined the materials, which help a student to prepare for the classes and navigate him on the huge number of informational resources, available in the global network and in the software educational products, which appear on the Internet.

The possibility to demonstrate many researches would be more visible, if we could use our department's laboratory, but unfortunately it is not equipped with the latest requirements of modern medicine, but we still strive to develop qualitative knowledge and skills and in this case the «virtual laboratory» becomes more useful. An appropriate selection of images and video fragments is formed in compliance with copyright, using hyperlinks, which are done according to the topic. A student can look over this collection, study and understand the way of the new research topics during the preparation for the class, and after that clarify the details in the class. The priority of the «virtual laboratory» is a demonstration of a perfect experiment. It always reproduces the same and reflects real patterns.

The program «virtual laboratory» allows teachers and students to solve a number of practical and organizational tasks, such as training students to work in the real situations, to practice basic skills with equipment, to keep safety requirements in the «virtual laboratory», to develop observation and ability to pick out the basis, to identify the goals and objectives, to plan the experiment, to make conclusions, to develop skills in searching for the optimal solution and the ability to transfer the real task on models and vice versa, to make the records in the laboratory register, to conduct the experiments, which are inaccessible (forbidden) in the conditions of the department's laboratory. Distance workshop of the laboratory work makes possible to control the time of the experiment and the real savings of consumables and equipment.

For example, the microbiological research consists of three stages: to detect causal microorganism, to separate it from the pure culture and to identify, which requires time for microorganisms cultivation, it takes 24–72 hours for most microorganisms. Very often it is impossible to master skills of an accurate results recording, due to this criterion, because of limits of the duration of the practical training. If the research continues at the next class with the another topic,

it distracts students, forcing them to switch over from one topic to another one, and the reliability of the results is considerably reducing, as the intersection between the research materials is unacceptable, because of the cross-pollution.

Another indicator of the obtaining knowledge, abilities and skills is fulfillment of certain tasks by a student on his own. As mentioned above, not any microorganism can be used for the educational purposes during the classes in microbiology, because their pathogenicity contradicts the safety rules in the classroom, that's why the process of acquiring skills will be definitely visual, even if the teacher does an experiment himself, but even if it is also impossible, the only way out is the usage of the «virtual laboratory», which will disclose all the features of the research. Because the work permit with pathogens (I–II groups) has only relevant laboratories, where the access is limited especially to the unauthorized persons.

Another criterion of microbiological research conduction is the price of the consumables and equipment that always confronts us with a choice: whether this research conduction is profitable or not? Diagnostics in modern medicine develops with a huge speed, while the use of expensive diagnostic kits, test-systems, bacteria- and PCR-analyzers and other for educational purposes, is considered too expensive for budget of the institution. This also should include materials for the research, namely: the blood, serum of patients, washings, tissue samples, stool, urine, sputum, sectional materials etc.; it's impossible to choose them according to the necessary topic, because the topic cannot depend on the epidemiological situation, and the microorganisms can be alive and viable not more than 24 hours, while they are kept in the special preserving environment. Concerning the topics of especially dangerous infections all experiments are forbidden, as the permit of work with such microorganisms, being discussed above, has only relevant labs.

Also the plan of microbiology, virology, immunology with the techniques of microbiological researches for the students of the specialty «Laboratory diagnostics» includes the list of topics, studying infections that are exotic for our region. Of course, it's a problem to teach foreign students, who came from India or Africa to study at the Bukovinian State Medical University, and those who study at the other medical institutions, where these infections are usual things. As for the native students of Ukraine, these topics may be possible in the case of the infection penetration into the country. But we have to predict the possibility for a future laboratory assistant to work in any other country. Our teachers don't have the work experience with pathogens of such infections, that is the main reason why they cannot transfer their skills to students. The «virtual laboratory» is very useful in this case.

For example, during the practical training «Laboratory diagnosis of plague» it's impossible to involve students into the bacteriological research in the educational laboratory, because of the contraindications for the storage of the material, which is contaminated with the microorganisms of the first group of danger due to the procedure. The «virtual laboratory» will help to develop practical skills related to the topic «Microbiological characteristic of brucella and francisella. Laboratory diagnosis of brucellosis and tularemia». This problem concerns the topic «Microbiological characteristic of the causative agent of anthrax». During the preparation

for the class, a student can watch the video of the «virtual laboratory», which gives the opportunity to learn more about the technique of the research, and at the practical training the teacher helps to develop skills due to the analysis of dummy reactions, while the student only records the results in a minutes book. Teacher's task is to make the process of the research conduction at the «virtual laboratory» more detailed and to put the emphasis on the danger and mistakes.

We faced with the problem of availability of special equipment and expensiveness of the consumables while studying the topics of the chapter «Virology»: «Laboratory diagnosis of the rhabdoviridae disease», «Laboratory diagnosis of epidemic poliomyelitis» and «Laboratory diagnosis of HIV infection». The presence of the material for researches is also a problem, because it's impossible to figure out the suitable date of the practical training. There are infectious diseases, appearance of which considered to be unusual. It's unacceptable to use the contaminated samples with the viruses for the educational purpose. The teacher is responsible for the safety of students during the class.

Projecting and implementing of the informative educational environment for active learning is a complex task, that requires a lot of time and charges. It cannot be compared with the charges of making the educational hypertext (e.g. electronic book or media library). Conducted the detailed selection of materials, which are on Internet, a teacher directs the student to the necessary page, reducing the time the student is spending while looking for the information necessary for classes.

Thus, student can study not only theoretical material, but also get acquainted with the technology of the research. If it's possible, the research can be conducted even during the class, but if not, the «virtual laboratory» will be useful in the skills development. The main task of a teacher is to explain the rules of the research and to emphasize the possible danger. Also it's important to orientate a student towards possible mistakes, errors or negative results, and it also can be obtained virtually.

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ВИКОРИСТАННЯ ВІРТУАЛЬНОЇ ЛАБОРАТОРІЇ ПРИ ПІДГОТОВЦІ ФАХІВЦІВ У ГАЛУЗІ ЛАБОРАТОРНОЇ ДІАГНОСТИКИ

Резюме. У статті обговорені способи та можливості використання віртуальної лабораторії на заняттях із мікробіології, вірусології, імунології з технікою мікробіологічних досліджень для студентів, які навчаються за спеціальністю «лабораторна діагностика». Співставлено всі сторони в раціональному засвоєнні практичних навичок студентами, враховуючи можливості імпровізованої лабораторії в межах навчальної аудиторії. Проаналізовано критерії, що обумовлюють використання електронних ресурсів навчального призначення для навчання студентів на кафедрі мікробіології та вірусології.

Ключові слова: віртуальна лабораторія, студенти, лабораторна діагностика, практичні навички, мікробіологія, вірусологія, імунологія з технікою мікробіологічних досліджень.

Conclusion

Thus, the «virtual laboratory» in microbiology not only simplifies, makes cheaper, more available and demonstrative microbiological researches which are dangerous and expensive but assimilates the educational process with the modern generation of students of 3–4 courses of the specialty «Laboratory diagnostics», who are experienced Internet users.

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ИСПОЛЬЗОВАНИЕ ВИРТУАЛЬНОЙ ЛАБОРАТОРИИ ПРИ ПОДГОТОВКЕ СПЕЦИАЛИСТОВ В ОБЛАСТИ ЛАБОРАТОРНОЙ ДИАГНОСТИКИ

Резюме. В статье обсуждены способы и возможности использования виртуальной лаборатории на занятиях по микробиологии, вирусологии, иммунологии с техникой микробиологических исследований для студентов, обучающихся по специальности «лабораторная диагностика». Сопоставлены все стороны в рациональном освоении практических навыков студентами, учитывая возможности импровизированной лаборатории в рамках учебной аудитории. Проанализированы критерии, которые обуславливают использование электронных ресурсов учебного назначения для обучения студентов на кафедре микробиологии и вирусологии.

Ключевые слова: виртуальная лаборатория, студенты, лабораторная диагностика, практические навыки, микробиология, вирусология, иммунология с техникой микробиологических исследований.