

## METHODOLOGY OF ORGANIZATION OF STUDENTS INDEPENDENT STUDY ACTIVITIES IN MICROBIOLOGY WITH THE USE OF VIRTUAL EDUCATION TECHNOLOGIES

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### ABSTRACT

This article presents the problems of organizing independent learning activities of students in the field of microbiology with the help of virtual learning technologies and suggestions, as well as recommendations for their elimination.

**Keywords:** Microbiology, independent learning, virtual learning technologies, platform.

### INTRODUCTION

The State Education Standard, which is composed of biology subjects in higher education institutions, defines the knowledge, skills and abilities that students must acquire, which are very difficult for students to acquire during lectures, practical and laboratory classes. Therefore, the professor-teacher should ensure that students acquire certain skills and abilities in independent educational activities, which is a necessary form of teaching [1].

A student studying at a higher education institution is a person who is experiencing a period of physical and mental activity, during that time their tendency to independent learning increases [2]. We know that the work plan of higher education institutions provides for at least an hour of lectures for students to study independently. A reasonable question arises, - in what order should the hours allocated for this independent study be used effectively and in what form, method and means should it be organized? [1]. Independent practice leads to the development of psychological processes in students and then prepares them to think broadly, to analyze events and facts, in order to explain the subject [1].

Therefore, one of the most important issues facing higher education institutions is to improve the methodology of independent education, which allows students to continuously and independently improve their knowledge, creating the basis for the effective organization of learning activities [3].

At the same time, many methods of organizing independent learning have been developed [4], in which students have independently been learning some of the program materials in a particular subject.

However, due to the rapid development of today's world and the emergence of new approaches to teaching, it seems that the teaching methods and means used are outdated and do not fully meet the requirements of today's world. Therefore, in order to be effective and modernize the independent education of students studying in higher education institutions, it is necessary to widely introduce computer pedagogical software, including virtual learning technologies. As a result, the following opportunities are created: develops students' communication skills;

prepares an individual who owns an informed culture of society; provides a clear explanation of processes and events that are difficult for a wide range of learners to learn and imagine; forms and develops research skills in students as well as the ability to make optimal decisions [5].

### **LITERATURE REVIEW**

Research on e-learning resources and virtual learning technologies in the organization of independent learning activities of pupils and students in the disciplines of biology in our country and the Commonwealth of Independent States was carried out by the scientists named G.S.Ergasheva, M.N.Ibodova, L.M.Karakhanova, Sh.B.Khasanova, E.A.Filippov, O.G.Petrova, T.I.Krylova, E.S.Gladkaya, A.S.Lysenko, Y.A.Komarov, V.A.Smirnova.

Although the above research puts forward some theoretical and practical approaches to the use of electronic means in education, the possibilities of using virtual learning technologies, improving teaching methods, the use of virtual learning technologies in the organization of independent learning activities in microbiology in pedagogical higher education institutions has not been done.

One of the promising directions is the organization of independent education of students in microbiology with the help of virtual learning technologies. Virtual learning technologies virtualize various forms of learning materials, including the processes and events being studied, allows you to get full answers at any time to questions that arise in the process of learning new topics. Therefore, virtual learning technologies serve as an important tool for independent study of the subject of demonstration experiments by students during laboratory classes on the science of microbiology. Independent study is based on the individual characteristics of each student [3]. The formation of students' skills of active and independent work with electronic information resources in the lessons of microbiology, the provision of communication also creates the basis for in-depth study of other disciplines in the field of biology [6].

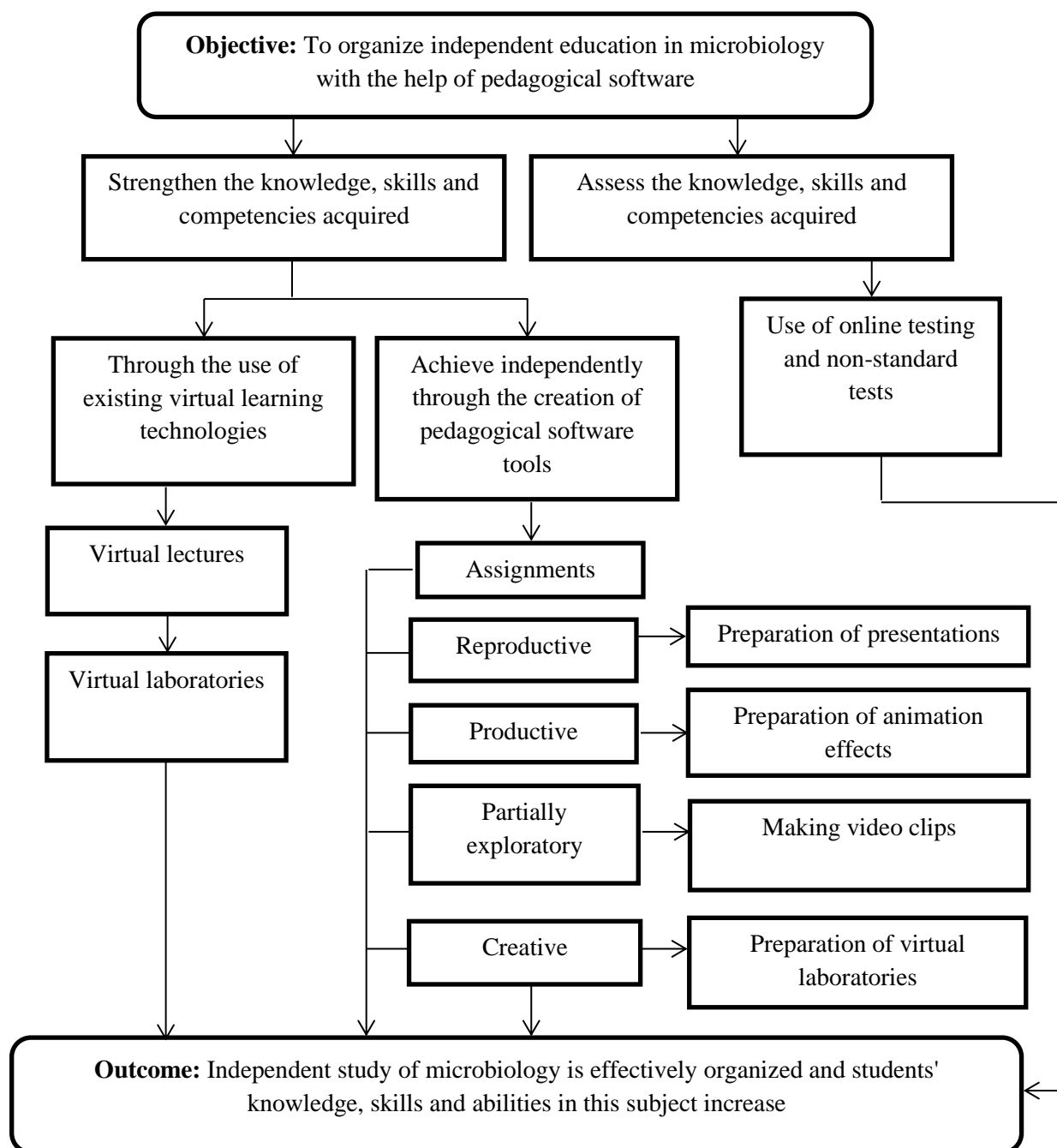
In this regard, according to M.N.Ibodova, the organization of independent work in biology education on the basis of e-learning resources provides students with modern didactic materials, high level of visualization and interactivity to teach in real conditions and increases their motivation and interest in learning [6]. Therefore, in the effective organization of independent educational activities in microbiology in pedagogical higher education institutions, it is necessary to use virtual educational portals and platforms created on the Internet.

One of the most important tasks of future biology teachers is not only to impart knowledge, but also to enable them to explore and acquire knowledge independently. The use of virtual learning technologies for the Internet in the independent learning of students is a modern pedagogical means for achieving effective results. Education for students based on virtual learning technologies is a complementary (auxiliary) tool for full-time education or an independent educational system of science, which works on the basis of a well-known curriculum, the process of independent learning is carried out under the guidance of a professor.

### **RESEARCH METHODOLOGY**

The organization of independent work in the formation of students' skills in the field of microbiology, that is, helps to analyze, summarize their activities, collect data, organize them and store learning information in memory. Students' knowledge of microbiology is formed and developed through the reception, processing, separation of its important aspects, the interaction of newly acquired knowledge, skills and abilities with the previous ones, generalization,

repetition, their implementation during independent study with lectures and laboratory classes [3]. This can be seen in the example of the structure of the creation and use of virtual learning technologies with the help of computer pedagogical software in the organization of independent learning in microbiology (See Figure 1).



**Figure 1. The structure of the organization of independent study of students in microbiology with the help of pedagogical software**

From this structure, in order to learn independently from the subject of microbiology, he first learns topics using virtual learning technologies. After that, you will be able to create pedagogical software tools and virtual learning technologies using computer applications. At the same time, students' knowledge, skills and abilities, as well as interest in science will increase.

The widespread introduction of virtual learning technologies in the process of education and upbringing is a global trend of global development [7]. We know that students increase the knowledge, skills and competencies they gain as a result of completing assignments independently. Therefore, it is expedient to teach students not only the study of ready-made information, but also the methods of their preparation in independent learning activities. In order to further improve the knowledge, skills and abilities of students in the field of microbiology, it is necessary to improve their skills in creating virtual learning technologies in this subject. At the same time, students strive to independently study a number of textbooks to create virtual learning technologies, with the help of computer pedagogical software. As a result, you will be able to master the science of microbiology on the basis of the integration of pedagogical software of the computer.

Shortcomings in the teaching methods used in the process of teaching and education of pedagogical higher education institutions, in particular, the "Methods of teaching biology" in the field of microbiology for students in the field of independent work, due to insufficient use of computer pedagogical software, including virtual learning technologies, leads to insufficient development of independent thinking of some students. Therefore, in order to further improve the independent learning activities of students in the field of microbiology in pedagogical higher education institutions, a virtual educational platform microbiology.uz was created. This platform creates the following pedagogical opportunities for independent learning of students:

- Provides students with educational and methodological information for independent learning activities;
- Increases the effective organization of independent learning activities;
- Provides virtual performance of laboratory work;
- Strengthens the knowledge, skills and abilities acquired in lectures and laboratory classes;
- Provides an opportunity to independently assess and monitor the knowledge, skills and abilities acquired in science;
- For some reason he was unable to attend class and served to a certain extent to acquire the knowledge of the disabled;
- Provides e-learning tools for professors and teachers of microbiology.

Given the above capabilities of the virtual educational platform microbiology.uz can be recommended to use students of today's pedagogical higher education institutions in the field of "Methods of teaching biology" for the effective organization of independent educational activities in microbiology.

## **ANALYSIS AND RESULTS**

The introduction of virtual learning technologies in the process of microbiology education in pedagogical higher education institutions is a key factor in increasing the effectiveness of this discipline [8]. It is proving itself in practice what pupils are taught on the basis of computer hardware and virtual learning technologies to quickly and conveniently master the knowledge provided, as well as visually clear and long-lasting memory [9]. Virtual learning technologies in microbiology are a convenient tool for new sources of information and knowledge [8]. Therefore, in order to determine the effectiveness of virtual educational technologies and teaching models developed on their basis, as well as improved teaching methods, the educational direction of pedagogical higher education institutions "Methods of teaching biology" in the field of "Biology teaching methods" tests were performed [9].

Pedagogical experiments were carried out on the organization of independent learning activities of students using virtual educational technologies in microbiology for students of the

3rd stage of the educational direction "Methods of teaching biology" of pedagogical higher educational institutions. Experimental work was carried out in 2016-2020 at Tashkent State Pedagogical University named after Nizami, Jizzakh State Pedagogical Institute, Navoi State Pedagogical Institute. A total of 215 students were involved for the experiment and control groups.

Experimental work on microbiology on the basis of virtual educational technologies was carried out in four stages (diagnosis and forecasting, organizational training, practical, generalization).

Diagnosis and forecasting phase of experimental work in the field of microbiology in 2016, the analysis of normative and legal documents, pedagogical and psychological, scientific and methodological literature on the subject of research analyzed. The purpose, object, subject and tasks of the research were also defined. An experimental program has been developed and pedagogical higher education institutions have been identified.

Organizational-preparatory phase in 2017, the composition and objectives of the participants of three pedagogical higher education institutions in the country were determined. Criteria and indicators for assessing student learning outcomes were identified. From the scientific point of view, the stages of creation of a virtual educational platform on the Internet in microbiology and the corresponding virtual educational technologies, as well as the stages of testing, elimination of these shortcomings and commissioning were analyzed from a scientific point of view.

Practical stage in 2018-2019, the microbiology.uz virtual education platform on the subject of "Microbiology" was created and placed on it virtual learning technologies. In order to test the created virtual educational platform and determine the level of quality, 3rd year students of Tashkent State Pedagogical University named after Nizami, Jizzakh State Pedagogical Institute, Navoi State Pedagogical Institute in the field of "Methods of teaching biology" were involved. The content of the microbiology.uz virtual educational platform and the virtual educational technologies placed on it were tested by 57 experimental professors and teachers in pedagogical higher education institutions designated as experimental areas.

The study also developed criteria for assessing microbiology students with biology teachers to determine how well they could perform in independent learning activities (presentations, virtual visual aids, virtual stands, video lessons, and virtual labs) and how creative they were. These evaluation criteria are given in Table 1.

**Table 1. Biology teaching methods are criteria for assessing the creativity of students in the field of education**

T/r	Assignments	Assessment levels
1.	Preparation of presentations and electronic tests	Reproductive
2.	Animated visual aids	Productive
3.	Preparation of video clips, video lessons and preparation of virtual stands	Partially exploratory
4.	Virtual laboratory training	Creative

From the tasks in **Table 1**, the creative ability of students who prepared presentations and electronic tests was determined as **productive** for those who prepared **reproductive** and animated visual aids, **partially researched** for those who prepared video clips, video lessons and virtual stands, and **creative** for those who prepared virtual laboratories. Experimental work was carried out on the basis of these criteria.

According to the analysis of experimental results, the number of students with knowledge, skills and abilities in the experimental group on the simultaneous creation of virtual learning technologies at the reproductive, productive, partial-research, creative level - 55%, reproductive, productive, partial-research - 30%, reproductive, productive - 10%, and at the reproductive level - 5% was consisted of. The number of students with knowledge, skills and competencies on the control group focused on the simultaneous creation of virtual learning technologies at the reproductive, productive, partially exploratory, creative level was 14%, reproductive, productive, part-time - 20%, reproductive - 34% productive - 32% at the reproductive level.

From these indicators, it was found that the mastery rate of students in the experimental group was higher than that of the control group. We concluded that the main reason for this was that the students involved in the experimental group had a high performance due to the fact that they were given homework to create virtual learning technologies independently and supervised and given the necessary recommendations.

The generalization phase of pedagogical experimental work in 2020 summarized the assessments received by students, mathematical-statistical analysis was conducted using the Student-Fisher criterion to check the reliability and accuracy of their results. We will consider its level of effectiveness in the next paragraph of the dissertation.

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Corresponding mean values  $\bar{X} = \frac{1}{n} \sum_{i=1}^4 n_i X_i$ , scattering coefficients  $D_n = \sum_{i=1}^4 \frac{n_i (x_i - \bar{X})^2}{n-1}$ , standard deviation  $\tau_n = \sqrt{D}$ , indicators of variation  $\delta_n = \frac{\tau_n}{X}$ , reliable

deviations from the assessment  $\Delta_n = t_{kh} \cdot \frac{D_n}{\sqrt{n}}$ , in determining the indicators of mastery

$A\% = \frac{x}{3} * 100\% - \frac{y}{3} * 100\%$  formulas were used for selections using this criterion. According to the numerical results, the criterion for evaluating the effectiveness of teaching is a sudden magnitude and the criterion for assessing the level of knowledge is greater than zero. It is known from this that the performance of the experimental group is higher than that of the control group. According to the results of the calculation, the average mastering rate of the experimental group was higher than that of the control group, that is to say, increased by 10.27%.

## CONCLUSION

In pedagogical higher education institutions, a total of 126 hours are taught to students of microbiology during 5 semesters, of which 20 hours are devoted to lectures, 46 hours to

laboratory classes and 60 hours to independent study. Therefore, it is necessary to improve the effective use of virtual learning technologies in the effective organization of independent learning activities of students in the field of microbiology. The science of microbiology is aimed at improving the knowledge, skills and abilities of the external structure (morphology), internal structure (anatomy), reproduction and development of very small microorganisms that are invisible to the naked eye. The use of virtual learning technologies in their study serves as an effective learning tool. Because in teaching these topics, it is very difficult to show a realistic picture of the processes that take place in it. These can be effectively organized with the help of virtual learning technologies.

Therefore, we recommend the use of a virtual educational platform developed in the framework of research in the process of independent teaching of microbiology in the field of biology teaching methods of pedagogical higher education institutions. With the help of this platform, students have the opportunity to independently use virtual educational technologies in the field of microbiology, as well as self-assessment online.

From the above statistical analysis, it can be concluded that pedagogy is the basis for the popularization of microbiology in higher education institutions for the use of virtual learning technologies in the organization of independent learning activities of students.

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