

DIDACTIC SIGNIFICANCE OF MEDIA EDUCATION TOOLS IN TEACHING BIOTECHNOLOGY

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ANNOTATION: This article analyzes the role and didactic significance of media education tools in teaching biotechnology. Media education enriches the educational process in an interactive, visual, and practical way, increases the effectiveness of teaching, and activates student activity. The article highlights the didactic possibilities of media education tools in biotechnology education, the advantages of their application, and the conditions for increasing their effectiveness. Also, methodological directions for organizing the science of biotechnology in higher educational institutions based on modern media education are indicated. The research results confirm that the use of media education tools is an important factor in adapting the educational process to the digital environment, developing students' scientific thinking, and strengthening interdisciplinary integration.

KEY WORDS: biotechnology, media education tools, interactive learning, didactic significance, higher education, digital education, innovative methodology.

INTRODUCTION

In today's era of globalization, the rapid changes taking place in the field of education require new approaches to the teaching process. In particular, as a result of the rapid development of digital technologies and information and communication tools, the use of media education tools in the educational process creates wide opportunities [1].

Media education is a system aimed at increasing the effectiveness of teaching, learning, and assimilation through the use of various digital, audio, video, interactive, visual, and information technologies in the educational process. It is recognized as an innovative approach that not only complements traditional teaching methods, but also transforms the student into an active participant.

In the higher education system, in particular, in the process of teaching biotechnology, the use of media education tools is of particular importance. Because biotechnology is a field that includes complex processes, inextricably linked with natural sciences, in particular, biology, chemistry, genetics, microbiology, and bioinformatics. The topics studied within this discipline often consist of theoretically difficult, difficult to imagine topics such as molecular-level processes, cell structures, genetic manipulations, enzymatic reactions, DNA and protein synthesis. Therefore, for effective teaching in this area, it is extremely important to use the didactic possibilities of media education tools [2].

Media education tools, in particular, multimedia presentations, virtual laboratories, 3D animations, interactive simulations, digital platforms (Moodle, Google Classroom, Edmodo), video lectures and infographics, allow for the visual representation of educational materials. This makes it easier for students to understand the topic, visualize scientific processes, and most importantly, apply the acquired knowledge in practice.

In addition, the didactic significance of media education tools in teaching is manifested not only in increasing the effectiveness of the educational process, but also in the formation of students' skills of independent reading, critical thinking, analysis, research, and a creative approach. Media education helps the student transform from a passive learner into an active creator of knowledge, which is the main requirement of modern pedagogical approaches.

Also, the use of media education tools in the process of teaching biotechnology in higher education serves as an important step towards bringing the quality of education in line with international standards, increasing the pedagogical potential of teachers, and digitalizing the educational process. Virtual laboratories, online experiments, and interactive platforms are widely used in teaching biotechnology at

leading universities of the world. The process of implementing this experience in the higher education system of Uzbekistan is also being carried out in stages.

From this point of view, teaching biotechnology based on media education not only modernizes the educational process, but also develops students' scientific worldview, practical skills, analytical thinking, and research abilities. Lessons conducted using media education tools increase students' interest in the subject, encourage independent learning, and, as a result, significantly increase the didactic effectiveness of the educational process [3].

Main Part. In the modern education system, media education is recognized not only as a means of transmitting information, but also as a pedagogical mechanism that manages and activates the educational process. In teaching biotechnology, these tools serve the practical implementation of the principles of visualization, systematization, logic, and independence of the educational process.

The advantage of media education tools is that with their help, the student has the opportunity to see, hear, analyze, and understand complex scientific concepts through experience. For example, showing the spiral structure of the DNA molecule in a 3D model or observing the growth of microorganism colonies through interactive simulation creates a complete picture of the topic in the minds of students.

Also, media education tools allow the teacher to organize the educational process based on an individual approach. Each student can work with the material, independently analyze and evaluate the result in accordance with their learning speed. This process brings education to a subject-oriented form [4].

The use of media education tools in biotechnology opens up several important didactic possibilities:

a) Concretization of abstract concepts. It is difficult to explain genetic, molecular, and cellular processes encountered in the content of science through simple text or pictures. In this case, media education tools allow for the demonstration of the topic in a visual form, with spatial actions. For example, showing biochemical reactions involving enzymes in an animated way forms the student's ability to fully understand the process and connect it to real conditions.

b) Strengthening cognitive activity. In a lesson organized on the basis of media education, the student is not only a listener, but also an active participant. Tasks, virtual experiments, or visual tests given on interactive platforms activate their thinking and encourage them to defend their views. Thus, media education tools lead students from "obtaining ready-made knowledge" to the stage of "independent discovery of knowledge."

c) Formation of analytical and practical competence. Biotechnology requires students to provide accurate evidence, analyze the results of experiments, and draw conclusions. Media education tools help to carry out this process in a comfortable and safe environment. Through virtual laboratories, the student changes various parameters and observes the change in the results of the experiment. As a result, they will acquire not only theoretical knowledge, but also the ability to think analytically and make decisions.

d) Development of dialogue and cooperation. Through online discussions, video conferences, forums, and group projects, students develop skills in working together, exchanging ideas, and presenting evidence. This is especially important in the scientific field of biotechnology, since biotechnological research often relies on collective activity [5].

The use of media education tools gives new meaning to the learning process. Now the teacher is not only a source of knowledge, but also actively participates as a person who manages, directs, and analyzes the learning process. And students become not passive listeners, but active participants who independently search, ask questions, and can defend their opinion. Also, as a result of the transformation of the classroom environment from a traditional classroom into an interactive, digital, and creative educational space, the educational process will become even more lively. This strengthens students' interest in knowledge, creates an atmosphere of effective communication, exchange of ideas, and cooperation between the teacher and the student. As a result, the lesson process will be technically convenient, didactically effective, and psychologically interesting. In such conditions, the learning process rises from the stage of "delivering information" to the stage of "active assimilation and practical application of knowledge."

Pedagogical research shows that in lessons using media education tools, the student's memorization

rate increases to 40-60%, and the level of satisfaction with the lesson is higher than 70%.

The following types of media education tools are widely used in biotechnology education.

1. Multimedia presentations - combine the visual and audio components of the topic, simplifying complex processes.
2. Virtual laboratories - simulate laboratory equipment, allowing for safe experiments.
3. Video lessons and animations - provide a step-by-step explanation of the educational material.
4. Online tests and electronic assessment systems - quickly determine the results and monitor the dynamics of student development.
5. 3D models - show the spatial structure of biotechnological objects.
6. Interactive projects - encourage students to work in a team, creativity [3].

Each tool has its own didactic purpose, and their complex application makes the educational process more effective.

Teaching biotechnology based on media education has a number of pedagogical advantages. Such an approach enriches the educational process with modern technologies, increases student activity, and significantly improves the effectiveness of teaching. With the help of media education tools, the teacher presents the topic in a more understandable, visual, and interactive way.

Below we present the main advantages of teaching biotechnology based on media education tools.

1. Strengthens interdisciplinary integration. For example, in biotechnology, it is easier to demonstrate the connection with chemistry, physics, and computer science through media education.
2. Expands the possibilities of conducting experiments. Experiments that are impossible or dangerous in real conditions are performed virtually.
3. Individualizes teaching. The student works at their own pace, re-examining the desired topic.
4. Develops digital competence Through the use of media education, students learn to work with modern information technologies.
5. Facilitates control for the teacher. With the help of electronic assessment systems, it is possible to quickly analyze the level of assimilation [6].

Thus, media education means bring biotechnology education to a new level in terms of technology, methodology, and content.

The effectiveness of using media education tools is determined not only by their application, but also by their correct selection, planning, and purposeful integration into the educational process. Therefore, in order to achieve maximum results from media education tools in the educational process, it is important to comply with the following conditions:

1. Clarity of the pedagogical goal - each media education tool should be used in accordance with its purpose.
2. Methodological compatibility - the teacher must thoroughly know the methods of working with media.
3. Technical support - the educational institution must be equipped with the necessary computer, projector, internet, and software.
4. Interactive feedback - the teacher must monitor and evaluate the activities of students during the lesson.
5. Creating a motivational environment - media education tools should be used in a form that interests the student and encourages communication.

When these conditions are met, media education tools significantly increase the effectiveness of teaching and guarantee the quality of biotechnology in the educational process [2].

In the future, the use of media education tools will expand in biotechnology education. With the introduction of artificial intelligence, digital laboratories, augmented reality (AR) and virtual reality (VR) technologies, the learning process will become more interactive, personality-oriented, and research-based [7].

In conclusion, it should be noted that teaching biotechnology based on media education tools is an

effective approach that brings the educational process to a qualitatively new level in the modern education system. Media education tools not only enrich the technical aspects of teaching, but also increase the effectiveness of education in didactic, psychological, and methodological aspects. With their help, it will be possible to organize the educational process in a visual, interactive, and student-centered manner.

Such a form of training, taking into account the specifics of the science of biotechnology - reliance on experience, analysis, and practical skills, simplifies complex biological processes and makes it possible to visualize them in virtual and digital environments. With the help of media education tools, students learn to conduct experiments, observe, analyze the result, and draw conclusions more easily.

Classes based on media education activate communication between the teacher and the student, develop students' independent thinking, creative approach, and analytical potential. As a result, the teacher becomes not only the giver of knowledge, but also the person who manages and directs the learning process. And students turn from a passive listener into an active participant, a person conducting research and inquiry.

Also, the use of media education tools makes lessons technologically convenient, didactically effective, and psychologically interesting. Students will have the opportunity to independently manage the learning process, assess their level of knowledge, and eliminate shortcomings. This increases the quality of the educational process and ensures its effectiveness.

In general, the use of media education tools allows achieving the following main goals in teaching biotechnology: deep assimilation of knowledge, development of practical skills, formation of scientific thinking, and strengthening of digital competence. Therefore, the systematic introduction of media education tools into the educational process in higher educational institutions is one of the most important conditions for improving the quality of biotechnology education and raising it to the level of modern scientific and pedagogical requirements.

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