

DEVELOPMENT OF STUDENTS' RESEARCH SKILLS BASED ON THE INTEGRATION OF RESEARCH ACTIVITIES IN THE CONTENT OF BIOLOGY EDUCATION

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ANNOTATION: This article covers the theoretical and practical foundations of integrating research activities in the biological education process, the content, and mechanisms for developing students' research competencies. The article also reveals interdisciplinary integration based on observation methods, experimentation, and projects in the development of students' research activities. Methodological recommendations aimed at developing students' research skills have been provided.

KEY WORDS: biological education, research activity, research work, observation, experimentation, ecology, physiology, biotechnology, microbiology, project method.

INTRODUCTION

One of the priority areas of modern education is the preparation of students for independent research, the formation of their competencies in scientific thinking, analysis, and creative research. Biology, as an experimental science that reveals the essence of natural processes, allows for the wide involvement of students in research activities. In the process of working with natural objects and phenomena, students master such high-level cognitive actions as observation, conducting experiments, putting forward hypotheses, drawing conclusions.

LITERATURE REVIEW ON THE TOPIC. Research activity turns students into active participants in the cognitive process. According to the educational theories of many methodologist scholars, knowledge is not given to the student in a ready-made form, but is acquired through independent activity. Therefore, inquiry-based learning is currently recognized as one of the most effective pedagogical approaches.

RESEARCH METHODOLOGY. When carrying out students' research activities, identifying their cognitive activity, areas of interest, and certain talents in various fields, and guiding students towards scientific research based on this, yields positive results.

To direct students to any scientific research, it is first necessary to determine the topic, that is, the problem of scientific research. The problem is analyzed in collaboration with the teacher and student. In scientific research conducted by students, by developing a scientific hypothesis and predicting the results in advance, the teacher should guide the student towards finding a solution to this problem. After the student has formed an understanding of this problem, a research plan is developed, and the initial planning is given to the student. The reason is that the student, when drawing up their plan, refers to various sources and acquires scientific understanding of the research plan. The student's plan is reviewed by the teacher and necessary adjustments are made. Then the teacher gives the necessary recommendations for conducting experiments and observations in nature.

Experiments and observations carried out by students themselves with their direct participation are one of the most effective methods of education. Because such activity occupies a special place in the formation of the following knowledge, skills, and abilities:

- First, the theoretical concepts given in the lesson are tested in practice, the student sees them with their own eyes and becomes convinced of their correctness through their own work. This helps retain knowledge for a long time.
- Through observation and experiments, the student sees how natural processes occur, their cause-and-effect relationships, and interrelationships through specific examples. This connects theoretical thought with real-life evidence.

- Processes such as drawing conclusions based on one's own experience, comparing results, and searching for reasons enhance students' intellectual activity and teach them independent research.
- Practical exercises such as using laboratory equipment, measuring, recording, and analyzing results serve to develop skills that will later be needed in independent life.
- experiments and observations increase students' interest in the subject and make them active participants in the lesson. This significantly increases the effectiveness of the lesson.

Therefore, the experience and observations of students are very important from a methodological point of view, and their purposeful organization in each lesson serves to improve the quality of education.

The methodological significance of processing and analyzing the results of experiments conducted by students is very great, because with the help of this process, not only is the information obtained during the experiment analyzed correctly and accurately, but also the application of students' theoretical knowledge in practice, scientific thinking skills, and research skills are formed. This is important for increasing the effectiveness of the educational process and developing students' skills in conducting independent research.

The results of the research work carried out by the students are analyzed in detail, and scientific conclusions are developed based on the analysis. These conclusions make it possible to assess the effectiveness of the methods and techniques used in the study, conduct a comparative analysis of the results, and give recommendations and directions for future scientific work. Each of these processes by students develops students' analytical and logical thinking skills.

ANALYSIS AND RESULTS. Integrating students' research activities based on various disciplines in biology lessons further increases their interest in scientific research and helps them to understand the interrelationships between disciplines in the study of processes occurring in the body. This method is implemented by directing students towards independent scientific research, starting the lesson from a problem situation, asking questions, proposing various hypotheses, and conducting independent experiments. In particular, this method is very suitable for topics such as "Photosynthesis," "Genetics," and "Ecological Balance."

The project method develops students' ability to think independently, conduct research, and solve real-life problems. This method takes students out of the passive learning process and directs them to active, searching, and creative activity. The use of the project method in biology not only strengthens students' theoretical knowledge, but also, along with the formation of practical skills, directs them to scientific research activities.

Project methods, widely used in the process of teaching biology, occupy a special place in the following. Including environmental monitoring, obtaining certain productive products through biotechnological experiments, physiological research conducted on humans and animals, and designing work on microorganisms.

Implementation of environmental monitoring projects allows students to study the state of the environment, observe and assess changes in nature. For example, in a water quality monitoring project, students measure physicochemical parameters (pH, oxygen content, nitrate and phosphate content) in rivers and lakes. Soil fertility analysis projects will help solve real problems in agriculture and ecology. Through such projects, students reinforce their ecological knowledge with practical experience.

When designing biotechnological experiments, students' projects in the field of biotechnology are aimed at creating new products or methods using microorganisms, plant and animal cells. For example, projects studying fermentation processes, extracting plant extracts, or analyzing microorganism growth conditions help students gain a deeper understanding of the scientific research process. Projects on physiological research are aimed at studying the various functions of the human and animal organisms. For example, by measuring physiological parameters such as heart rate, blood pressure, and respiratory rate, students develop skills in identifying life problems and analyzing them on a scientific basis.

Microbiological projects are aimed at studying the presence, distribution, and activity of microorganisms in various environments. Students study biological processes based on practical experience by taking microorganism samples from water, soil, or food products, cultivating them, and observing them.

In biology, the project method develops students' skills in independent research, observation, and analysis. At the same time, they gain practical experience in identifying and solving real-life environmental, biotechnological, and health problems. This method is an important tool in the formation of scientific and creative thinking.

In the process of assessing students' research activity, it is necessary to be based on a number of criteria. Firstly, the scientific validity of the problem is of great importance, in which the problem of the topic chosen by students is scientifically substantiated, its compliance with modern scientific analyses and theoretical views is checked. Secondly, the logic and validity of the scientific hypothesis are evaluated. The hypotheses put forward by students should be clear, based on scientific evidence, and aimed at finding a solution to the problem. Thirdly, the correctness of the methods chosen for conducting research is important. The methods, experiments, and data collection methods used in this study must be appropriate and effective for analyzing the problem. Fourthly, the quality of processing the obtained data and their interpretation in graphical or visual form is taken into account. At this stage, students' ability to analyze using statistical methods, correctly analyze data, and present them in an understandable form is assessed. Fifthly, the scientific significance of the conclusions and their practical application are analyzed. It is important that students can draw conclusions based on the results obtained and demonstrate their scientific and practical value. As a final criterion, the fluency of presenting the research results and compliance with the scientific methodology are taken into account. This is assessed by students' ability to express their thoughts clearly, concisely, and understandably, as well as by presenting scientific information in a logical order.

CONCLUSIONS AND PROPOSALS. Involving students in research activities and developing their research skills in biology lessons in general education schools, the integration of various disciplines is of great importance. In the research process, students apply the knowledge they have acquired in various disciplines, which contributes to the development of their scientific thinking, the formation of independent thinking and problem-solving skills. Methods of conducting observations, conducting experiments, and preparing projects in biology lessons increase the effectiveness of education.

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