FEATURES OF THE ORGANIZATION AND USE OF A PHYSIOLOGICAL EXPERIMENT IN BIOLOGY LESSONS

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Abstract. This article describes the features of using one of the most effective methods used in biology lessons in the educational process - a physiological experiment. Data on the organization, methods and effectiveness of this experiment were analyzed. The types and locations of physiological experiments, the duration and the expected results from these experiments are described. Topics are given for use in the educational process by sections and levels of difficulty. The advantages of using various experiments are described, as well as examples of experiments taking into account age characteristics. The importance of using experiments at different stages of learning is revealed, including the very initial stages of teaching biology and subsequent stages, taking into account the difficulties that may arise in the process of teaching biology. The purpose of this article is to reveal important points in organizing, conducting and evaluating a physiological school experiment and introducing new research methods into school education.

Keywords: education, teaching methods, methodology, knowledge, experiment.

In school education, along with the establishment of the scope of the content of the subject and the selection of material for the lesson, teaching methods are of great importance.

The methods chosen according to the content and age of the students ensure a high quality of knowledge. Such methods contribute to the development of concepts and skills, the strength and awareness of knowledge and have an educative influence.

“A method in the most general sense is a way to achieve a goal, an ordered activity in a certain way.”

The educational method is a way of transferring knowledge by the teacher and at the same time a way of assimilation by students.

This definition of the method expresses the concept of its two interrelated sides: transmitting, influencing – the teacher and perceiving, assimilating—the students.

In the practice of teaching biology, various teaching methods have developed [1].

Materials and methods. The study used scientific, previously published literary sources as supporting materials.

Research methods include literature reviews, the use of information and articles on the Internet.

Results and discussion
teacher of objects and phenomena, and the word of the teacher acquires a different meaning. The teacher directs the course of observations and the logic of students' thinking, clarifies the correctness of their perception. Students, observing, comprehend facts, draw conclusions, gain new knowledge, and sometimes new skills, for example, how to independently put the experience demonstrated by the teacher, prepare a micro-preparation, etc.

The main source of knowledge acquired by students is observation, not the word of the teacher, although he remains the guide of the entire cognitive process.

The activity of students is expressed in observation and telling about the observed and much less in listening and answering.

Finally, the teacher applies such methods in which the transfer of knowledge occurs mainly in the process of practical work of students. According to the assignment (instruction), they independently examine the structure of a seed, a fetus, an opened frog, produce crops at a school educational and experimental site, work on a livestock farm, etc. and, working, acquire new knowledge, skills, and then skills, i.e. automated, familiar skills.

The practical activity of students is connected with the use of research tools (tweezers, scalpel, magnifying glass, microscope, etc.) and productive (shovel, pruner, pollinator, etc.) labor.

The teacher's word is also necessary in these cases: he instructs, indicates what the purpose of the work is, what theoretical knowledge is important for its proper conduct. The teacher checks the progress of the work, helps to draw conclusions — directs the cognitive process. In some cases, at the direction of the teacher, a book (textbook, reference book and other literature) can serve to help carry out the work and acquire knowledge in the process of it as a guide to the main source of knowledge — practical work, but not as an independent source of knowledge.

Listening and observation take place in the activity of students, but practical work prevails, during which an independent thought process plays a special role, allowing solving a problem and question. The results of such work are the main source of knowledge.

When answering, students show the results of the work done and talk about it, making conclusions, notes, at the request of the teacher, repeat it again.

Thus, based on the predominant nature of the sources of knowledge, the activities of teachers and students, methods of teaching biology are divided into three groups or kinds: verbal, visual, practical.

In pedagogy and methodology for a long time there were no uniform generally accepted definitions of teaching methods and their classification. But already in the second half of the 20th century there was a common point of view on these issues.

The concept of verbal methods is usually associated with the idea of the supposedly inevitable passive role of teaching the changes in their application. Such a false understanding of verbal methods occurs due to the fact that due attention is not paid to the mental activity of students in the case of the use of verbal methods.

**The types of verbal methods include:**
- conversation,
- explanation,
- a teacher's or students' story,
- lecture.

**The types of visual methods include demonstrations:**
- experiments,
- natural objects,
- visual aids.

Practical methods are a complex interaction of words, clarity and practical work, organized and directed by the teacher, pursuing the development of students' thoughts. The application of practical methods is also associated with the active activity of receptors and analyzers of students, with the development of their general work activity [3].

The types of practical methods include:
- works on recognition and identification of natural objects;
- observations with subsequent registration of the phenomenon;
- conducting an experiment (solving the issue by experience).

**Biological experiment.** The experiment is carried out in artificially created conditions, and from a complex of diverse natural influ-
ences on the body, the effect of only isolated individual factors is selected and clarified.

The experiment is carried out mostly in the study of physiological processes. The experiment can be short-term and long-term.

An example of a short-term experiment or experience conducted in botany lessons are well-known works on the study of the composition of seeds, the physical properties of the soil, the formation of starch in leaves, etc. The simplest experiments, such as seed germination conditions, evaporation of water by leaves, students perform at home. As an example of short-term experiments conducted in the course of human physiology, one can name the work on clarifying the digesting effect of saliva and gastric juice.

Biological experiment requires for the most part a long time, so it is not carried out entirely in the classroom, but only the formulation of the experiment and its results are demonstrated [4].

In general biology, long-term experiments are conducted to find out the effects of various environmental factors on organisms, on crossing animals (laboratory mice, gold sold hamsters, pigeons).

Experimental work is usually carried out by students in the order of extracurricular activities (individual or group) in a corner of wildlife or on the educational and experimental site of the school.

The most diverse experiments are at the training and experimental site. They are especially long and take up the entire growing season, i.e. the whole summer. Students are asked questions or tasks that are solved by comparing the results of experience and control (experimental and control plants or animals are put in the same conditions, except for one test). During the experiment, accurate observations with measurements are carried out. Of particular importance is the correct fixation of observations and results of the experiment in special plates that allow comparing the indicators of development and yield of experimental and control plants and leading to conclusions. The staging of experiments should accustom students to the discipline of thought, culture, accuracy, reliability and honesty in research.

Students are accustomed to setting up an experiment, starting with the simplest experiments at home and in a corner of wildlife, thereby preparing for more complex and long-term experiments at the school educational and experimental site.

Each type of practical methods (work on distinguishing and defining, conducting observations, registering phenomena, setting up an experiment) passes a number of standards:

- Stages of practical work:
  - Statement of the question that determines the purpose of the work.
  - Technical and organizational instruction.
  - Performance of work (definition, observation, statement of experience).
  - Fixing the results (carried out simultaneously with the execution of the work).
  - Conclusions answering the suppressed question.
  - Report or message about your work in the lesson [5].

The student's practical work, depending on the content, can be constructed deductively, when an already known position is confirmed by facts, or inductively, when a conclusion is drawn based on facts. Recognition of plants or animals and their organs, as a rule, is deductive, experiment is always inductive; work on definition and observation with subsequent registration can be inductive and deductive.

In each type of practical work, it is necessary to distinguish between preliminary research work and subsequent work, consolidating and practicing concepts.

In the process of teaching biology, practical methods are modified – developed in accordance with the strengthening of students' independence and the complexity of work [6].

Properly conducted practical work forces students to perform a number of logical operations: Identifying similarities and differences, classification, conclusion, generalization, inference.

The role of experiment in the formation of beliefs, the formation and development of biological concepts and a materialistic worldview, in the development of children's cognitive abilities, in the emergence and preservation of students' research interest in biology is well known [7, 8].
A very important feature of educational experiments is that for the first time students form ideas about a biological experiment, a number of special and general cognitive concepts are formed: experiment, experience, control, variant of experience, purpose of experience, comparison, analysis in experiment, result of experience, conclusion from experience, etc. Therefore, when preparing a demonstration of experience, it is necessary to plan and work with students on these concepts – on their formation and development [9].

Modern scientific experiment includes several stages. The first is the analysis of facts or theoretical research on the basis of which the problem is formulated, the second is the compilation of hypotheses that solve it in the form of assumptions, the third is the identification of consequences that would help plan an experiment to verify the correctness of the hypothesis, the fourth is the development of experimental techniques, the fifth is its actual implementation and the sixth is a conclusion confirming or refuting the hypothesis. In school conditions, it is quite difficult to show this system as a whole, however, individual stages of the experiment can be shown to schoolchildren by the example of solving experimental problems to formulate a hypothesis, to prove an assumption and to infer from experience [10].

**Conclusion.** Experimental classes are an integral component of the educational system, implying a connection between the teacher and the student, which arises in the course of common activities - solving problems and finding the most rational solution. The ultimate goal of this organized communication between the teacher and the class is to acquire the skill of solving problems, checking or refuting the hypothesis put forward, which has a direct applied value.

On the basis of experimental research conducted during the lesson, a certain way of thinking is formed, which allows in later life to translate all the difficulties and problems that arise into tasks and implement their solution. At the same time, it is very important that from the school age the teacher should convey to the students the fact that there are no unsolvable tasks. On the contrary, there are several ways to solve any problem, but we need to choose the one that is the most rational.

**References**


ОСОБЕННОСТИ ОРГАНИЗАЦИИ И ИСПОЛЬЗОВАНИЯ ФИЗИОЛОГИЧЕСКОГО ЭКСПЕРИМЕНТА НА УРОКАХ БИОЛОГИИ

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Аннотация. В данной статье описаны особенности применения в образовательном процессе одного из наиболее эффективных методов, используемых на уроках биологии, – физиологического эксперимента. Проанализированы данные об организации, методах и эффективности данного эксперимента. Описаны типы и места проведения физиологического эксперимента, продолжительность и ожидаемый от этих экспериментов результат. Темы даны для использования в учебном процессе по разделам и уровням сложности. Описаны преимущества использования различных экспериментов, а также примеры экспериментов с учетом возрастных особенностей. Раскрывается важность использования экспериментов на разных этапах обучения, включая самые начальные этапы обучения биологии и последующие этапы с учетом сложностей, которые могут возникнуть в процессе преподавания биологии. Целью данной статьи является раскрытие важных моментов в организации, проведении и оценивании физиологического школьного эксперимента и внедрение новых методов исследования в школьное образование.

Ключевые слова: образование, методы обучения, методология, знание, эксперимент.