



## Formation of Research Competence in Teaching Biology at a Comprehensive School

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### ABSTRACT

The article discusses the main conditions for the formation of research competence in the section of school biology. The authors proved the effectiveness of the created methodology, the use of which improves the quality of students' knowledge and the level of assimilation of biological concepts, phenomena and processes.

### Keywords:

teaching biology, competence, competence, research, research competence, research activity, research skills, special skills, subject skills, experiment

The current stage of development of domestic education puts forward as the main task the education of an active, independent and competent person capable of creativity. Great opportunities for this have research activities, characterized by productivity, problematization, realization of the personal cognitive needs of schoolchildren, orientation towards their creative, independent search. The issues of the competence-based approach and the problems of formation and key competencies were studied in the works of I.A. Agapova, V.A. Bolotova, E.F. Zeera, I.A. Zimney, D.A. Ivanova, V.V. Kraevsky, O.E. Lebedeva, V.V. Serikov, A.V. Khutorsky, S.E. Shishova and others [1].

Analysis and scientific reflection of biological education in the context of the problem of the formation of research competence of schoolchildren revealed the following productive directions in its functioning: strengthening the orientation of biological education towards the development of ways of human interaction with nature; the formation of meta-subject skills and abilities, which are an educational result, built on top of traditional subject knowledge, skills and

abilities; implementation of the problem of learning motivation as a factor that opens up the possibility to decide on the choice of the future profile of education.

All of the above allows us to note an important problem at the moment in the methodology of teaching biology, which is associated with the search and development of modern technologies, methods and teaching aids to improve the quality of students' knowledge in the course of school biology. These areas have been developed to varying degrees by methodological science and practice.

An analysis of the educational field of biology in the problematization of the category of research competence in the context of the new constructive changes that are currently taking place in society and education made it possible to identify contradictions between: the reserves of the subject of biology in terms of the personal development of schoolchildren and the existing teaching practice that does not fully use these possibilities; the objective need to expand the activity potential of school biology and the insufficient orientation of programs, textbooks, methodological aids to

the practical activities of schoolchildren; existing innovative educational trends and methodological tools for their implementation in modern schools. In search of means to overcome these contradictions, the choice of the research topic was made.

An analysis of the psychological and pedagogical literature has shown that the formation of a competency-based approach in education is still ongoing. The authors (I.A. Zimnyaya, I.Ya. Lerner, G.K. Selevko, A.V. Khutorskoy) emphasize that this category is constantly evolving, and therefore there are differences in the interpretation of the concepts of "competence" and "competence". A.V. Khutorskoy distinguishes between the concepts of "competence" and "competence". In his opinion, competence is a predetermined social requirement for the educational preparation of a student, necessary for his effective productive activity in a certain environment. And competence is the possession, possession by a person of the corresponding competence, including his personal attitude towards it and the subject of activity. In interpreting the concepts of "competence" and "competence", we adhered to the point of view of I.A. Winter, G.K. Selevko, A.V. Khutorsky and other scientists who believe that competence is an integrative quality of a person, which includes not only knowledge, skills and abilities, but the ability and willingness to demonstrate them in solving urgent problems. And competence implies the presence of a minimum experience in the manifestation of competence [2,3,4]. So, V.A. Bolotov, V.V. Serikov understand competence as a way of existence of knowledge, skills, education, contributing to personal self-realization, finding one's place in the world [5].

Based on the analysis of various points of view, based on the subject of our study, the following definition by I.A. Winter: competence is a set of components of the content of education, the assimilation of which in the learning process allows you to effectively carry out practical activities. For our work, it is important to find out the place of research competence in various classifications of key competencies. Despite the active interest of

scientists in the problem of the formation of research competence, this issue remains insufficiently studied in the theory and practice of pedagogy. In the classification of I.A. Winter research competence is included as a component in the "competence related to human activity". In the classification of A.V. Khutorsky, research competence is considered as an integral part of cognitive competence. V.V. Kraevsky and A.V. Khutorskaya was suggested to consider the structure of each competence as a unity of three components: substantive, technological (procedural) and personal.

By research, we mean the study, clarification of any facts, processes or phenomena in wildlife on the basis of existing knowledge. According to the authors, research competence should be understood as knowledge as a result of a person's cognitive activity in a certain field of science, research methods and techniques that he must master in order to carry out research activities.

Based on the understanding of the structure of competence, it is necessary to find out what research activity is. M.A. Artseva, giving a definition of research activity, focuses on the unpredictability of its result, i.e. this is an activity associated with the search for a previously unknown solution to a problem [6]. The formation of research skills is possible during research work, which is carried out in two stages: a) theoretical, b) practical.

The main activity belongs to the teacher at the first stage, he is an assistant, a comrade-in-arms in search of truth and mastery of skills, introduces students to the subject. The second stage is a continuation of the first, students independently conduct research, form and consolidate these skills. As experience shows, the greatest difficulties are caused by the ability of students to correctly formulate the purpose of the study, to put forward and substantiate a hypothesis. The faster these skills are formed, the more effective the lessons and elective courses will be.

"Biology" grade 10 includes information about the distinctive features of living organisms, their structure and life processes. The content of the section is presented on the

basis of ecological-evolutionary and functional approaches, according to which the emphasis in the study of organisms is transferred from the structural features of individual representatives to the disclosure of the processes of their life and complication in the course of evolution, adaptability to the environment, and role in ecosystems. The formation of research competence is a whole methodological system, it is constructed at two levels: theoretical and methodological and methodological.

At the first level, the formation of research competence was carried out in the course of students' research activities. At the second level, the target, content, procedural, technological and resultative-evaluative components are integrated. On this basis, we have developed a methodology for the formation of research competence.

By research skills, we understand the readiness to carry out research activities based on the use of knowledge and life experience, conditions and means of activity aimed at studying the processes of life. In the structure of research skills, we identified the following components: motivational, in the form of cognitive interest; meaningful, including a system of research knowledge; operational, including a system of simple skills.

The motivational component is based on the biological knowledge that schoolchildren have and their life experience. In the content component, we consider it possible to single out two components of the system of research knowledge related to the specifics, organization and conduct of educational research, and subject knowledge that provides a conceptual framework for studying and elucidating certain biological processes, facts, and phenomena.

In the operational component, we include two groups of interrelated skills that provide a system of actions that make up the structure of research activities: special, subject. We include the following skills as special skills: to put forward a hypothesis; build a research plan; implement the planned research plan; to find out the connections of the studied phenomenon with others; formulate a solution

to the problem; explain and test solutions; draw conclusions. The organization of research activities in the study of wildlife forms the following subject skills in schoolchildren: use magnifying devices; prepare temporary micropreparations and examine them under a microscope; set up simple experiments; conduct observations and introspection, etc. The developed methodology for the development of research competencies in the lessons of biology section "Biology".

"Biology" of the 10th grade includes: defining tasks for the development of research skills for each lesson; additional educational content in research biology; saturation of lessons with tasks of a problem-research nature; organization of independent research activities of schoolchildren; use of demonstration of physiological and biochemical experiments and experiments with their subsequent discussion; use of a system of problem-research exercises, a set of research tasks for independent work.

During the pedagogical experiment, students were offered a solution to a system of research problems, for example, "When examining a plant cell under a microscope, a dense cellulose membrane is clearly visible that covers the living contents of the cell. How does water and substances dissolved in it penetrate through the membrane into the plant cell?", "Determine a way to find out how much water a sprouted onion bulb absorbs per day. Think of a way to measure how much water this bulb evaporates per day. Do you expect these values to be different? Why? Do this experiment."

Work with tasks of a research nature in biology lessons can be considered successful if there is a gradual increase in the independence of schoolchildren when discussing the issues of the task, if the students' statements become more complete and reasoned, and the teacher's activity gradually comes down mainly to communicating the necessary additional information and to the general guidance of the mental students' activities.

When choosing the forms and methods of teaching, we proceeded from the unity of the content and the learning process. Therefore, when studying biological material in order to

give knowledge a practical orientation, it is important to use research teaching methods in the classroom.

When studying the topic: "Modification of shoots" research work was carried out in pairs. At the beginning of the lesson, the students were involved in a problematic situation: a potato tuber, an onion bulb and a birch shoot lay in front of the students, the question was posed: "What is common between these parts of the plant." Some said that these are completely different parts of the plant, differing in appearance, others combined the bulb and tuber, considering them underground parts of the plant, but there were no complete and convincing answers. A state arose in the class when the students understood the problem, tried to solve it on their own, but experienced difficulties due to insufficient knowledge.

The way out of this situation was the implementation of research work. As a result of the implementation, which the schoolchildren exploratorily came to the general conclusion: the tuber and the bulb are a modified shoot, since they have a similar structure to the usual shoot. Modified shoots serve to store nutrients and reproduce, they are used as food by humans, thus, the ability to isolate a problem, put forward hypotheses and prove them empirically, the ability to compare, analyze biological objects, draw conclusions, write and draw up reports on the study was formed. It should be noted that even students who were lagging behind and not showing interest in the subject of biology were interested in these forms of education. For the lesson, research requires a lot of creative preparation, which students receive in traditional classrooms and the primary consolidation of new knowledge and methods of activity. Research lessons should be used when students are theoretically prepared to acquire new knowledge. Now the student has to analyze the possibility of applying previously acquired knowledge to solve the problem. The knowledge gained by the student on his own through trial and error, sorting through various tools, applying all kinds of formulas and actions will remain in his memory for a long time, and the value of the thought process, which, unfortunately, cannot

be described and measured, is difficult to overestimate [7].

Experimental studies made it possible to determine the pedagogical conditions for the development of research competence: a) taking into account the degree of readiness and ability of schoolchildren to conduct research activities; b) creating a psychological attitude of students to the need to perform certain actions in the process of completing a learning task; c) ensuring the clarity and accessibility of the presentation of the goal and objectives that students must solve in the course of research activities.

Competence-based tasks were developed to assess the formation of research competence. Using element-by-element operational analysis of students' activities in learning situations, we checked the levels of formation of research competence.

During the study, the following were assessed: the ability to use biological knowledge in life situations; the ability to identify questions that can be answered using biological knowledge; the ability to draw conclusions, argue their position; the ability to analyze the data of the study. To monitor the qualitative changes in students, we developed the content of assessment and diagnostic cards, which included tasks for understanding simple and complex information, analyzing and solving problems, using natural science methods and conducting research.

The results of the conducted pedagogical experiment confirmed the validity of the initial assumptions regarding the impact of the use of research teaching methods in biology lessons aimed at improving the quality of biological education. Thus, the process of forming research competence in the field of biology includes a variety of forms and methods of teaching, creating conditions for gaining experience in emotional-value relations of actualizing the processes of self-development and self-improvement of the student's personality.

Research at school is unthinkable without the actualization of the cognitive activity of students and the formation of cooperative

relations between teachers and students in the learning process.

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