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A formation of creative thinking in students under solving exercises and tasks on biology

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Abstract---The actuality of research is due to the enormous importance of the development of creative thinking in students in solving exercises and tasks in biology, the importance of the role of the teacher in the development of such qualities in a student, as well as for enhancing the cognitive activity of students in biology classes. Some types of exercises and tasks used in this study are shown. The process of developing students' creativity and independence, as well as increasing cognitive ability in the process of finding ways to solve the tasks are considered.

Keywords---creative thinking, biology, exercise, tasks, solution, student.

Currently, we are faced with the main question, which is to enhance the cognitive and mental activity of students. The implementation of the principle of activity in learning is of great importance, because learning and development are inextricably linked and the learning outcome depends on this. The development of cognitive activity is directly related to the formation of cognitive interest – the desire to cognize an object or phenomenon, to master this or that type of activity. Interest is selective and acts as one of the most significant incentives for the acquisition of knowledge [1,6,9].

Recently, we can note a decrease in the level of interest in learning activities and intellectual passivity. For this reason, we can notice the teacher's special attention to methods and techniques, thanks to which the active thinking activity of students will be increased. The more students think independently, analyze, compare, generalize, see the problem correctly, form a hypothesis, find solutions, the faster the results will improve. The use of entertaining exercises and tasks in biology classes contributes to the formation of creativity, as well as independent logical thinking. According to the current system of higher education, students receive about 40% of knowledge from the teacher, while the remaining 60% find

themselves. Moreover, this ratio is gradually changing towards more independent work of students.

It is very important that the educational and cognitive activity of students is of a creative, exploratory nature and, if possible, includes elements of analysis and generalization. The process of studying this or that phenomenon or problem should, by all indications, be of a research nature. This is another important principle for the development of creative thinking and enhancing educational and cognitive activity: the principle of researching the problems and phenomena under study [2,8,11].

Skills of independent thinking are at the forefront of teaching any discipline. Such skills enable students to make sense of the world through personal experience and observation, and in the same way make critical decisions. Giving students the same assignments and tests is not the best way to determine the grade of each student. This is why the educator must make it clear from the start that he wants his students to be active and not passive. Activation is considered to be the management of students' activity, we can observe motivation, focus on knowledge, the ability to cope with passivity, stagnation in research activities in this process. The main purpose of activation is to increase the activity of students, improve the quality of the educational process [9].

The study of biology is considered difficult, especially in some areas such as cell division, genetics, and hormones. On the other hand, there is a link between student success in science and creativity. Because creativity can be defined as the formation of new and useful ways to solve a problem, it can be used to help students learn biology. Meanwhile, according to Guilford, creativity includes both divergent and convergent thinking. Research on creativity in the study of biology helps integrate various research results and formulate ideas. While integrating different research findings is important, students generally cannot find any relationship in different topics. The formulation of ideas is used to support students' skills in developing a hypothesis and the resulting conclusion. When students reach a high level of cognitive activity in the learning process, the knowledge acquired as a result will be of higher quality, since activity is one of the necessary conditions for cognition [10]. The person involved in the learning process should be as active as possible. The goal of the teacher is to contribute to the development of students in every possible way.

In higher education, students must be good critical thinkers who can interpret, analyze, evaluate and criticize the subject taught. Meanwhile, their judgments about their ability to perform a given type of academic performance should be positive, since these judgments affect their efforts, goals and desire to learn [3]. In fact, learning can meet the expectations of higher education, as in creative learning, students are encouraged not to limit their development to the given field, to have creative thinking skills, to criticize the received information, to be aware of what they have learned, and build relationships between concepts in order to learn to perceive meaningfully [4].

Cognition in the form of conscious, creative, predictive and transformative is an exclusively human way of reflecting reality and necessarily presupposes the

activity and independence of the subject. An assignment is a written or verbal instruction for working with educational materials. It always contains some requirement: to answer a question, perform some exercise, prove or disprove something, etc. The assignment can include questions from any biological field. Take your time to choose the answer you like without finishing the exercise, carefully study each thesis and try to understand why the answer is suitable or not. You need to compose in your head your own correct statement on the proposed question and compare it with the proposed one.

There are many types of tasks in biology

selection of one or more types of answers; establishing compliance; knowledge of the essence of physiological processes and the establishment of their correct sequence; knowledge of numerical values; to combine anatomical concepts; generalization; comparison; filling in the blanks in the proposal; filling in tables with the correct indication of the answer.

Let's look at a few examples of exercise.

1. Match the terms

1	mediator	a	arousal path
2	reflexivity	b	neuronal contact point
3	synapse	c	substance that is released into the synapse cavity
4	reflex	d	reflex formation
5	reflex arc	e	the body's reaction to the influence of the external and internal environment

2. Establish the sequence of the passage of the nerve impulse through the reflex arc:

- Receptors convert these influences into nerve impulses – nerve signals;
- The reflex arc starts from the receptor;
- From them, nerve signals are transmitted through the motor nerves to the working organs;
- Nerve impulses have electrical properties and transmit impulses to the central nervous system or intermediate neurons.

Each section of biology has its own content and teaching methods. When solving tasks and tasks, we use a complex that covers many sections of biology: botany, zoology, anatomy, ecology, molecular biology, reproduction, metabolism, evolution, biochemistry, genetics. Genetics, in turn, is subdivided into the following sections: Mendel's laws; analyzing crossing; gender genetics (sex-linked and non-sex-linked); codification; intermediate inheritance; interaction of genes: complementarian, epistasis, polymerization and pleiotropy.

When compiling assignments and tasks in biology, we used the content of these sections, and also provided guidelines for each of them. First of all, the student must correctly formulate the task, and then, according to the principle of algorithmization, perform it step by step. All actions must follow a logical sequence. If everything is done correctly, then we will get positive results and achieve an increase in cognitive activity.

A pedagogical experiment on the implementation of the formation of skills and abilities among students in solving exercises and tasks in biology was carried out at the Tashkent State Pedagogical University named after Nizami at the Faculty of Natural Sciences in the groups of the direction of methodology of teaching biology. The experiment consisted of ascertaining and formative stages. Teaching methods used during the class: verbal (story, explanation, conversation, work with a book), visual (visual, auditory, tactile, painted posters, blackboard), practical (practical action performed by students) [5].

In his experiment at the ascertaining stage, the value of the cognitive criterion prevails in the area of medium and extremely low values. Practical - in the area and high values of the non-pragmatic modality of the relationship is approximately the same. Analyzing – represented more in the area of average and low-average values than high, the main indicators are in the area of average values.

At the formative stage, a stimulus material was developed. The proposed tasks were differentiated into groups: 1) solving exercises and tasks simplified; 2) solving exercises and tasks of medium complexity; 3) solving extraordinary exercises and tasks. For students, the value of the cognitive criterion generally has from medium high to very high values, and there are no criteria for extremely low and low values. The indications of the practical criterion of non-pragmatic modality of relations are insignificant in the area of low and prevail in the area of medium and high. The analyzing criterion is presented more in the area of medium and high values.

Comparison of the values of the criteria at the ascertaining and formative stage of the pedagogical experiment shows that after training according to the experimental methodology, students showed an increase in indicators for all criteria, which indicates the positive effectiveness of the application of this methodology. Comparison of the values of the criteria at the ascertaining and control stages of the experiment, students show that the same values of the studied ratio have been preserved, as in the first diagnosis at the ascertaining stage.

From the above, we can say that in the process of teaching biology, we must actively use entertaining tasks and tasks in biology, which form cognitive activity, develop logical thinking, as well as independent thinking [7]. Based on the study of psychological and pedagogical literature, conducting experimental work, we came to the following conclusion: for the successful teaching of biology, it is necessary to know the characteristics of the educational activity of a middle-level student, because this is what makes it possible to successfully choose the right teaching methods and techniques; an important task of a teacher is to teach students how to perform new forms of educational activity, not to let their interest in them fade away; for the purpose of high-quality teaching of biology, the teacher should rely on the cognitive interest of students, and, in order to develop cognitive interest, the teacher uses additional forms of education in his activities that positively affect the assimilation of educational material and activate cognitive interest in the subject.

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