



WAYS TO DEVELOP STUDENTS' CREATIVE THINKING IN BIOLOGY TEACHING

Mirjalol R. Khayitov,

Researcher, Tashkent State Pedagogical University Tashkent, Uzbekistan

Ozoda S. Kholmurodova

Researcher Of The Tashkent State Pedagogical University Tashkent, Uzbekistan

ABOUT ARTICLE

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Abstract: Creative thinking is a vital skill in the field of biology, as it encourages students to think critically, solve problems, and explore innovative approaches to scientific inquiry. This article aims to provide educators with a comprehensive overview of effective strategies to foster and develop students' creative thinking abilities within the context of biology teaching.

The article begins by highlighting the importance of creative thinking in biology education and its relevance to nurturing students' scientific curiosity and engagement. It then explores various pedagogical approaches that teachers can employ to stimulate creative thinking among their students. These approaches include encouraging open-ended questioning, promoting divergent thinking, incorporating hands-on activities and experiments, and fostering collaboration and peer learning.

Furtherore, the article discusses the role of technology in enhancing creative thinking in biology teaching. It explores the potential of digital tools and resources, such as virtual simulations, interactive apps, and online platforms, to provide students with immersive and interactive learning experiences that foster creativity and problem-solving skills.

Additionally, the article addresses the significance of creating a supportive classroom environment that encourages risk-taking and embraces failure as an opportunity for growth. It emphasizes the role of the teacher as a facilitator and motivator, fostering a positive mindset and providing constructive feedback to nurture students' creative thinking abilities.

Lastly, the article highlights the importance of assessment and evaluation methods that align with the goals of promoting creative thinking in biology education. It suggests alternative assessment strategies, such as project-based assessments, portfolios, and presentations, that allow students to demonstrate their creative thinking skills beyond traditional exams and quizzes.

By implementing these strategies, educators can create an environment that nurtures students' creative thinking abilities in biology teaching, empowering them to become critical thinkers and problem solvers in the field of biology and beyond.

INTRODUCTION

To improve the quality of education in the world's leading educational institutions, to modernize the content of education based on the competence approach aimed at forming the ability to creative and logical thinking, independent research, the ability to use the acquired knowledge, skills and abilities in their practical activities. scientific research is being carried out.

Thought is a spiritual-human quality that makes up human activity, his own strength, power and knowledge. Since the development of thought is the main driving force of socio-economic development, it is necessary to develop students' creative thinking skills in the process of teaching biology.

The dictionary meaning of the concept of creativity in English is "create", "creative" means creator. Creativity is the creation of new ideas, a non-standard way of thinking, finding positive solutions to given problems. Creativity is a student's creative ability that describes the readiness to produce new ideas and is part of talent as an independent factor. Creative thinking is important in the educational process. Creative thinking is considered an important stimulus that young people need to develop in themselves today.

The main results and findings

In the development of creativity in students, it is necessary to pay attention to the following:

1) encourage them to ask a lot of questions and support this habit; 2) encouraging students' independence and increasing their responsibility; 3) creating an opportunity for students to organize independent activities. In addition, the following factors prevent the development of creativity in students: 1) risk avoidance; 2) allow rudeness in thinking and behavior; 3) underestimation of personal

fantasy and imagination; 4) subordination to others; 5) thinking only about success in any case. Prevention of such obstacles directly depends on the teacher's professional and pedagogical skills.

Creativity describes a person as a whole or his specific characteristics. Also, creativity is reflected as an important factor of talent. In addition, creativity determines mental sharpness. According to the famous scientist P.Torrens, the concept of "creativity" is based on the following: - putting forward scientific hypotheses or problems; hypothesis testing and modification; identifying the problem based on the formation of decision results; the sum of knowledge and practical actions in finding a solution to the problem is highlighted.

Creativity is consistently developed in certain stages. Although creativity is often visible in students' work, this situation does not guarantee that students will achieve creative achievements in the future. It only represents the possibility that they need to master this or that creative skill.

In order to develop students' creative thinking skills in teaching the subject of biology, the teacher should first of all:

- ☒ creating educational assignments for students to work independently in class;
- ☒ preparing instructions for conducting experiments and observations in order to study biological objects, seasonal changes in nature;
- ☒ taking into account the interests of students, it is necessary to choose additional literature and multimedia for their creative thinking.


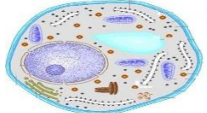


In order to develop students' creative thinking skills, it is appropriate for the teacher to be able to apply the educational technology that develops in the educational process to his pedagogical practice.

The main idea of developmental educational technology is the comprehensive development of students. The main features of this technology are:

- forms and develops the mechanism of thinking by turning students into subjects of their cognitive activity;
- students' cognitive activity is organized in the integrity of empirical and theoretical knowledge, deductive learning of knowledge becomes a priority in the teaching process;
- the basis of the teaching process is the independent activity created by the performance of the educational tasks of the students;
- preparing the ground for students' intellectual development and forming creative thinking in this process is considered a priority.

Students can use components of analytical thinking, particularly independent thinking skills, to develop creative thinking skills. It should be noted that it is impossible to develop creative thinking skills in students without developing analytical and independent thinking skills. Because these two types of thinking are the basis of creative thinking.

In order to develop students' creative thinking skills, the biology teacher should give tasks that determine the connections between the studied objects and the studied object in each lesson. For example, when studying the topic "Tissues" from the biology textbook intended for 7th grade students of general education schools, divide the students into small groups and give them the following table along with the educational tasks. filling is recommended:

Cell structure				
Cell shell				
Organoids				
Nutrition				
Synthesis of ATF				
Reserve material				

Pupils analyze the educational information provided in the textbook, select facts about the cell structure, compare them with previous objects and draw a conclusion. Students analyze the internal structure of the cell and compare it with previously studied bacteria, fungus, plant, and animal cells. Studying educational materials in this way prepares the ground for students to develop creative thinking skills.

In order to activate the knowledge acquired by the students from the subjects of natural sciences, the teacher recommends them to fill in the following table along with the educational tasks when studying the topic "Diversity of Vertebrate Animals" from the biology textbook.

Task 1. Compare the structure of fish, amphibians, reptiles, birds and mammals. Identify the similarities and differences in their structure.

Comparable Aspects	Fish	Amphibians	Reptiles	Birds	Mammals
Body cover					
Digestive system					
Blood circulation					
Breathing					
Subtraction					
Nervous system					
Sense organs					
Increase					

As soon as the students finish the task, the teacher asks them to explain why the representatives of the animal world are diverse on Earth.

After students complete these tasks, the teacher provides information about the diversity of vertebrates and recommends students to give examples. In this way, students develop analytical thinking skills.

Independent thinking is important in creative thinking as well as analytical thinking. Independent thinking creates the basis for the formation of characteristics such as analyzing problematic situations, putting forward hypotheses, applying previously acquired knowledge, skills and abilities in new situations, acquiring new knowledge, skills and abilities, proving one's opinion. Therefore, it is necessary for the teacher to pay attention to the development of independent thinking skills in students in all forms of teaching biology (lessons, extracurricular and extracurricular activities, excursions).

Independent thinking is carried out in the following stages:

- analysis of problematic situations;
- put forward hypotheses;
- applying previously acquired knowledge, skills and abilities in new situations and acquiring new knowledge, skills and abilities;
- to prove one's thoughts;
- check the correctness of the answer.

In order to develop independent thinking in students, the teacher should create problem situations in the study of each topic and direct students' cognitive activity to solve problem situations.

Along with the above thinking, logical thinking is the basis for developing creative thinking. Logical thinking is a systematic process aimed at determining the logical sequence of methods, logical reasoning, taking into account the internal and external logic of problem solving.

The development of logical thinking skills consists of the following stages:

- understanding of the problem situation;
- identifying ways to solve the problem;
- reasoning logically, taking into account the internal and external logic of problem solving;
- to determine the logical sequence of problem solving methods;
- prove the correctness of their answers;
- check the correctness of the answer.

Systematic thinking is based on the development of students' skills to divide the studied object into parts, to determine its integrity, interdependence, and to describe it.

In order to develop systematic thinking in students, the teacher should organize students' independent work on certain topics and prepare appropriate educational tasks. In particular, it is appropriate to recommend the following educational tasks to students on the topic "Cell structure and function".

The didactic purpose of the assignment: by studying the structure and functions of the cell, to determine that the cell is a complete system, the structure and function of organelles, and the connections between them.

Cell organelles	Structure	Function

Thus, critical thinking embodies analytical, connected, independent, logical, systematic thinking, and there are internal and external, specific and relative connections between them.

Creative thinking skills form the basis of creative activity experiences. When acquiring creative activity experiences, students should be able to analyze, compare, divide the studied object into components, synthesize, imagine cause-effect relationships, generalize and draw conclusions, which are methods of mental activity. Only then will students learn the features that form the basis of creative activity: finding new features and functions of familiar objects, solving problems in familiar situations independently, solving problems by applying knowledge and skills to new unexpected situations, acquired knowledge and can learn to apply skills creatively in practice.

An important condition for the development of students' creative thinking skills is to prove their ideas. Therefore, students' creative thinking skills are mainly developed through educational discussions and debates rivojlantiriladi.

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