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Paper Authors

**Mustafaqulova Dildora Ismatullayevna, Ismatullayev Otabek**



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## DEVELOPING OF SYSTEMATIC THINKING OF STUDENTS IN BIOLOGY COURSES

<sup>1</sup>Mustafaqulova Dildora Ismatullayevna, <sup>2</sup>Ismatullayev Otabek

<sup>1</sup>Teacher of Biology and Methods of Teaching at the Faculty of Natural Sciences

<sup>2</sup>Student of Faculty of Pedagogical Psychology, Department of Defectology

**Annotation:** This article discusses the problems of developing students' structural thinking through the use of new pedagogical technologies in the teaching of biology.

**Keywords:** Biology, Keys, Insert, Waster, Venn diagram, Brainstorming,

Today, the problem of training biology teachers is more important than ever for the developing general secondary education system, both globally, both scientifically and theoretically.

As the first President of Uzbekistan noted, today, at the threshold of the XXI century, in the context of rapid development of scientific and technological processes and changes in world geopolitical structures, the problem of managing the impact on the biosphere, as well as social development is [1, p. 110].

The teaching of biology in secondary schools is currently carried out on the basis of the scientific and cultural heritage of thinkers of the past, taking into account local traditions and characteristics, as well as the achievements of modern Uzbek scientists in biology and ecology.

Article 42 of the Constitution of the Republic of Uzbekistan states: "Everyone is guaranteed freedom of scientific and technical creativity and the right to enjoy cultural achievements" [2].

Science plays an important role in the economic and social-spiritual development

of society. From the first days of independence, our country has been paying great attention to creating conditions for the development of fundamental sciences, and effective projects and developments are being put into practice.

Consistent implementation of reforms in all areas of science, its connection with socio-economic development, is yielding positive results. We can see this when the results of fundamental research of scientists of our republic are recognized by the international community. A well-thought-out system of involving young people in science, the support of young professionals with new thinking, serves to further increase the effectiveness of this work.

The science of the XXI century is inextricably linked with the creation of new technologies. In particular, the great discoveries and inventions made in recent years in the field of biology have become the basis for the effective solution of a number of problems in medicine and agriculture, as well as the introduction of modern innovative technologies [129].

The problem of protecting the environment and flora is of vital importance for all mankind. The independence of our country has given a fundamentally new impetus (internal impetus) to the protection of the environment, flora and fauna. On December 9, 1992 the laws "On nature protection", on May 7, 1993 "On specially protected areas", on December 26, 1997 "On protection and use of flora", in 1999 "On forests" were adopted [9, 10,11,12]. These important documents allow us to preserve the flora of the republic in all its forms. The threat of extinction of flora and fauna requires significant measures at the national and global levels. Founded in 1948, the International Association for the Protection of Nature and Natural Resources manages all activities aimed at the conservation of flora and fauna, as well as the publication of the Red Book of endangered and endangered animals and plants. Many countries create their own "Red Book" and keep records of plants and animals in their territories. The Red Book has been published in Uzbekistan since 1979.

During the years of independence, our country has created a legislative framework for environmental protection, conservation and use of natural resources, in cooperation with the world community to improve the environment, systematic measures are being taken, rational and integrated use of natural resources, production from environmental pollution. Some progress has been made in achieving conservation, harmony of environment and community life through the

use of environmentally friendly technologies [15,139].

The need to include biological and environmental issues in school and university biology courses is consistent with the ideas of sustainable development in the coming decades.

Sustainable development is a development aimed at meeting the needs of the current generation, which should not endanger the needs of future generations.

Effective education and upbringing, leading to sustainable development, requires covering the physico-biological, socio-economic foundations of life and finding and studying the connections and interrelationships between them.

By incorporating the idea of sustainable development into the content of all disciplines, it is necessary to develop students' understanding of economic, environmental, social factors, to help them develop harmoniously, otherwise it can lead to a crisis.

The goal of education for sustainable development is to bring up an educated person who has an active civic position, who is able to critically observe, evaluate his / her activities and behavior, and who can see the future, who is socially developed and has a positive attitude to the environment.

Uzbek scientists are also making a worthy contribution to the development of world science. This is evidenced by the promising biotechnological projects of our scientists in such areas as medicine and agriculture. In particular, we can cite the research of 25 young scientists, candidates of biological

sciences Zabardast Buriev, Alisher Abdullaev, Shukhrat Shermatov, Fakhridin Kushanov, who have improved their skills in developed countries. We can highlight the results of important global research obtained by scientists of the Academy of Sciences of the Republic of Uzbekistan. Important fundamental scientific results in the field of bioecology are:

- creation and conservation of biological diversity of flora and fauna of the republic, including in the ecological crisis zone - the Aral Sea region;
- Preparation and publication of two volumes of the Red Book of Uzbekistan;
- Establishment of the Institute of Genetics at the Republican Academy of Sciences at the suggestion of the First President;
- Approval by the state of the scientific program "Geninmar" providing development of genetic engineering;
- Creation of biotechnologies based on genetic engineering in cooperation with the Scientific Center for Genetic Engineering "Geninmar" of the State Committee for Science and Technology of the Academy of Sciences [14,52,65].

At present, the achievements in the field of biotechnology and genomics and new innovative technologies are opening up new and effective ways to solve the problems of understanding the human body, plants and nature. During the years of independence, large-scale work is being carried out on the development of new biotechnology and genomics.

I.Abdurahmanov, founder of the Center for Bioinformatics and Genomics in Uzbekistan,

Doctor of Biological Sciences, Professor, the only full member of the International Academy (TWAS) from Central Asia, in cooperation with the Texas University of Agriculture and Mechanics Biotechnology Center (Texas A and M) discovered a family of going genes. This, in turn, serve as a basis for biotechnologies aimed at improving the quality of cotton fiber.

I.Abdurahmanov has been presenting the results of his inventions on cotton genetics to the international community through his lectures at Oxford University. Prof. The scientific project of treatment of hepatitis B (popularly known as jaundice) with the use of genetic and cellular engineering diagnostics by laboratory scientists under the leadership of Sh.S.Azimova has been successfully completed.

In order to activate the cognitive activity of students in the study of biology, the course should identify the knowledge, skills and abilities acquired by students on the previous topic, systematize the knowledge, skills and competencies acquired on a new topic and monitoring and evaluation, as well as the use of local technologies in the process of learning a new topic. "Case", "Insert", "Waster", "Venn diagram", "Brainstorming", "Working in small groups", "Chain of terms", "Sheet of terms", quick games from local pedagogical technologies in teaching biology and it is recommended to use different forms of game exercises. The use of "Keys" in the teaching of problematic issues in the content of the course of biology is highly effective. "Keys" are derived from the English word

case studies, meaning process or situation. Initially, this technology was used in the training of businessmen and entrepreneurs. Then in the teaching of biology, evolutionary concepts in the content of the program have led, and can also be used in the teaching of controversial topics such as “the emergence and development of plants” and “the emergence and development of the animal kingdom”. In order to use the case in the educational process, the teacher must:

- identify the problematic topic in the content of the program, create problem-solving tasks to teach these topics;
- determine whether the problem-solving task will be organized individually or in small groups of students according to the level of difficulty during the lesson;
- plan ways for students to engage in learning activities to address these issues and participate in discussions through learning discussions;
- form a final opinion in the learning discussions organized on the basis of problematic questions and tasks.

It is recommended to use Insert on topics that are intended to study only factual material in the program content. Insert is a pedagogical technology at the local level, which is used by students to understand the main idea and factual material in the curriculum. Students will be given a syllabus and a spreadsheet to help them develop their Insert skills. Students are encouraged to review

each sentence and mark it on a special table using specific symbols. If the information given in the sentence corresponds to the knowledge acquired so far, “I know” - V, if the information is clear and new, then “I agree” +, if the information is students if it does not correspond to the acquired knowledge, then "it is necessary to learn" -, if students have difficulty in mastering the learning materials, then "I do not understand"? puts the mark.

The following requirements must be observed when using Insert in the educational process:

- Students are divided into small groups, but through Insert, each student must first work individually and complete the table, after which the group members complete the work within the specified time, compare opinions;
- Ensuring that the members of the subgroup are the same in the table through the learning contest, ie achieve the same in the next two columns of the table; j: r: n: i j
- The teacher should organize the discussion based on the questions and assignments based on the teaching material and the signs of the small group members in the table. The advantage of working with the insert is that first there is a mutual learning competition between the members of the small group, filling in the gaps in the knowledge of the students, filling in the gaps in their knowledge. The information provided by the teacher on teaching serves the effectiveness

of education. The function of the source of information in the pedagogical activity of the teacher using the insert is slightly reduced, and the functions of management and control of students' cognitive activity are increased. Therefore, the teacher should carefully plan and implement this issue.

The use of clusters is important in the teaching of biology in order to systematize and consolidate the knowledge acquired by students. Waster - cluster - means tree in English. This local technology is the basis for the development of analytical and critical thinking skills, allowing students to understand the relationship between the ideas, theories, laws and concepts that are assimilated to understand the interdependence.

Creating a cluster is done in the following order:

- a specific idea in the content of the biology course is written in the middle of the board or paper;
- The laws and concepts related to this idea are determined by an indicator of their interconnectedness, then the actual data of these laws and concepts are recorded graphically and a network is formed;
- A conclusion is drawn about the connections between the topic studied and the topic being studied. In cluster-based lessons, students are divided into equal number of subgroups, explained the didactic purpose and order of the assignment, and given the opportunity to summarize their ideas, defend the cluster they have created, and justify their ideas, the best and reasonably structured Waster is determined,

the winners are encouraged. Creating a cluster as a whole on a single topic or chapter provides a foundation for students to think systematically. At the heart of a cluster is a basic idea or concept, for example, the structure of a cell is structured as follows:

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Then, in the form of a network for each section, for example, genetic variability, struggle for survival, and natural selection are included in the driving force section, followed by their types, and thus the interrelationships between the concepts are described in tabular form. One of the technologies used locally in the educational process is the Venn diagram, named after the English scientist John Venn, who developed it. The Venn diagram requires the analysis, synthesis, and comparison of facts, concepts, and processes from the subject under study. This diagram can be used to analyze, synthesize, and compare natural selection and artificial selection, natural selection, and forms of struggle for survival. For example, it is recommended that the Venn diagram used to compare families of flowering plants be as follows.

It is important to prepare the ground for students to master the concepts and terms in the educational process, so the teacher should bring the concepts and terms in the content of each chapter and topic to the "Chain of Terms".

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