

THE IMPORTANCE OF TEACHING BIOLOGY BASED ON THE INTEGRATION OF NATURAL SCIENCES

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ABSTRACT

This article shows important aspects of integrating physics, chemistry, geography into teaching biology. On the basis of the integration of natural sciences, a methodological model was developed to improve the methods of teaching biology, and according to the results of the experiment, the efficiency of assimilation in the Tashkent region averaged 11-13%, in the Andijan region 11-13%. 12%, Fergana allowed to increase by 12-13 percent in the region.

Keywords: Integration, biology, natural history, chemistry, physics, geography.

INTRODUCTION

In order to raise the standard of instruction and make lessons more effective, general education schools are now putting extensive measures in place. The Decree of the President of the Republic of Uzbekistan dated August 12, 2020 (No. PQ-4805) "On measures to improve the quality of continuous education and the effectiveness of science in the fields of chemistry and biology" confirms the above-mentioned information. In addition, on the basis of modern educational concepts, the National Program, textbooks, teaching aids are published and implemented in accordance with the requirements of the time.

The following information provided in the Decree of the President of the Republic of Uzbekistan dated August 12, 2020 (No. PQ-4805) "On measures to improve the quality of continuing education and the effectiveness of science in the fields of chemistry and biology" is the basis of our research.

Research institutes of the Academy of Sciences and business associations, industrial enterprises and clusters - to ensure an effective educational process in the areas of chemistry and biology in affiliated universities, to achieve the integration of science and production, the area is ripe for undergraduate practice under the guidance of specialists, creating conditions for familiarizing students and teachers using laboratories and production processes, providing practical assistance in the defense of candidate and doctoral dissertations, providing support in the implementation of the results of scientific work and scientific cooperation in the commercialization of developments [1].

In this regard, the affiliated organizations provide basic vocational and vocational schools, higher and vocational education, research institutions with textbooks, laboratory equipment and equipment, organize internships and internships for teachers, encourage their work, encourage, attract foreign specialists, help students participate in prestigious international Olympiads and covering other expenses [1].

In recent years, more and more attention has been paid to the use of integration, i.e. interdisciplinary communication, in the process of teaching biology. On the basis of integration, the following new sciences related to biological science have emerged: molecular

biology, ecology, biogeography, biochemistry, biophysics, bioinformatics, biometrics, radiobiology, cosmo biology, bionics, etc.

The distribution of organisms is studied by the science of biogeography, the composition of tissues and cells - by the science of biochemistry, physical processes and methods - by the science of biophysics. In turn, these sciences can be divided into separate sciences according to the objects of study (for example: plant biochemistry, animal biochemistry). Biochemical and biophysical methods are often combined or merged with other disciplines to form new disciplines (eg radiation, biochemistry, radiobiology). Biometrics, that is, biological mathematics, is of great importance in the analysis and generalization of the results obtained as a result of biological research. At the level of studying the structure of living organisms, a number of sciences have been formed (for example: molecular biology, histology, anatomy, ecology, etc.). Issues of biology directly related to practice are studied by such sciences as parasitology, helminthology, immunology, bionics, and space biology [5].

METHODS

We have observed that the issue of using the integration of natural sciences in biological education is presented in the scientific and methodological literature in different areas.

E. Belskaya's book "Botanical Didactics" (Tashkent, 1978) describes the essence of interdisciplinary connections in botanical education and the place and role of topics such as air, water, and soil in the 1-4th grade natural science lessons and it is very important to remember above-mentioned topics of the growth and development of plants, because it will help students to understand the lessons of physiology.

Authors of the book - "Mejpredmetnye svyazi v obuchenii biologii" in 1978, V.N. Maksimova, N.V. Gruzevarin analyzing various aspects of the issue of interdisciplinarity, showed connections of botany, zoology, human and health and general biology lessons in natural science, and chemistry, physics, information technology with subjects such as geography, mathematics.

C. M. Fayzullaev's scientific work presents the methodological foundations of the problem of interdisciplinary communication and its coverage in the literature. Some topics of the VII-XI course of physics are enriched with materials on the environment. Attempts were made to conduct classes in physics in various forms using interdisciplinary communication. But students should know these lessons the content of existing environmental knowledge, their characteristics and the issue of their rational use are not disclosed.

Some of the literature deals with the role of visual aids in the use of integration.

The place and role of integration in the teaching of zoology is incomparable, so several works have been published on this subject. K. Samadov, in his article on the connection of zoology with other sciences, pointed out a number of issues of interdisciplinary connections in zoological education. He paid special attention to the concepts of animals in the natural science textbook. In the 1970s, in the methodology of teaching zoology, methods of teaching general human biology and human health, attention was paid to interdisciplinary connections in teaching aids for teachers.

There is great potential for integration in biology education. Stolyarova Valeria Vadimovna in the article "The system of integrated lessons in biology and chemistry as a means of

environmental education" writes about the importance of chemistry in the essence of the breathing process as follows.

Carbon dioxide and water resulting from oxidation are called metabolic end products and are excreted from the body. Carbon dioxide is removed through the respiratory organs.

An analysis of the psychological and pedagogical literature shows that Yu. A. Kamensky, J. Locke, I. Herbert, J. J. Rousseau, I. G. Pestalozzi, K. D. Ushinsky, P. F. Kapterov gave information in their works about the importance of integration in the educational process.

The concepts of biological science help to better understand physical laws. Physicist Richard Feynman said that biology contributed to the formation of the law of conservation of energy [5].

Zunnunov A., Sulaimonov A., Musaev U., Mavlonova R.A., Burkhanov R., Safarova R., Abdullaeva B.S., Yusupov Sh., Redzhapova D., Azimova Z., Nazhmiddinova T.N., Juraev R.Kh., Kh.P. Nazarova, E.Turdikulov, M.Mirgosimova, T.Nuriddinov, N.Abdullaeva, N.Abdusamatova, Kha.A.Yulbarsova, have done works on the formation of natural science knowledge among students, A.Azizov, A. Abdulkasimov, I. H. Abdullaev, M. Aligulova, P. Gulomov, N. Mamashokirov, A. Tukhtaev, G. Komilova, P. Baratov, S. Matsaidova, Sh. Nuritdinova, Sh.Mirzaakhmatova, D.Polatova, H.B.Norbotaev on the acquisition of environmental knowledge, environmental education, and a number of other scientific works [6].

RESULTS

The main goal of our scientific work is to improve the methods of teaching biology on the basis of the integration of natural sciences into a general secondary school, as well as to determine the effectiveness of didactic materials developed with the help of a pedagogical experiment.

Our research aims to clarify the method, form, and means and develop a methodological system based on them, as well as to prepare a scientific and methodological manual, by analyzing the pedagogical and psychological possibilities for improving the methods of teaching biology based on the integration of the natural sciences to 7th grade students.

For the purpose of conducting a pedagogical experiment, the natural science literacy of students was developed for students in the seventh grade of general education schools. It involved examining the effects of increasing the level and developing specific laws and measures based on the results obtained.

The educational process of the 7th grade in general education schools was observed throughout all stages of our research (2021–2022, 2022–2023) and evaluated based on the aims and objectives of biology courses.

In the Tashkent region, where the pedagogical experiment was conducted, the effectiveness of teaching experimental 7th grade students of specialized general education schools on the integration of biology with other natural sciences averaged 11–13%, and in the corresponding general education in the Andijan region, the effectiveness of teaching experimental 7th grade students of general education schools is an average of 11–12%.

A topic-based curriculum that is organized to let students create independent work tasks by reflecting particular knowledge and abilities, studying, practicing, and reinforcing them, as well as monitoring and researching the activity's content to enable evaluation. With the help of the students, it was determined how much they had learned about biology in terms of natural science, chemistry, geography, and physics.

To solve the problem, sociological techniques (questionnaires, interviews, and question-answer sessions), modeling, pedagogical observation, mathematical and statistical analysis of the pedagogical experience, and generalization techniques were all used during the study. given assignments.

The didactic material and the related recommendations were put to the test at this point in our pedagogical experiment.

The experimental skills that 7th grade students learned were tracked and assessed through project work, laboratory and practical classes, and other means to ascertain the efficacy of the effort.

Students' performance on their practical assessments was graded using a 5-point scale and the average score method.

The pedagogical and psychological (didactic, methodical, factual, theoretical, and practical) options for enhancing biology teaching strategies based on the integration of natural sciences are identified, with a focus on students' cognitive activity.

Due to the importance of motivating, reflective, and didactic factors in training sessions in accordance with integrated educational technologies of the goal, process component, and result, the mechanism for the development of a holistic natural-science imagination was improved when the methodology of teaching biology based on the integration of natural sciences was improved.

Students can explore the patterns of life processes more broadly and simply due to the integration of natural sciences in the classroom. It is crucial to devote more attention to creating consistent connections between chemistry, physics, astronomy, and geography while describing the subject matter of biology lectures. All disciplines of biology lessons can employ such interdisciplinary integration.

When teaching, integration takes the form of incorporating the necessary knowledge on the same freshly studied topic from other disciplines in order to enrich the subject while covering specific issues in one subject to heighten student sensitivity and activity. The harmonious assimilation of material is made possible by inventiveness and enthusiasm in the lesson.

The development of competence in the lectures on how biology relates to other subjects shows how academic subjects are related. Students improve their transdisciplinary skills and logical reasoning [5].

DISCUSSION

Students find it challenging to independently generalize and apply knowledge acquired across multiple areas. Because of this, it is advisable to hold integrated classes to aid students in

developing a comprehensive understanding of the things, occurrences, and processes under study.

A textbook called "Integration of biology and related natural sciences" has been created based on the integration of natural sciences, and it helps to advance the way biology is taught. Here are some examples of how science can be included in the curriculum.

Natural science terms like "body," "substance," "element," "molecule," "macromolecule," "micromolecule," "water," "structure," "pressure," "temperature," "diffusion," "osmosis," "turgor," "phenomenon," "process," "energy," "movement," "photosynthesis," "resin," etc. are used to refer to general natural science ideas.

Biology students frequently employ physics and chemistry concepts like energy, process, water, and organic and inorganic substances to examine the processes of photosynthesis, chemosynthesis, assimilation, and dissimilation.

Many biological ideas are intricate, and it is impossible to understand them without relating them to physical and chemical ideas. As an illustration, the cell receives the minerals, water, oxygen, carbon dioxide, and other elements required for photosynthesis and respiration from the air and the soil. The aforementioned ideas were covered in chemistry and physics lessons.

The efficiency of the subject is impacted by how information regarding the exchange of gases during an organism's breathing is explained in a physics textbook by the concept of diffusion.

It is also taken into account that the body performs the role of transferring food and oxygen through the blood to the body and the significance of blood in gas exchange in the topic "The phenomenon of diffusion in various media" in the physics for grade 6:

"Diffusion has a significant role in both human and animal life. As an illustration, diffusion causes air oxygen to enter the body through human skin. Animals' intestines produce nutrients that diffuse into the blood [3].

An efficient outcome is obtained by relating the processes of photosynthesis and respiration to chemistry and physics. The seventh-grade biology textbook's chapter on "The Essence of Breath" was read to us. We will explain the subject of "Plant Breathing" as we study it by relating it to ideas from the natural sciences, such as chemistry and physics.

According to a biology textbook, a plant's respiration mechanism and its nutritional process are highly dissimilar. Organic materials in the leaves do not form during breathing; rather, they degrade. The fact that breathing does not require light is another significant distinction. Day and night, plants continuously breathe. During the day, the process of cellular respiration and the synthesis of organic materials take place simultaneously in the leaf's cells. Some of the oxygen produced during photosynthesis is used by plants for respiration. Through the stomata on the leaves, the remaining oxygen is expelled into the atmosphere. Aerobic organisms use this oxygen for respiration [2].

The information below on the subject of "Natural and artificial light sources" in a sixth-grade physics textbook can be linked to the principles mentioned above.

"Complex processes take place in plants under the influence of sunlight, including the release of oxygen, which is necessary for life on Earth, and the formation of proteins and fats." [3].

The following details regarding photosynthesis are provided in the section of the seventh-grade chemistry textbook titled "Using the Most Important Oxides":

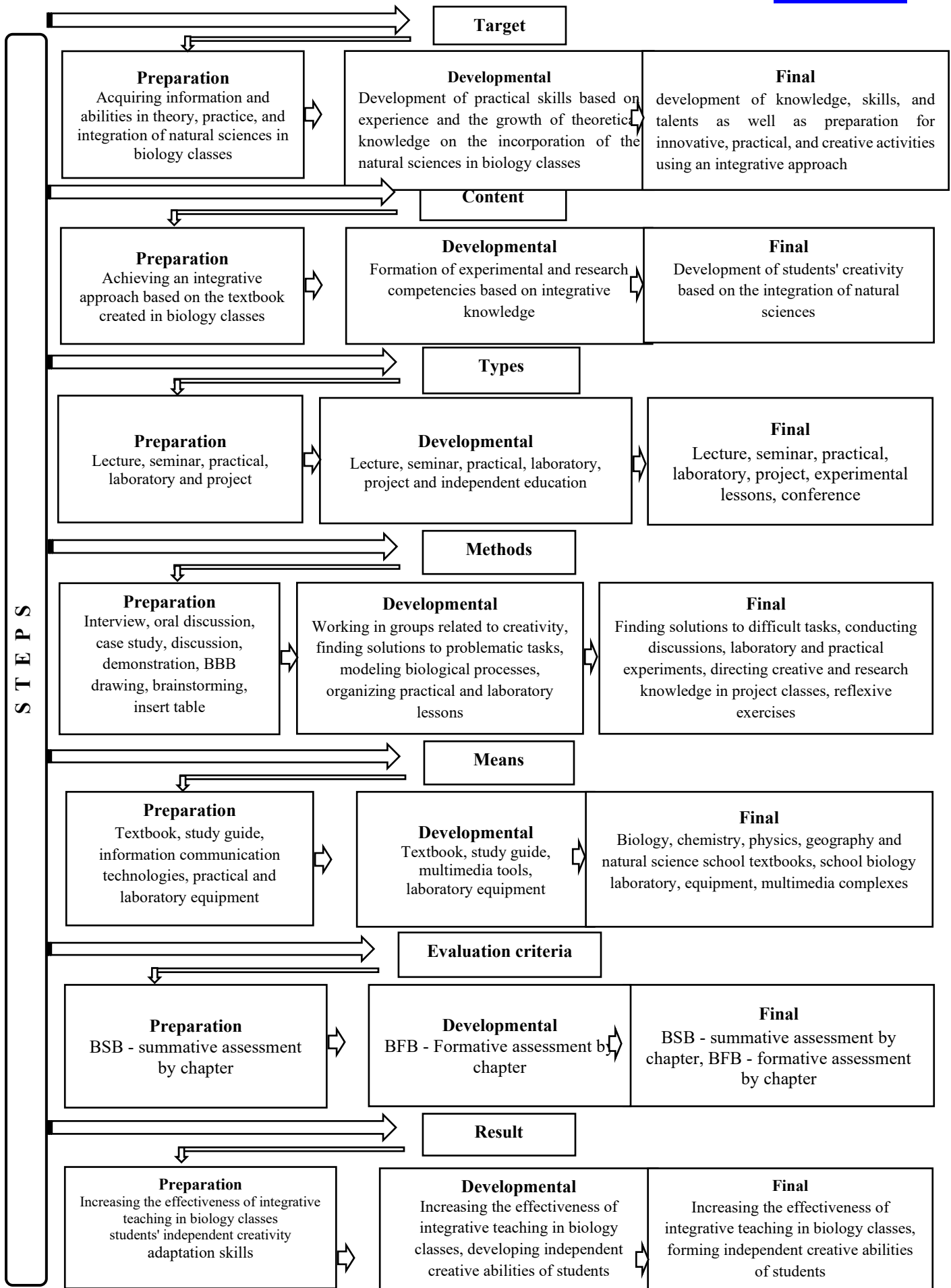
"CO₂, which makes up 0.03% of the air, is a constant component. It is the primary food of plants. Through their leaves and roots, all green plants absorb water and carbon dioxide from the atmosphere, convert them into organic nutrients called sugars under the influence of sunshine, and release oxygen into the atmosphere. Photosynthesis is the name given to this process [4].

These findings demonstrate the interconnectedness of the natural sciences.

The teacher uses information about the lithosphere, hydrosphere, and atmosphere from geography to enhance the lesson while describing the living circumstances of plants and animals in biology courses.

For the biology instructor, interdisciplinary integration presents certain challenges. because it calls for the instructor to be familiar with the material covered in textbooks and programs in other areas. The biology teacher must always work with the chemistry, physics, and geography professors to accomplish interdisciplinary integration. Attend their classes, research their experiences, design combined lessons, etc. to achieve this.

A methodology for improving the methodology of teaching biology based on the integration of natural sciences was established on the basis of defining the pedagogical and psychological possibilities of the educational process.



Students are encouraged to accurately examine natural phenomena, comprehend issues and identify solutions, and develop their reasoning, thinking, communication, and potential through integrated lessons. They play a larger role than typical in the development of the capacity to compare bodies, make generalizations, and draw inferences.

CONCLUSION

Today's STEAM education has developed on the foundation of integration. Following the subsequent endeavors of their graduates, some institutions made the decision to incorporate STEM (Science, Technology, Engineering, and Mathematics) into their curricula. STEAM [8] has now formed once Art (Art) was later added to it.

For the following reasons, STEAM education is highly regarded in many nations:

- There will be a severe shortage of IT specialists, programmers, engineers, high-tech production specialists, and other specialized professionals worldwide in the upcoming years;
- There will be occupations in the future that are currently impossible to even envisage; they are all connected to technology and high-tech production in relation to the natural sciences. Particularly, there will be a greater need for experts in the fields of bio- and nanotechnologies;
- Future specialists have a broad education and extensive training;
- Their understanding of the natural sciences, engineering, and technology is necessary [8].

In order to apply interdisciplinary links, it is also crucial to examine the relationship between more general scientific, general professional, and special disciplines.

By categorizing them in accordance with different integration-related factors, it is now able to evaluate their role and position. The phases of modernizing a lesson, studying new educational content, implementing it in real life, monitoring, and assigning homework all present potential for integration.

Scientists stressed the need to avoid subordinating one discipline to another in the implementation of integration, meaning that each discipline must keep its independence.

The method of running integrated classes is novel and engaging.

It provides students with possibilities for self-expression and self-awareness, and the teacher's ability to employ integration effectively helps students' creativity and interest in learning to grow. Integration provides a chance to discover new ideas, a reasonably expansive and vivid view of the world in which you live, mutual aid, and the vast world of material and cultural culture.

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