BG Pulse Journal USA
ISSN:1947-2536 http://www.bgpulseusa.com/index.php/bg
BG PULSE JOURNAL

ASSOCIATE PROFESSOR AT NAVOIY INNOVATION UNIVERSITY, DOCTOR OF PHILOSOPHY (PHD) IN PEDAGOGICAL SCIENCES

Methodology for introducing design technology in biology lessons

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Annotatsiya

Mazkur maqolada biologiya ta'limida o'quvchilarni loyihalash faoliyatiga yo'naltirishning nazariy asoslari, amaliy imkoniyatlari va pedagogik afzalliklari tahlil qilinadi. Shuningdek, biologiya fanini o'qitishda loyihalash mashg'ulotlarini tashkil etish metodikasi, o'quvchilarda ilmiy-tadqiqot ko'nikmalarini rivojlantirish, tanqidiy va ijodiy fikrlashni shakllantirish imkoniyatlari yoritilgan.

Аннотация

В данной статье анализируются теоретические основы, практические возможности и педагогические преимущества ориентации студентов на проектную деятельность в обучении биологии. Также раскрываются методика организации проектных занятий при преподавании биологии, возможности развития у учащихся научно-исследовательских навыков, формирования критического и творческого мышления.

Annotation

This article analyzes the theoretical foundations, practical opportunities, and pedagogical advantages of directing students toward project-based activities in biology education. It also highlights the methodology for organizing project-based lessons in teaching biology, as well as the opportunities for developing students' research skills, and fostering critical and creative thinking.

Kalit so'zlar: biologiya ta'limi, loyihalash mashg'uloti, innovatsion pedagogika, kompetensiya, tadqiqot faoliyati, ijodiy fikrlash.

Ключевые слова: биологическое образование, проектное занятие, инновационная педагогика, компетенция, исследовательская деятельность, творческое мышление.

Key words: biology education, project-based learning, innovative pedagogy, competence, research activity, creative thinking.

INTRODUCTION

In the current era of globalization, the main goal of teaching biology is to form students' competencies in independent thinking, analysis of problem situations and finding practical solutions. In this sense, design activities (designing) are an effective means of teaching students to

demonstrate their creative potential, think based on a scientific approach and find solutions to real-life problems.

LITERATURE ANALYSIS AND METHODOLOGIES

A special educational activity that is purposefully carried out by the teacher to ensure the independent actions of the student (student) in performing a specific task, from planning and organizing his activities to presenting the product for public evaluation. In design activities, the student learns to study, analyze and develop a practical solution to a problem in biology on a scientific basis. In this, the teacher proposes scientific problems, provides advice on how to solve them, and students become active participants in the learning process by researching, observing, conducting experiments, and preparing presentations in small groups. It encourages active learning, engages students, and allows for higher-level thinking.[1] Loyalash technology was created in the 1920s on the basis of the design method developed by the American philosopher and educator J. Dewey and his student V.H. Kilpatrick. We know the research of our country's scientists B. Orinbayev, Sh. Khodjayev, U. Tolipov on problem-based learning and project-based learning. Project-based learning is multidisciplinary, it uses skills and knowledge from several disciplines. This approach, formed on the basis of the progressive pedagogical ideas of J. Dewey and V. Kilpatrick, can also be used in the conditions of Uzbekistan. Gulan Y.V. proves in his work: "Projects based on interdisciplinary integration increase the cognitive interest of students by 40-50%"[2].

During the project work, students use Internet resources, conduct experiments in virtual laboratories, create projects on the topic, prepare presentations and present the results in digital format. This process also increases their digital literacy.

However, practice shows that in many schools the project method is still not fully effective. The main reasons for this are as follows:

1. Lack of methodological training: Many biology teachers do not have a deep knowledge of the project methodology, confusing it with a simple abstract or independent work. T. Ergashev notes in his research: "There is a need to conduct special training on the organization of project activities in order to improve the professional competence of teachers"[3].

Otherwise, the project may become formal and cause boredom in students. Teachers may not be able to systematically carry out the stages of the project (problem identification, planning, research, presentation, reflection).

2. Time constraints: Project work is time-consuming. Due to limited class hours, teachers have difficulty implementing full-fledged projects. Therefore, it is urgent to develop mechanisms for the effective use of extracurricular time and enrich homework with project elements.

3. Lack of material and technical base and resources: High-quality biological projects require laboratory equipment, reagents, microscopes, computers, and a stable internet connection. These resources are limited in rural schools. For example, there may not be enough microscopes for each

[1] (1. John R. Savery (2006). Overview of Problem-based Learning: Definitions and Distinctions. Interdisciplinary Journal of Problem-Based Learning, 1(1).

[2] Gulan Y.V. *Project-based learning in science education: International perspectives*. Journal of Science Education, 2023, Vol. 15, No. 2. P. 118.

[3] Ergashev T.T. *Umumta'lim maktablarida biologiya fanini o'qitishning zamonaviy metodikalari*. Dokt. diss. avtoreferati. – Toshkent, 2022. – B. 12-14.

student to conduct the "Cell Structure" project. Or, due to the lack of special measuring instruments (pH-meters, thermometers) for the "Ecosystem Monitoring" project, students are forced to limit themselves to approximate data. This undermines the scientific accuracy of the project.

4. Imperfect assessment system: While the traditional assessment system is mainly focused on the final result (exam or test), the project method requires assessing the process, teamwork, and creativity. Currently, clear criteria (rubrics) for project work in schools have not been sufficiently developed. As S. Abdullayeva noted: "It is necessary to widely use formative assessment tools when assessing project work, taking into account the student's activity at each stage"[4].

Loyihalash metodining xususiyatlari nimalardan iborat va u o‘quvchiga qanday imkoniyatlar yaratadi

From a pedagogical point of view, the design method radically changes the roles in the educational process,

Firstly, in this process, the teacher is not a source of knowledge, but a "facilitator", mentor and partner.

Secondly, another important pedagogical feature of the design method in biology lessons is the possibility of a differentiated (individual) approach. Each student has different interests, abilities and learning speed. Within the project, students can choose roles that suit them. For example, in one group, a student who likes to draw pictures can be engaged in project visualization, while a student with strong analytical thinking can be engaged in data processing and drawing conclusions. A student who likes to use technology can prepare a presentation. This allows each student to demonstrate their talents and makes them equal members of the team.

Thirdly, a specific psychological aspect of using the design method in biology lessons is the formation of empathy and ecological awareness. Working with living organisms (plant care, animal observation) instills in students a sense of love and care for living nature. These feelings are not only a source of moral education, but also a source of psychological stability. Studies show that projects that are closely connected with nature help reduce depressive states in students and maintain peace of mind. Also, the design method is the most effective pedagogical tool for implementing interdisciplinary integration. Biology does not exist in isolation; it is closely related to chemistry, physics, geography, and even literature. For example, in the "Water Purity" project, students analyze not only biological organisms, but also the chemical composition of water (chemistry), the filtration mechanism (physics), and statistical data (mathematics).

The following measures are recommended to eliminate existing problems and effectively use the opportunities:

1. Development of methodological manuals: Create an electronic methodological manual containing ready-made project scenarios, assessment rubrics, and student sheets for each grade and subject. This will save teachers' time and guarantee quality.

[4] Abdullayeva S.R. *O‘quvchilarning tadqiqotchilik kompetensiyalarini shakllantirishda loyiha metodining o‘rni*. Pedagogika fanlari nomzodi... diss. – Samarqand, 2023. – B. 34-36.

2. Practical training of teachers: Instead of theoretical courses, conduct practical training based on the "Master-Student" principle. Experienced teachers should demonstrate their projects.

3. Optimization of time management: Integrate project work with class hours. For example, collect information as homework, and analyze and discuss it in class. Use the "Flip Classroom" model.

4. Centralization of resources: Formation of "Project kits" in school libraries, consisting of the necessary equipment for the project (tablets, measuring instruments) and their use in turn.

5. Organization of the assessment system based on new approaches: Introduction of formative assessment criteria. The project assessment should be given not only for the final product, but also for activity in the process, teamwork and presentation skills.

It is advisable to pay special attention to the assessment of life skills when carrying out project work with students.

Life skills are important for students to succeed in everyday life and professional activities. This process includes measuring the following skills:

Problem-solving skills: Analyzing problems and finding effective solutions.

Teamwork: The ability to communicate and collaborate with a group.

Creative thinking: Finding new approaches and making creative decisions.

Decision-making: Making the right choices, taking into account the consequences.

Stress management and adaptability: Self-control and adaptation in difficult situations.

For the project method to be successful, the following conditions must be met:

1. State-level support and standards;

2. Continuous professional development of teachers;

3. Adequate material and technical resources;

4. Flexible curriculum (elasticity of time limits, i.e. setting projects that can be implemented at different times)

At the same time, the following measures should be taken to effectively use the opportunities:

1. Development of methodological manuals: Development of manuals containing ready-made project scenarios and evaluation criteria for each grade and subject. This saves teachers' time and ensures lesson efficiency.

2. Practical training of teachers: Instead of theoretical courses, conduct practical trainings based on the "Master-Student" principle. Teachers should demonstrate their projects, hold project competitions on textbook topics.

3. Optimize time management: Integrate project work with class hours. For example, collect information as homework, and analyze and discuss it in class.

4. Centralize resources: Form "Project Kits" in school libraries, consisting of the necessary equipment for the project (tablets, measuring instruments) and use them in turn.

5. Reform the assessment system: Introduce formative assessment criteria. The project should be assessed not only for the final product, but also for activity in the process, teamwork, and presentation skills.

The project process consists of five stages, and at each stage the activities of the teacher and student, the biological operations to be performed, and the expected results are clearly defined.

Stage I: This stage focuses on identifying a biological problem and putting forward a hypothesis and creating a scientific foundation for the project

Student activity: Analyzes the question, connects it with existing knowledge, puts forward a preliminary hypothesis.

At the end of the first stage, the project passport is approved, groups are formed, roles are distributed (researcher, laboratory manager, data analyst, designer, presenter).

Stage II: It consists of drawing up a research plan and determining resources,

the groups draw up a plan for how to implement the project. A biological experiment or observation protocol is developed.

A list of materials and equipment is compiled and prepared for work.

At this stage, special attention is paid to safety rules and time allocation

At this stage, the teacher gets acquainted with the students' plans, makes necessary adjustments, and provides methodological instructions.

At the end of the stage, an approved project plan, experimental protocol, safety instructions, and resource table will be ready.

Stage III: Implementation of biological research

is the stage where students engage in scientific work independently or in groups. In this, students are engaged in observation, laboratory work, information collection, and data recording activities.

The teacher monitors this process, provides guidance in difficulties, encourages students to think independently and draw conclusions from mistakes.

Stage IV: Data analysis and biological conclusion

The results obtained are compared with biological laws, and statistical and graphical analysis is performed.

Students tabulate measurement data, calculate the average value, and create graphs (linear, column, circular).

They are directed to compare the results of the control and experimental groups, identify the causes of differences, and write a scientific report: introduction, methodology, results, discussion, conclusion, list of literature used, analyze the data, scientific conclusion, and prepare a draft final report.

Stage V: Product formalization, presentation, and scientific defense

At the end of the project, the results obtained are presented to the public, the process is analyzed, and reflection is conducted.

In short, these five stages are not linear, but iterative (repeated) in nature. If unexpected results emerge during the research process or the initial hypothesis is not confirmed, students can return to previous steps, adjust the plan, and try new methods. This flexibility ensures that the project approaches real scientific research and develops students' resilience to solve problems and learn from mistakes.

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