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PROJECT ACTIVITY AS A MEANS OF FORMING COGNITIVE INTEREST IN BIOLOGY LESSONS

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ПРОЄКТНА ДІЯЛЬНІСТЬ ЯК ЗАСІБ ФОРМУВАННЯ ПІЗНАВАЛЬНОГО ІНТЕРЕСУ НА УРОКАХ БІОЛОГІЇ

The article analyzes the use by teachers and the perception of students of the method of project learning in the study of biology in the 7th grade. The modern education system requires the teacher to use new approaches to covering a large amount of information. Students must have completely different skills: to think, understand the essence of things, make sense of ideas and concepts, and already on the basis of this, be able to search for the necessary information, analyze it and apply it in specific conditions, formulate and defend their opinion. Project technologies are used in the educational process to successfully achieve this goal. The scientific analysis of psychological and pedagogical studies of project-based learning and the project method made it possible to draw a conclusion about the importance of using the project method, which provides intellectual and creative development of the individual.

Key words: project method, biology lessons, cognitive interest, ascertaining and searching experiments.

Анотація. У статті проаналізовано використання вчителями та сприйняття учнями методу проєктного навчання при вивченні біології у 7 класі, оскільки сучасна система вимагає від учителя нових підходів до охоплення великого обсягу інформації. Доведено, що учні повинні мати зовсім інші навички: думати, розуміти суть речей, осмислювати ідеї та концепції і вже на основі цього вміти шукати потрібну інформацію, аналізувати її та застосовувати в конкретних умовах, формулювати й відстоювати свою думку. Авторами узагальнено, що для успішного досягнення мети в навчальному процесі використовують проєктні технології, які забезпечує інтелектуальний та творчий розвиток особистості.

Ключові слова: метод проєктів, уроки біології, пізнавальний інтерес, констатувальний і пошуковий експерименти.

Introduction. In the project of the State Educational Standard of General Education, in order for students to receive quality education, there are high requirements for the subject results of mastering the biology program. Students must master the components of research and project activities, including the ability to see a problem, ask questions, put forward hypotheses, explain, prove, defend their ideas.

Theoretical knowledge alone is not enough for a future citizen – science is rapidly developing, which leads to their rapid aging, because competitiveness in the labor market depends on the person activity, the flexibility of thinking, the ability to improve knowledge and experience. The ability to successfully adapt to the ever-changing world is the basis of social success – that's what school should teach. In this regard, the interest shown by today's pedagogy in the activity technology of learning is quite understandable. The project method, developed in the first half of the 20th century, is becoming relevant again in the modern information society *(Image of a modern teacher, 2007).*

The leading type of activity for schoolchildren is teaching, so it is necessary to look for the possibility of increasing their activity in this process, which will contribute not only to improving the quality of general education of students, but also to the formation of an active personality in general. Currently, the problem of formation of cognitive interest and activity is solved from different positions, in the relationship of cognitive and practical activity, cognitive activity and communication between the teacher and students or between students.

Currently, many means of stimulating learning have been developed, all of them are effective. This work will consider such means of activation as the project method, that is, the application of the project method in the study of biology.

The purpose of the study is to develop and experimentally test the effectiveness of the method of organizing students' project activities in biology lessons in the 7th grade.

Research methods. An experimental study of the effectiveness of the method of organizing students' project activities was conducted during 2021–2022 on the basis of the Lyceum No. 13 of the Ivano-Frankivsk City Council. Students of the 7th grade took part in the study – 52 students and 8 teachers.

At the first stage, an ascertainment experiment was conducted. At this stage, psychological-pedagogical and methodical literature was studied and analyzed. During the research, we got acquainted with the legislative and regulatory documents on the requirements for the educational process; an analysis of the biology curriculum for the 7th grade was carried out, as well as didactic materials, methodical guides, biology textbooks, school documentation was studied, and a survey of students and teachers was conducted.

At the second stage, a search experiment was carried out. A method of organizing project activity was developed, which includes: motivational and target, substantive, procedural, effective, components and pedagogical conditions.

At the third stage of the research, a formative experiment was conducted, the level of educational achievements and motivation were measured. The development and implementation of the developed methodology for the organization of project training for 7th grade students was carried out. The results of the research were also worked out and summarized, and conclusions were formulated.

Comparison of the data obtained during the study required establishing their reliability. For this, we used x^2 or Pearson's test for control and experimental groups.

In order to carry out the ascertainment experiment, conversations were held with teachers, familiarization with their work experience, visits and analysis of lessons.

We developed questionnaires for students and teachers on the issue of implementing project activities in biology lessons.

The questionnaire questions for teachers were as follows:

1. Are you familiar with project technology?

2. Do you use the project method in your work?

3. In your opinion, are educational projects appropriate in biology lessons?

4. In your opinion, can students complete projects without help? Whose help will the students benefit from?

5. What difficulties arise in the application of project learning?

8 teachers took part in the survey.

A survey of students was also conducted, the questions were as follows:

1. Are you interested in questions in biology that are not studied in class?

2. Would you like to conduct research on issues that interest you?

3. Could you do your own research?

52 students took part in the survey.

Results and discussion. Cognitive interest can be characterized as the most important personality formation that takes place in the course of a person's life and activity, and can also be formed in the social conditions of his existence and is in no way inherent to a person from birth. Also, cognitive interest can be characterized as a persistent desire of an individual for purposeful active cognitive activity in relation to objects that are important to him. By the term "cognitive" we will understand exactly what "refers to the process of cognition, that is, to the process of acquiring true knowledge" *(Balashova, Ermolova, Potylitsyna, 2016).*

Since there can be several important objects, we can talk not only about cognitive abilities, but also about the cognitive interest of an individual. Cognitive interest is a very subtle structure of personality, which is an important part of the general phenomenon of "interest". Practical studies show that cognitive interest can be developed most effectively through the organization of the student's educational and cognitive activities. A successful activity that brings pleasure to a schoolchild is the strongest stimulus for his cognitive interest.

1. The analysis of the literature shows that there are various modifications of cognitive interest in the educational process: means of education; motive of educational activity; student's personality trait. Cognitive interest as a means of learning acts as a teacher's pedagogical tool, but it can only arouse curiosity from the outside, in other words, the initial elements of curiosity *(Education of Ukraine, 2017).*

To expand the interpretation of the

concept of cognitive interest, to clarify its essence, we note that educational activity takes place for the sake of knowledge, satisfaction of cognitive interest. Cognitive need as a desire to obtain new knowledge is based not only on enthusiasm for subject content, but also on an interested attitude to the process of mastering this content, to acquiring ways of knowing *(Tarasyuk, 2020).*

Currently, the method of project activity is an integral part of the educational process. It motivates students to develop creative abilities, work independently, search for information and obtain the final product. The prerequisites for the emergence of the project method can be traced back to the 5th century BC.

The project method is not fundamentally new in pedagogical practice, but at the same time, today it is considered a pedagogical technology of the XXI century, which involves the ability to adapt in the rapidly changing world of post-industrial society. "Thrown forward" is such an accurate translation from the Latin word "project" *(Zanyuk, 2002).*

John Dewey considered education as a process of accumulating and reconstructing experience in order to deepen its social content. According to his views, only that which is useful to people, which gives a practical result and is aimed at the benefit of the whole society is true and valuable. At the same time, the significance of the benefit is determined by the feeling of self-satisfaction. Over time, pragmatism turned into a certain ideology, adequate to the "American way of life", which was based on the criterion of utility.

A child's accumulation of individual experience leads to the formation of his personality. Based on this, J. Dewey put forward the idea of creating "instrumental pedagogy", which is based on the spontaneous interests and personal experience of the child. According to this concept, learning should be reduced to play and work, where each child's action becomes a tool for his knowledge, self-discovery, a way of understanding the truth. This way of learning seems to be more in line with the child's nature than traditional communication of ready-made knowledge. According to J.Dewey, the final result of training should be the formation of thinking skills, which means the ability to self-study. With such a system of education, the goals of the educational process were the ability to solve life tasks, mastering creative skills, enriching experience, which meant knowledge as such and knowledge about methods of action, as well as fostering the desire for self-learning and self-improvement *(Image of a modern teacher, 2007).*

Modern didactics successfully uses visualization, practical and laboratory work, search and problem-based learning methods. However, it should be noted that J. Dewey's underestimation of theoretical knowledge and deductive method in cognition, overestimation of the role of spontaneous interest and systematization of the child's abilities were erroneous.

J. Dewey's ideas were widely implemented in 1884–1916 in various educational institutions by his students and followers – American teachers U. Kilpatrick, E. Collings and E. Parkhurst *(Chechel, 1998).*

One of the ways of implementing J. Dewey's ideas was learning by the "project method". Children performed specific tasks – "projects", while it was assumed that the incentive to encourage students to work to achieve a certain goal and the associated need to acquire new knowledge was the "goal reflex" (the concept was introduced by the physiologist I.P. Pavlov).

Thus, students' interests are reflected in various projects. However, the implementation of such projects is not always connected with the students' acquisition of new knowledge and skills, that is, with their learning. Excessive attention to the child interests and the so-called accompanying learning, denial of the teacher leading role in the school definitely reduced the value of the most pragmatic principle - "learning by doing", that is, they should be interested in the organization of independent activity of students to solve problems *(Sergeenkova, Stolyarchuk, Kokhanova, Pasieka, 2012).*

The project method led, in fact, to the elimination of educational subjects, since students used only fragments of knowledge to solve a practical task, as a result of which the internal logic of individual subjects was violated. Therefore, U. Kilpatrick's idea of building the educational process only taking into account the child's interests is not appropriate.

Today it is clear that without structuring the studied material taking into account the age characteristics of students, without programs for individual subjects, guided only by the acute interests of schoolchildren, it is impossible to make the pedagogical process effective. However, the ideas of U. Kilpatrick have been developed and have not lost their relevance in our days, and above all, the idea of increasing the effectiveness of schoolchildren's education, with the help of independently planned and interesting activities.

Professor E. Collings of the University of Missouri made a great contribution to the implementation of the project. One of the first classifications of educational projects belongs to him. So, the scientist highlighted:

• project games – children's activities, the immediate purpose of which is participation in various group activities;

• excursion projects – activities that involved the appropriate study of problems related to the surrounding nature and social life;

• narrative projects – projects aimed at obtaining pleasure from storytelling in the most diverse form:

• constructive projects – projects aimed at creating a specific, useful product *(Pokora, 2018).*

According to E. Collings, the main idea was to gain knowledge while working on projects, the main thing in this work was the independent activity of children, which interested them. Taking into account the personal characteristics of each child, an incentive was created to acquire knowledge through independent work *(Dewey, 2003).*

In the first half of the 20th century, P. Petersen presented the original concept of the Jen-plan school to the pedagogical community. The educational material is based on the students individual abilities and their interests. The idea was developed by J. Dewey. The Jen Plan was based on teaching children respect for their individuality, freedom and independence and their interdependence in life, education, and work. Classes were replaced by groups that were divided by age. Pupils of older groups acted as assistants for younger ones. Training was based on the individual advancement of the student with the possibility of transition from one group to another, the implementation of individual and group projects and tasks, a combination of independent work and mutual assistance in the group. The lesson was replaced by various types of educational work. Students worked on project tasks, the result of which were any expositions, models, educational games. Every week at the school, summaries, report exhibitions and various general school meetings were held *(Image of a modern teacher, 2007).*

In the 20s, the "Method of projects" and its variant "Dalton Plan" began to be used in the practice of domestic schools - first experienced ones, and then in some mass schools. The ideas of J. Dewey and U. Kilpatrick were most fully substantiated, taking into account the Ukrainian reality, in the works of V. M. Shulgin and M. V. Krupenin, B. V. Ignatiev, and in practice were implemented by A.S. Makarenko, whose students created the world's best (at that time) electric drills and FED cameras *(Pokora, 2018).*

Work in the classroom takes place between the teacher and one, rather small group of students. The rest of the participants are observers of this work to a greater or lesser extent. S.T. Shatsky believed that the organization of classes in the classroom is of a non-energetic nature. He suggests organizing the work so that the classes are exactly the implementation of lessons at school, in an appropriate environment, under the control of the teacher and with his direct assistance *(Zanyuk, 2002).*

In Ukraine, such pedagogues as H. Vashchenko and H. Ivanits considered the issue of project-based learning. In their opinion, only active learning methods turn students into subjects of the pedagogical process.

The analysis of modern psychological-pedagogical and methodical literature on the researched problem showed that project-based learning has become widespread in pedagogical theory. It is a modern learning technology that increases the effectiveness of the educational process, which is carried out with the help of educational projects that differ in typology and structure.

Project-based learning has such advantages as the combination of theory and practice in class, the possibility of choosing different types of activities, the development of the motivational sphere and intelligence of students, their independence.

The results of the pedagogical experiment confirmed the possibility of project-based learning in a secondary school and indicated the need to develop scientifically based methods of project-based learning in biology.

The basis of the project method is creativity, the ability to navigate in the information space and independently construct one's knowledge. The educational project can be implemented both in classes and in extracurricular work. And the uniqueness of the project is achieved by fulfilling the goals of the students themselves, and accordingly, each project is unique.

The effectiveness of the professional education system, raising the quality of education to the level of international requirements directly depends on the applied educational technologies. Project-based learning is a useful alternative to the classroom system. According to experts, project-based training is necessary as a supplement to traditional types of training.

When analyzing the pedagogical possibilities of project activities as a means of developing students' cognitive interests, it was determined that the pedagogical possibilities of project activities as a means of developing students' cognitive interests can be most effectively implemented under the condition of ensuring the participation of schoolchildren in projects of various types (research, role-playing, creative, informational, applied), which allow actualizing and enriching various components of their subjective experience. The combination of different types of activities (game, research, design, language) during the implementation of different types of projects will ensure mutual complementation and strengthening of the pedagogical opportunities contained in them, thus contributing to the significant enrichment of the subjective experience of students and the parallel development of their cognitive interests.

Based on the analysis of psychological and pedagogical literature and conducting a pedagogical experiment in the Lyceum No. 13 of the Ivano-Frankivsk City Council, we have developed a methodology for organizing students' project activities in biology lessons in 7th grade. The productivity of this technique is provided by four components that form its basis:

- motivational and targeted;
- meaningful;
- procedural;
- effective.

The components are interconnected, which ensure a change in the goals, tasks, motives of the students' activities during the project activity.

The effectiveness of the method of organizing project activities is ensured by the pedagogical conditions that form its foundation:

- creating a situation of success;
- educational environment;
- pedagogical support;
- professional focus;
- motivational environment.

The proposed method of organizing project activities makes it possible to:

- carry out personality development on the basis of independent cognitive activity;
- stimulate independence,

development of motivation;

• monitor students' progress and adjust their learning path.

The analysis of the results of the teachers' survey made it possible to draw the following conclusions:

• 100% of teachers are familiar with project technology, but only 37.5% (3) of teachers use it in their work;

• 50% expressed a positive attitude towards project-based learning, the last 37.5% believe that project-based learning requires spending time, 12.5% noted that project-based learning is not very effective;

• almost all teachers (87.5%) believe that students are unable to complete projects independently, believe that students need help, 75% (6) of teachers note that the help of a subject teacher is useful.

The analysis of the results of the student questionnaire made it possible to draw the following conclusions:

• 79% of students answered that they have questions that are not considered in lessons;

• of all respondents, 49% want to conduct research on issues that interest them, 51% of students want to find answers to questions, but do not want to conduct research;

• 43% of students answered that they could independently conduct research in the field of biology, 57% of students answered that they need the teacher's help in conducting research.

Many respondents (79%) have questions outside the curriculum, but only 49% want to do research. This indicates insufficient motivation for educational and scientific activities.

The conducted ascertainment experiment proved that the teachers do not have sufficient knowledge of the method of conducting project-based learning in the lessons, which is confirmed by the results of the student questionnaire, 49% want to conduct research on issues that interest them, but 57% of the students would not be able to conduct it on their own.

Teachers, knowing about project technology, do not use it due to lack of practical experience and time. Therefore, a problem arose in the development of a methodology for using project-based learning in biology lessons, which would provide an effective solution to the above-mentioned problems.

At the stage of the search experiment, we developed a method of using project-based learning.

The formative experiment involved the following stages:

1. According to the results of the analysis of school documentation, the control and experimental groups were selected.

2. Conversations were held with teachers regarding the organization of students' project activities.

3. The first measurement of the educational achievements level and calculation of the motivation level to study in the control and experimental groups and their comparison.

4. Educational work in experimental groups using project-based learning during the study of biology and educational work in control groups according to the traditional scheme.

5. Final measurement of the level of educational achievements and motivation for educational activities in control and experimental groups, their analysis.

6. Formulation of conclusions regarding the proposed project learning in biology lessons.

number of lessons. The only difference was that the students of the experimental group studied according to the developed methodology. That is, the difference in the indicators we investigated between the control and experimental groups under such conditions could be attributed only to the influence of applied project training.

The level of motivation for educational activities was determined using a questionnaire consisting of five blocks. The first block allows you to determine how strong the personal meaning of learning is for the student. The second block demonstrates the ability to set goals. The third block of the questionnaire reveals the focus of motivation on the cognitive or social component. With the help of the fourth block, it is possible to establish the

Table 1

The motivation level for the educational activity of the students of the experimental and control groups (first measurement)

Motivation level	Experimental group		Control group	
	Number of students	%	Number of students	%
Very high	0	0	0	0
High	7	28	3	11
Average	10	40	15	56
Reduced	5	20	7	26
Low	3	12	2	7

Table 2

The motivation level for the educational activity of the students of the experimental and control groups (second measurement)

Motivation level	Experimental group		Control group	
	Number of students	%	Number of students	%
Very high	2	8	0	0
High	10	40	4	15
Average	7	28	13	48
Reduced	5	20	8	30
Low	1	4	2	7

predominance of internal or external motivation in a schoolchild. Questions of the fifth block of the methodology characterize such an indicator of motivation as a teenager's desire to achieve success in studies or avoid failure. How strong the personal meaning of learning is for a student characterizes the sixth block. Analysis of the data for each of these indicators will allow us to draw a conclusion about the effectiveness of pedagogical activity in the aspect of forming a personal sense of learning, the ability to set goals, and will help to take corrective measures *(Makar, 2013).*

I. In order to eliminate the randomness of the choice and get more objective results, students are asked to choose two answer options. The points of the selected answer options are summed up.

II. I, II, III indicators of motivation by the sum of points reveal its final level. According to the evaluation table, it is possible to determine the levels of motivation according to individual indicators (I, II, III) and the final level of motivation of teenagers.

III. The sum of the points of the final level of motivation. The following final levels of schoolchildren's motivation are distinguished.

IV. A very high level of learning motivation (72–85).

V. High level of learning motivation (55–71).

VI. Normal (average) level of learning motivation (42–54).

VII. Reduced level of learning motivation (30–41).

VIII. Low level of learning motivation (up to 29).

Having conducted the first measurement of the students motivation level of the experimental and control groups' educational activities, we can say that according to the "very high" indicator, there are no students, which indicates a lack of strong motivation among students. According to the "high" indicator, there were 7 students in the experimental group and 3 in the control

Table 3

The level of students educational achievements at the beginning of the experiment

Level of educational achievements	Experimental group		Control group	
	Number of students	%	Number of students	%
High	1	4	1	4
Sufficient	10	40	11	41
Average	11	44	12	44
Low	3	12	3	11

Table 4

The level of educational achievements at the end of the experiment

Level of educational achievements	Experimental group		Control group	
	Number of students	%	Number of students	%
High	5	20	1	4
Sufficient	12	48	7	26
Average	8	32	17	63
Low	0	0	2	7

group, that is 28% and 11%. According to the "average" indicator – 10 students (40%) in the experimental group and 15 in the control group (56%), the largest number of students entered this group in both classes. According to the indicator "reduced" – 5 students (20%) in the experimental group and 7 students (26%), respectively, and according to the indicator "low" - 3 and 2 students in the respective groups. Here we see the smallest number of students, and therefore a low level of motivation in only five students from both classes (*table 1).*

Having carried out the second measurement of the motivation level of the students educational activity of the experimental and control groups, we can say that some positive changes are noticeable. According to the "very high" indicator, 2 students appear in the experimental class, that is, 2 students show good motivation to study. According to the "high" indicator, there are already 10 students (40%), that is, in this scale, students have increased by 12% compared to the first measurement. According to the "average" – 7 students, in this scale there was a decrease of 12%. According to the "reduced" and "low" indicators of the students of the experimental group, 5 and 1 student, respectively (*table 2*).

Next in the study, we determined the level of students educational achievements at the beginning and at the end of the experiment. The data are highlighted in the tables shown below (*tables 3, 4).*

We proved the homogeneity of the experimental and control groups using the homogeneity criterion, which was calculated on the basis of the average score of the students' educational achievements. Since the criteria for evaluating the students educational achievements in the system of general secondary education are implemented in the norms of four levels of achievement: elementary, middle, sufficient, high, then L = 4.

Critical value $x^2_{0,05}$ criterion x^2 for a significance level of 0,05 is equal to 7,82.

Calculations show that $x^2_{crit} > x^2_{emp}$ = 7,82 > 0,0703, therefore, the characteristics of the samples coincide at the significance level of 0,05.

After the measurement at the end of the experiment, it can be seen that the number of students with a high and sufficient level increased in the experimental group, and the number of students from a low level to an average level increased. In the control group, almost the entire main part of the class is at the average level – 63%, although there were more evenly divided between sufficient and average levels – 41% and 44%, respectively, according to the level of educational achievements.

So, after using the method of project activity developed by us, the students of the experimental group show better results in learning, which is evidenced by the increase in motivation and the level of educational achievements at the end of the experiment.

While the students of the control group, learning according to the traditional method, show an increase in motivation and the level of educational achievements at the end of the experiment, the assessment is a smaller proportion, compared to the experimental group. So, we can conclude that as a result of using project activities according to the methodology developed by us, the level of educational achievements increases, motivation improves.

In the case when the initial states of the studied groups are the same, and the final states are different, it is possible to conclude about the effectiveness of the methodology we developed for applying project technology in biology lessons. Thus, it has been proven that when using project-based learning in biology classes, students' level and strength of knowledge, motivation for educational activities, cognitive interest and activity increase significantly.

Conclusions. It is possible to develop students' interest in biology as a science, and as a school subject, using project-based learning aimed at activating the cognitive activity of schoolchildren, involving students in the process of active intellectual search for information, giving them the opportunity to realize their cognitive interests.

The analysis of the pedagogical

experiment results conducted in the classes of a modern secondary school gives grounds for asserting that all the tasks were solved, the goal was realized and the research hypothesis was confirmed.

Project-based learning has not been widely used, but teachers (37.5%) who use it in their activities indicate its high efficiency, which ensures a high level of student training. The survey showed that 87.5% of teachers are sure that students are unable to complete projects on their own, that they need help. 87.5% of respondents expressed interest in the possibility of using project-based learning in lessons. The reasons that prevent the practical implementation of project-based learning are most often cited by teachers as: lack of practical experience (37.5%) and lack of study time (75%).

As a result of the student survey, it became clear:

• students like lessons in which they independently pose a problem and find ways to solve it;

• especially interesting lessons with natural objects, as well as lessons with presentations and project works on biology were noted;

• many students noted that the cognitive activity during the implementation of the project helps them realize the role of biology in practical life;

• students noted an increase in cognitive interest in additional scientific and cognitive literature on biology;

• many students want to improve their results in biology, want to learn more.

The conducted research showed that the use of project-based learning allows you to develop:

• students' cognitive skills: observation, abstraction, systematization (classification, differentiation), proposing hypotheses, solving problems, finding ways of empirical verification, correlating results with hypotheses, etc.

• practical skills: making and reading diagrams, searching for information, mastering the language of science.

• communication skills: tolerance for alternative opinion, readiness for learning and cooperation, self-criticism, ability to defend and defend one's position, ability to speak publicly.

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