EFFECTIVENESS OF THE PROGRAM FOR INTEGRATING INTERACTIVE TECHNOLOGIES IN BIOLOGY LESSONS IN A MULTILINGUAL ENVIRONMENT

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ABSTRACT

Multilingual education expands the possibilities of active use of a foreign language, providing students with wide access to information in subject areas, obtaining new information in accordance with individual needs, the possibility of continuous education, which is a prerequisite for the successful adaptation of graduates to the conditions of the European market. In this regard, the orientation towards interactive teaching methods contributes to the mastery of knowledge on and through the subject, the formation of a creative personality capable of self-development, self-education, the transition from the formal performance of certain tasks with a passive role of the student to cognitive activity with the formation of one's own opinion when solving the problematic questions and challenges posed.

Keywords: Multilingual school. Interactive teaching methods. Cognitive activity. Language environment. Interdisciplinary relationships.

EFICÁCIA DO PROGRAMA DE INTEGRAÇÃO DE TECNOLOGIAS INTERATIVAS EM AULAS DE BIOLOGIA EM AMBIENTE MULTILINGUE

EFECTIVIDAD DEL PROGRAMA DE INTEGRACIÓN DE TECNOLOGÍAS INTERACTIVAS EN LECCIONES DE BIOLOGÍA EN UN ENTORNO MULTILINGÜE

RESUMO

A educação multilingue amplia as possibilidades de uso ativo da língua estrangeira, proporcionando aos alunos amplo acesso à informação nas áreas disciplinares, obtendo novas informações de acordo com as necessidades individuais, a possibilidade de educação continuada, que é um pré-requisito para o sucesso da adaptação do egresso ao as condições do mercado europeu. Nesse sentido, a orientação para métodos de ensino interativos contribui para o domínio do conhecimento sobre e através da matéria, a formação de uma personalidade criativa capaz de autodesenvolvimento, autodidatismo, a transição do desempenho formal de certas tarefas com um passivo papel do aluno na atividade cognitiva com a formação da própria opinião na resolução das questões problemáticas e desafios colocados.

Palavras-chave: Escola multilíngue. Métodos de ensino interativos. Atividade cognitiva. Ambiente de linguagem. Relações interdisciplinares.

RESUMEN

La educación multilingüe amplía las posibilidades de uso activo de una lengua extranjera, brindando a los estudiantes un amplio acceso a la información en las áreas temáticas, obteniendo nueva información de acuerdo con las necesidades individuales, la posibilidad de la educación continua, que es un requisito previo para la adaptación exitosa de los graduados a las condiciones del mercado europeo. En este sentido, la orientación hacia métodos didácticos interactivos contribuye al dominio del conocimiento sobre y a través de la asignatura, la formación de una personalidad creativa capaz de autodesarrollo, la autoeducación, la transición del desempeño formal de determinadas tareas con un pasivo. papel del alumno en la actividad cognitiva con la formación de la propia opinión a la hora de resolver las cuestiones problemáticas y los retos planteados.

Palabras-clave: Escuela multilingüe. Métodos de enseñanza interactivos. Actividad cognitiva. Entorno lingüístico. Relaciones interdisciplinarias.

INTRODUCTION

Currently, interactive teaching methods are actively developing. Researchers believe that the main feature of interactive teaching methods is a forced intellectual activity, as the methods of the educational process themselves activate the thinking of its participants, regardless of their desire. By getting involved in interactive activities, students learn to think critically, solve independently assigned tasks based on information analysis, apply the knowledge gained in non-standard situations, participate in discussions, and jointly solve significant problems (MITINA, NURZHANOVA, 2013). Thus, interactive learning is one immersed in communication. Moreover, "immersed" does not mean "substituted". Interactive learning retains the ultimate goal and the main content of the educational process, and knowledge of foreign languages is a prerequisite for the implementation of educational activities, informal communication, and therefore multilinguistic nature is considered in an educational organization as an important way of information exchange (JOHANAN, 2010).

In interactive teaching, in addition to this, the dialogue is built as a "student – student", "student– group of students", "student – audience" or "group of students – audience" interaction etc. (CHEPEL, 2006). Another thing to mention is the individual approach, the differentiation of teaching, the collaboration of theoretical and practical components in the presentation of new material, which becomes possible when using interactive teaching methods (SIROTENKO, 2013).

The key task of the teacher in the interactive method is to facilitate (support, relieve) – direct and assist the information sharing process: identify the diversity of points of view; combine theory and practice; appeal to the personal experience of students, support of their activity, encouragement of creativity; mutually enrich the experience of the participants in the dialogue; facilitate perception, assimilation, and mutual understanding (DOROFEEVA, 2017).

RELEVANCE, OBJECTIVE, AND TASKS

The **relevance** of the research is due to the insufficient development of the issue of integrating interactive methods in biology lessons in a multilingual environment, as well as due to the social public order for the cognitively active personality of the student able to create, transform, and master new methods of organizing his educational activities and generate new ideas.

The **objective** of the research is to theoretically substantiate and experimentally test the effectiveness of the program for integrating interactive methods in biology lessons in a multilingual environment as a way to improve academic performance by increasing the level of cognitive activity

To achieve the objective, the following **tasks** have been stated:

1. Make a program with the inclusion of interactive teaching methods into various stages of the lesson.
2. Test and experimentally verify the effectiveness of the program in a multilingual environment for the development of cognitive activity of students.

METHODS

Classes that involved interactive teaching methods in a multilingual environment were based on the materials of textbooks:

1. "Biology. Grade 7", "Liniia Zhizni" series, ed. V.V. Pasechnik (LATYUSHIN, 2014);
2. "Biology. Animals. Grade 7" V.V. Latiushin (SHALAYEV,1 966);
3. "Zoology, textbook for grades 6 and 7", ed. V.F. Shalaev (PASECHNIK ,2014).

The traditional structure of the lesson was finalized with the inclusion of interactive methods, interpreted for the biology lesson, focused on the development of the cognitive activity of students.

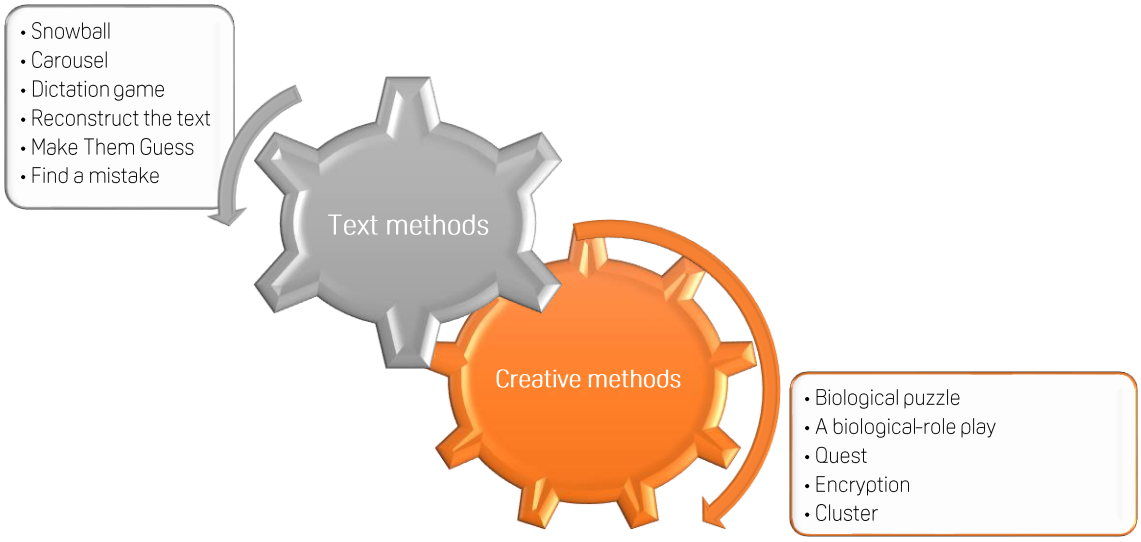
The experimental study took place in the MAOU "Secondary School No. 165 with advanced English learning", Novo-Savinovsky district, Kazan. The study involved 51 students of grade 7, 13-14 years old, with approximately the same level of cognitive activity and quality of education. The control group (CG, students of grade 7A) consisted of 22 people, and the experimental group (EG, students of grade 7B) consisted of 29 people.

To implement the program for the integration of interactive teaching methods in biology lessons in a multilingual environment, the following diagnostic program was developed:

- determination of the level of cognitive activity of students (B.K. Pashnev modified test) before and after the experiment (PASHNEV, 2019);
- tasks of the final test for the 1st and 3rd quarters to assess the quality of training before and after the experiment;
- study of the topics of the work program using interactive teaching methods in biology lessons in Russian and English in the experimental group;

During the preparation of the content of the lesson on the basis of interactive teaching methods, the challenge was not only to choose the most effective and appropriate form of teaching for studying a specific topic, but also to interpret them with a combination of several techniques to solve the problem of student achievement with the possibility of increasing cognitive activity (ERMAKOVA, 2013). In this regard, for the development of cognitive activity among students of the experimental group in biology lessons, a program was developed and implemented to develop cognitive abilities for the 7th grade students in the "Plants" and "Animals" sections of biology (LATYUSHIN, 2014). The interactive teaching methods used in this program have been systematized into creative and textual methods. The types of interactive teaching methods included in the "creative methods" group require students to be creative, which is advisable to apply in the lessons of quality control of teaching, or in the lessons of generalization and systematization of knowledge, "text methods" involve working with text when learning new material (Fig. 1).

Figure 1 – The structure of the program for the development of cognitive abilities by means of interactive teaching methods



Source: Search data

Quest

The students are divided into several competing teams, each located at its "station". Each station is given tasks at the same time, the completion of which is noted in the waybill and the solution to which is the key to the next task. School boards, announcements on stands (specially pasted in advance), random "passers-by" who accidentally drop a handkerchief with a code, etc. can help participants in completing tasks. Summing up – at the end. Each team must complete one task in one place.

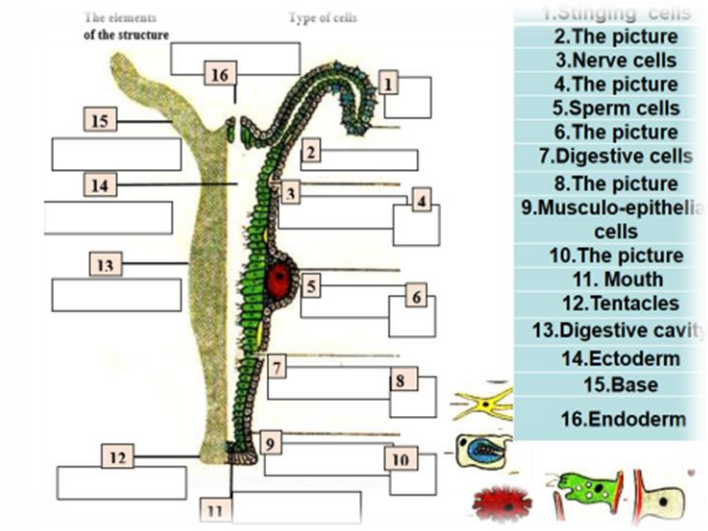
Figure 2 – A "Quest"-based biology lesson in English

Source: Search data

Biological puzzle

At the first stage of the task, students need to restore the sequence of structural elements of the external and internal structure of coelenterates. The next step is to collect the sequence of the internal structure through the use of cell-type drawings. The last stage involves the description of the structure of coelenterates in English using the assembled puzzle (Fig. 3).

Figure 3 – Biological puzzle



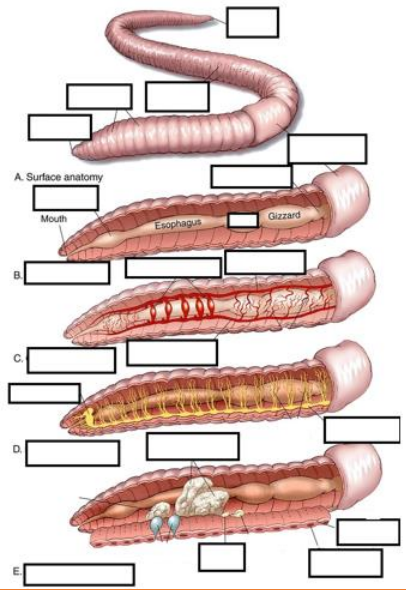
Source: Search data

Dictation game

The students are divided into groups, each provided with handouts (Fig. 4). During the lesson of learning new material, each group fills in the gaps in a short time, after the time passes, they exchange with another group, filling in what they did not have time before, or correcting what is erroneous (respectively, each group uses its own colors). This action is repeated 4 times within one row, until the sheet returns to the first desk.

The same handout is used later in the lessons of generalization and systematization and/or control, assessment and correction of knowledge, where this task must be done in a group of two people.

Figure 4 – Dictation game



First name _____
Last name _____
Grade _____

Put each of the following words in its correct place in the picture and translate:

WORDS	TRANSLATION
1. Circular muscle layer	
2. Circulatory system	
3. Bristles	
4. Crop	
5. Digestive system	
6. Dorsal vessel	
7. Girdle	
8. Intestine	
9. Longitudinal muscle layer	
10. Nerve system	
11. The posterior end	
12. Ovary	
13. Pharynx	
14. Pseudo-hearts	
15. Reproductive system	
16. Segments	
17. Suprapharyngeal ganglion	
18. Testes	
19. The anterior end	
20. Ventral nerve cord	
21. Ventral vessel	

Source: Search data

Encryption

Students can encrypt various words, sentences, which is a good opportunity to work out the types of questions, sounds/letters. Particular attention is paid to definitions in English, with translation into Russian. For example, this encryption was used when studying the topic “Types of roots. Modification of roots".

0		9	I	18	R
1	A	10	J	19	S
2	B	11	K	20	T
3	C	12	L	21	U
4	D	13	M	22	V
5	E	14	N	23	W
6	F	15	O	24	X
7	G	16	P	25	Y
8	H	17	Q	26	Z

0→null
1→A
2→B
…
26→Z

19	1	22	5	0	23	1	20	5	18	0
19	1	22	5	0	12	9	6	5		

Also, this technique helps to compose a test part of the tasks, which increases interest in solving it.

1.What kind of the perianth do a rose and an apple tree have?

A)1-о-,2-о,3-й,4-п,5-с,6-р,7-т

B)1-й,2-й,3-д,4-о,5-н,6-в,7-о,

2. The flower male reproduction organ is:

A)1-к,2-т,3-и,4-п,5-е,6-с,

B)1-а,2-ы,3-к,4-т,5-ч,6-и,7-н,

C)1-ь,2-з.3-я,4-а,5-в,6-з,

Snowball

Snowball: "Word - sentence - question - answer".

1. During the actualization of knowledge, the teacher says the name of the student and says "word" on the topic covered.
2. The student says this "word" and the term related to the topic and chooses the next student.
3. The student repeats the word and term of the previous student, composes a question and asks the next student.
4. The fourth student repeats the word, term, and gives his answer.
5. Continue, until the teacher decides to stop the snowball.

In a biology lesson in English, the steps of this technique can be alternated with the use of English, alternately with Russian. For grades 5 and 6 it can be simplified by composing and translating sentences one by one. And students of grades 7 and 8 can add composing questions.

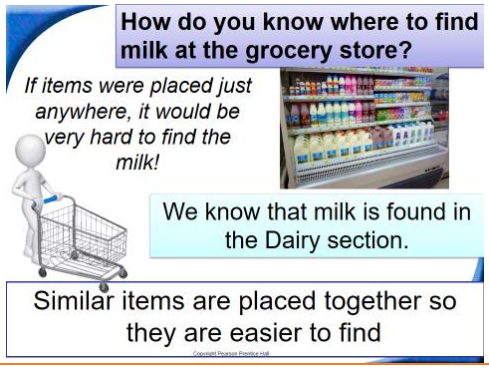
«General information about the animal world».

- Fauna
- Фауна – царство животных, содержащее около 1,2 млн. видов
- Fauna – the animal Kingdom containing about 1.2 million species. How do animals differ from plants?
- Чем животные отличаются от растения? Они отличаются способом питания.
- They differ in the way they eat. What is the name of the Association of related orders of animals?

«Make Them Guess»

The students need to answer intriguing questions about the practical side of life. Using these questions, the topic of the lesson or concept/term is determined. For example, when studying the taxonomy of the animal world, the lesson began with a discussion of store shelves and ended with the definition of a topic (Fig. 5).

Figure 5 – Make Them Guess



Source: Search data

To analyze the results of the intermediate and control sections, the method of statistical processing of the results was used - Student's t-test for dependent and independent samples, the results obtained were compared with Table t.

RESULTS AND DISCUSSION

Analysis of the results of the input questionnaire according to B.K. Pashnev's method of "Determination of the level of cognitive activity of students" showed the predominance in both classes of low and medium levels of cognitive activity. Comparison of the results before and after the experiment makes it clear that in the experimental group the transition to teaching using interactive methods in biology lessons in Russian and English contributed to an increase in the level of cognitive activity (Table 1).

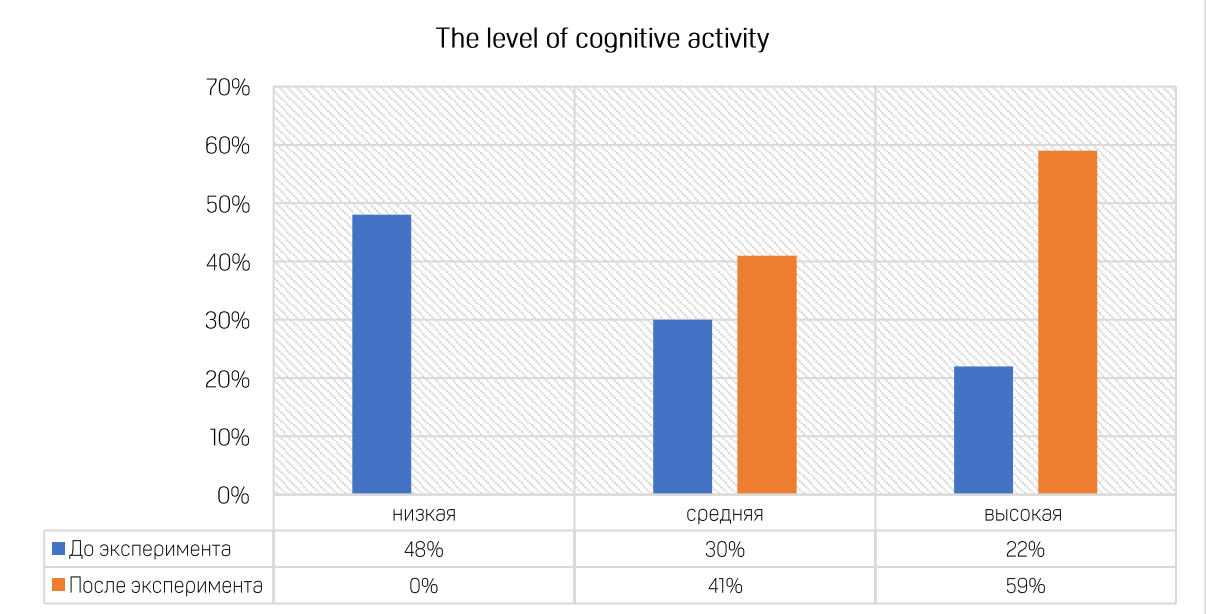
Table 1 - The results of the input and final questionnaires in the control and experimental groups

Level of cognitive activity	KG				EG			
	Before		After		Before		After	
	Number of students	% relation	Number of students	% relation	Number of students	% relation	Number of students	% relation
Low	8	36%	5	24%	14	48%		
Medium	5	23%	8	35%	9	30%	12	41%
high	9	41%	9	41%	6	22%	17	59%

Source: Search data

In the experimental group, the number of students with a high level of cognitive activity increased by 37%, the number of students with a low level decreased by 48% (Fig. 6).

Figure 6. The level of cognitive activity before and after the experiment in the experimental group



Source: Search data

Based on the results of the questionnaire survey (Table 1), we tested the hypothesis about the reliability of the difference in the mean when analyzing the quantitative data of this survey before and after the ascertaining stage. The calculation was performed using the Student's t-test method for independent samples (Table 2).

Table 2 – The calculation for independent samples

Calculation of the data of the "Determination of the level of cognitive activity of students using B.K. Pashnev modified method" questionnaire after the experiment in the control and experimental groups	Level of cognitive activity	
	KG	EG
Arithmetic mean value	21.2	29.5
Standard deviation	5.7	5.9
Number of students	22	29
T-criterion for independent samples	2,30	

Source: Search data

The tabular value of the t-test with a degree of freedom of 49 is 2.010, assuming the possibility of risk to make an erroneous judgment in five cases out of 100 (significance level = 5% or 0.05%).

Also, according to the Student's t-test for dependent samples, based on the results of a questionnaire to study the level of cognitive activity of students in the experimental group, they proved the hypothesis about the reliability of the results for determining cognitive activity before and after the experiment:

$\sum d = 324, \sum d^2 = 8790 \rightarrow t = 4{,}4$

The value of t=4.4 is higher than that required for a significance level of 0.05 at 28 degrees of freedom.

To determine the quality of teaching before and after the experiment, testing was used in both classes (Table 3).

Table 3 – The results of the "1st quarter final test" in the control and experimental groups

Mark	KG		EG	
	Number of students	% relation	Number of students	% relation
Not satisfactory	2	9%	1	3%
Satisfactory	4	18%	9	31%
Good	6	27%	9	31%
Excellent	10	46%	10	35%

Source: Search data

Based on the results of the initial testing we assessed the quality of training:

Control group: (6+10)/22x100=72%;

Experimental group: (9+10)29x100=65%.

We used the results of the final control work for the 1st quarter in comparison with the results of the final control work for the 3rd quarter to assess the success of the experiment (Table 4).

Table 4 - Comparison of the results of the final test in biology for the 1st and 3rd quarter:

Mark	KG				EG			
	Test for 1 quarter		Test for 3 quarter		Test for 1 quarter		Test for 3 quarter	
	Number of students	% relation	Number of students	% relation	Number of students	% relation	Number of students	% relation
Excellent	10	46%	3	14%	10	35%	15	52%
Good	6	27%	14	64%	9	31%	11	38%
Satisfactory	4	18%	5	22%	9	31%	3	10%
Not satisfactory	2	9%			1	3%		

Source: Search data

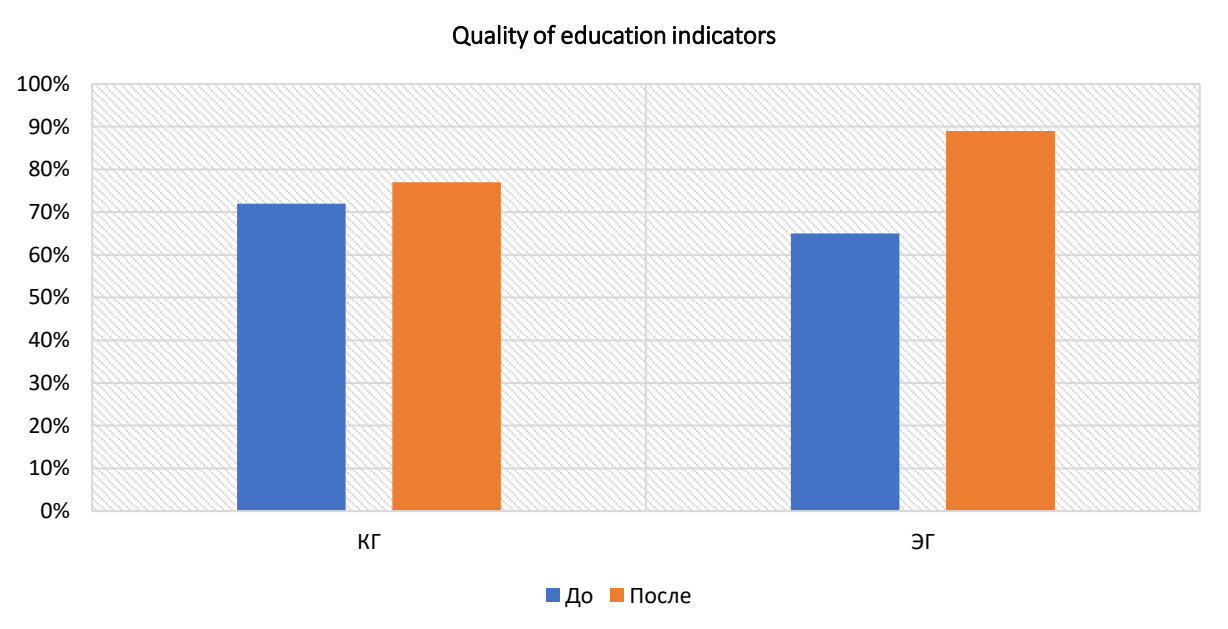
Based on the results of the final testing (Table 4), we will assess the quality of training:

Control group: (3+14)/22x100=77%;

Experimental group: (15+11)/29x100=89%

Comparing the test results, we concluded that the experimental group, after the experiment, improved its quality of education by 24% (Fig. 5).

Fig. 5. Assessment of the quality of education in the control and experimental groups before and after the experiment.



Source: Search data

Based on the results of the final test for the 1st and 3rd quarters of the experimental group (grade 7B) (Table 4), we tested the hypothesis about the reliability of the difference in the mean in the analysis of the quantitative data of these tests using the Student's t-test for dependent samples (Table 5).

Table 5 - Numerical data of the final test in biology for the 1st and 3rd quarters in the control and experimental groups

	EG		Student t-test for linked samples
	Test for 1 quarter	Test for 3 quarter	
Arithmetic mean value	3.9	4.4	$\sum d = 13, \sum d^2 = 17$
Standard deviation	0.9	0.68	$t = 3.82$
			t0.05=2.049 → 3.82>2.049
Number of students	29		

Source: Search data

SUMMARY

According to the results of the experiment, after the integration of interactive teaching methods in the experimental group, the following was recorded:

1. In the experimental group, the number of students with a high level of cognitive activity increased by 37%.
2. In the experimental group, the quality of education increased by 24%;

The results of the experiment show that the students who studied biology in accordance with the developed teaching program, at the end of the experiment, demonstrated more robust learning outcomes than the seventh-graders who were taught biology using the traditional method. The students of the experimental group developed an interest in biology, a need for self-education and self-study. In addition, overall class performance improved.

CONCLUSION

The inclusion of interactive teaching methods in biology lessons provide a faster and more accessible assimilation of knowledge. This is necessary due to the fact that modern conditions are characterized by the humanization of the educational process, an appeal to the personality of the child (Razumnaia,2016). The implementation of this task undoubtedly requires a new approach to both teaching in general and to the organization of the entire cognitive process. In addition, a modern school requires each student to learn how to independently acquire knowledge and apply it in everyday life, find the right solutions, adapt to new conditions, and for this the thought processes must be very fast and diverse. All this will develop in students under the clear guidance of the teacher in the process of mastering the educational material through the use of interactive methods.

The study of the literature, analysis, and generalization of the materials collected on the problem made it possible to determine the theoretical foundations for the design and use of various interactive methods at different stages of a biology lesson and to interpret it for biology lessons in English.

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