



## ORGANIZATION OF EXPERIMENTAL WORKS ON INCREASING THE EFFICIENCY OF TEACHING BIOLOGICAL CHEMISTRY

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### ABSTRACT

*It is important to implement pedagogical research works and conduct experimental tests to determine their effectiveness. For this purpose, a number of scientific works on the testing of scientific research works and the analysis of their results were studied and put into practice.*

**Introduction.** The development of science and technology is increasing students' interest in the flow of knowledge and the tide of events. If we look at it from today's point of view, it is necessary for students to have high intellectual activity, good mental activity and be able to think independently. Teachers develop such qualities in students. It is the duty of professors and teachers of every higher education institution to work responsibly in such an honorable work for the development of our independent country and for our future generation. Solving such a responsible task depends on the method of arming students with deep and solid knowledge, interest in science, independent work and thinking. The more any specialist pays attention to the methodology of his work, the greater results he will achieve. The main teaching method of the teacher's work is the method of teaching and educating students. The basis of any science teacher's work is science teaching methodology.

**Analysis of literature on the topic (Literature review).** Clinical biochemistry, which is one of the fields forming the theoretical basis of the complex of medical sciences, is important for students of medical and pharmaceutical institutes. There are many biochemists who have their own specialization in this field of higher educational institutions: Tashkent Medical Academy professor R.A. Sobirova, O.A. Abrorov, F.Kh. Inoyatova, A.N. Aripov, Professor P. Mirkhamidova and Associate Professor N. Kamalova of Tashkent State Pedagogical University named after Nizomi, Professor S. N. Dalimova of the National University of Uzbekistan, Associate Professor, G.B. The Umarovas are active.



**Research methodology.** Practical testing of pedagogical research works and determination of their effectiveness is of great importance. For this purpose, a number of scientific works on the testing of scientific research works and the analysis of their results were studied and put into practice.

Andijan State Medical Institute, Samarkand State Medical Institute and Fergana Public Health Medical Institute were selected as the objects of experimental testing.

Pedagogical experiments were conducted in these experimental objects in the 2019-2020, 2020-2021, 2021-2022 academic years.

The purpose of the pedagogical experimental work is to test the level of students' mastery of the subjects of biological chemistry by strengthening the cooperation of medical institutions. Several pedagogical methods were used as experimental methods for the implementation of this goal and the organization of experimental work.

**Description of methods.** Educational and methodological developments in biological chemistry were developed for students of the medical institute during the pedagogical experiment. They are the classification of innovative technologies and the level of their use, the topics of "Blood composition, plasma proteins, lymph-reticular system biochemistry", "Liver biochemistry", "Physiologically active compounds and endocrine system biochemistry" and "Kidney biochemistry" topics of biological chemistry. methodical manuals, laboratory exercises, diseases related to the topic and skills of diagnosing them, situational issues were reflected in the content of didactic materials.

In order to test the above, the identification stage was carried out in the 2019-2020 academic year, the research stage was carried out in the 2020-2021 academic year, and the pedagogical experiment-testing stage was carried out in the 2021-2022 academic year.

Pedagogical experimental work in higher educational organizations specializing in medicine in the Republic of Uzbekistan, in particular, Andijan State Medical Institute (ASMI), Samarkand State Medical Institute (SSMI) and Fergana Public Health Medical Institute (FPHMI) Faculty of Medicine "Treatment Work" 369 students of the 2nd course of education were selected as respondents. Students were divided into control group and experimental group.

**The number of educational institutions and students participating in the experiment**

**Table 1**

No	Educational institutions	Number of participating respondents	Experimental group	Control group
1	Andijan State Medical Institute	124	61	63
2	Samarkand State Medical Institute	121	62	59
3	Fergana Public Health Medical Institute	124	64	60



4	Total	369	187	182
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When selecting medical higher education organizations to conduct pedagogical trial classes, attention was paid to the following:

- 1) existence of parallel groups in higher medical educational institutions;
- 2) voluntary and random selection of groups and students.

As a result of the analysis of the questionnaire, interview, and written work conducted before the pedagogical experiment-test, the following was determined:

- 1) innovative pedagogical technology and electronic module materials are almost never used in biological chemistry classes in some medical higher education institutions;
- 2) there are not enough necessary equipment and reagents for laboratory training in biological chemistry departments of some medical higher education institutions;
- 3) professors-teachers do not have enough teaching-methodical materials for the science of biological chemistry;
- 4) extracurricular activities and group classes in biological chemistry were almost never conducted for students.

Pedagogical experimental work was selected as an example of teaching "Biological chemistry" with students of the 2nd year of the "Treatment work" field of study at Andijan State Medical Institute, Samarkand State Medical Institute and Fergana Public Health Medical Institute.

**The selected educational institutions and the number of students participating in them are given in the table below.**

**Table 2**

№	Educational institutions	Academic years	Treatment work 2nd stage students	
			Experimental group	Control group
1.	Andijan State Medical Institute	2019-2020	58	60
		2020-2021	60	59
		2021-2022	61	63
2.	Samarkand State Medical Institute	2019-2020	60	61
		2020-2021	60	60
		2021-2022	62	59
3.	Fergana Public Health Medical Institute.	2019-2020	63	62
		2020-2021	60	62
		2021-2022	64	60
4	Total	2019-2020	181	183
		2020-2021	180	181
		2021-2022	187	182

When using the handout didactic materials prepared in the first stage of the pedagogical experiment and the lesson plans created for class and extracurricular activities, it was observed that the students of the experimental and test groups are almost close to each other in learning the subject materials, and the results are presented in the table below.



**Learning indicators of students in the 2019-2020 academic year**

**Table 3**

№	Educational institutions	Groups	Number of students	"excellent" - an excellent result with minimal errors	"very good" is an above-average result with some errors and "good" is an average result with significant errors	"satisfactory" - a poor result, with gross defects, "medium" - equal to the minimum result	"unsatisfactory" - additional independent learning is necessary to obtain the minimum level of knowledge, and "absolutely unsatisfactory" -
				5	4	3	2
				Excel lent	Good	Satisfacto ry	Unsatisfacto ry
1.	Andijan State Medical Institute	Experime ntal group	58	5	16	28	9
		Control group	60	6	15	29	10
2.	Samarkand State Medical Institute	Experime ntal group	60	5	17	28	10
		Control group	61	6	16	29	10
3.	Fergana Public Health Medical Institute.	Experime ntal group	63	6	18	29	10
		Control group	62	5	19	28	10
4.	Total	Experime ntal group	181	16	51	85	29
		Control group	183	17	50	86	30

In the second phase of the pedagogical experimental work, the following tasks were defined:

- Checking the level of students' understanding and mastery of the methodological materials recommended by us on the subject of "Biological Chemistry" in medical higher education institutions;
- Identifying highly effective pedagogical methods in teaching the subjects of the selected experimental groups in the field of "Biological Chemistry".



- Analyzing the results of lessons conducted on the basis of pedagogical methods in the study of methodical materials in the subject of "Biological Chemistry";

The second stage of the experimental part - the research stage - was completed in order to fulfill the specified tasks.

After the second stage of the experimental part, the students of the experimental group and the control group were given a written control task in order to determine the level of assimilation of theoretical and practical lesson materials. When the results were compared, it was found that there was a sharp difference in the mastery level of the students of the experimental group and the control group (table). In order to determine such a difference, an interview was conducted with professors and teachers of the Department of Biological Chemistry and students of the control group. As a result, it was found that many teachers hardly use innovative pedagogical technologies during the lesson, which leads to a decrease in the interest of students in the lesson.

**Learning indicators of students in the 2020-2021 academic year**

**Table 4**

Tr	Educational institutions	Groups	Number of students	"excellent" - an excellent result with minimal errors	"very good" is an above-average result with some errors and "good" is an average result with significant errors	"satisfactory" - a poor result, with gross defects, "medium" - equal to the minimum result	"unsatisfactory" - additional independent learning is necessary to obtain the minimum level of knowledge, and "absolutely unsatisfactory" -
				5	4	3	2
				Excellent	Good	Satisfactory	Unsatisfactory
1.	Andijan State Medical Institute	Experimental group	60	12	31	15	2
		Control group	59	7	19	28	5
2.	Samarkand State Medical Institute	Experimental group	60	12	30	16	2
		Control group	60	6	19	30	5
3.	Fergana Public Health Medical	Experimental group	60	12	28	17	3
		Control group	62	7	19	28	8



	<b>Institute.</b>						
<b>4.</b>	<b>Total</b>	<b>Experimental group</b>	<b>180</b>	<b>36</b>	<b>89</b>	<b>48</b>	<b>7</b>
		<b>Control group</b>	<b>181</b>	<b>20</b>	<b>57</b>	<b>86</b>	<b>18</b>

The third stage of the pedagogical experiment was held in the 2021-2022 school years. It has an educational nature, based on the principles of an innovative approach, experiential teaching was carried out based on the experiences gathered during the previous pedagogical experiment-test. It was noted that the innovative approach to the teaching of "Biological chemistry" in medical higher education institutions will be relatively easy to master.

The didactic effectiveness of the innovative approach to teaching materials was checked using the mathematical-statistical method. In order to check the effectiveness of teaching materials of the innovative approach, additional experimental work was carried out in experimental groups. In the test groups, work was carried out on the teaching of traditional types of educational materials.

The table shows "Blood composition, plasma proteins, biochemistry of the lymph-reticular system", "Liver biochemistry", "Physiologically active compounds and endocrine system biochemistry" of the II stage students of the "Treatment work" faculty of the medical higher education institutions. " and "Kidney biochemistry" subjects on the basis of innovative pedagogical technology, the results of the test work in the form of control work are presented (see Table 5).

In the III stage of the pedagogical experiment-test part, it was found that there is a statistical difference between the experimental group and the control group in the theoretical knowledge, practical skills and qualifications of students, as well as in the study of the results of using innovative pedagogical technologies in the diagnosis of the patient's illness. The knowledge of the students in the experimental groups showed that the theoretical knowledge, practical skills, and the ability to quickly and correctly diagnose the patient's disease were relatively high in the control groups.

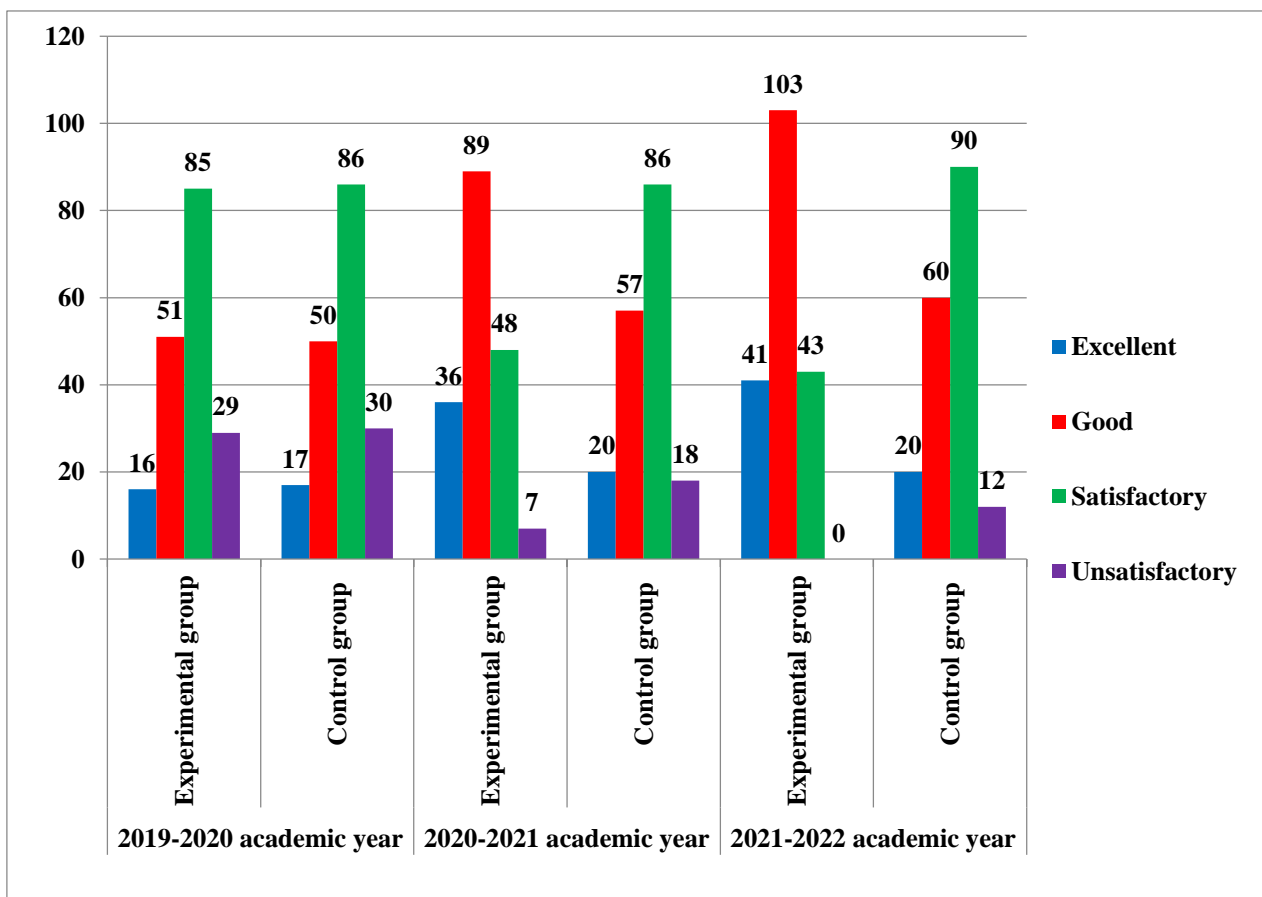
**Student achievement indicators in the 2021-2022 academic year**

**Table 5**

№	Educational institutions	Groups	Number of students	"excellent" - an excellent result with minimal errors	average result with some errors and "good" is an average result with	"satisfactory" - a poor result, with gross defects, "medium" - equal to the minimum result	"unsatisfactory" - additional independent learning is necessary to obtain the minimum level of knowledge, and "absolutely unsatisfactory" -
				5	4	3	2
				Excellent	Good	Satisfactory	Unsatisfactory



1	Andijan State Medical Institute	Experimental group	61	14	32	15	0
		Control group	63	7	20	32	4
2	Samarkand State Medical Institute	Experimental group	62	13	36	13	0
		Control group	59	6	20	30	3
3	Fergana Public Health Medical Institute.	Experimental group	64	14	35	15	0
		Control group	60	7	20	28	5
4	Total	Experimental group	187	41	103	43	0
		Control group	182	20	60	90	12



**Figure 1. The learning indicators of students in higher medical educational institutions changed as follows.**

### Discussion



1. Recommendations were developed on the implementation of the State educational standard for teaching biological chemistry, especially clinical biochemistry, and educational programs based on innovative approaches in higher medical educational institutions.

2. In the process of organizing the independent work of biological chemistry students in medical higher education institutions, if they used modern pedagogical technologies, it was possible to defend their prepared independent work in front of the team of professors and teachers of the department.

### **Conclusion.**

Theoretical knowledge, laboratory work, virtual experiments, independent work of students in the field of "Biological chemistry" were widely used in the educational process and efficiency was achieved in medical institutions of higher education.

A method of organizing and conducting laboratory work, virtual experiments, and independent work of students in the subject of "Biological Chemistry" was developed in medical higher education institutions.

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