THE METHOD OF PROBLEM-BASED LEARNING AS A MEANS OF IMPROVING THE QUALITY OF EDUCATION

Abdullaev Bakhtiyor Abdurakhmanovich
Guliston state university

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Abstract. *Despite the fact that the theoretical aspects of problem-based learning are widely represented in the psychological and pedagogical literature, in the teaching of the exact and natural sciences, the forms, methods and essence of problem-based learning have not yet been studied enough. This article presents ways to improve the quality of teaching the subject of physics in secondary schools based on various types of problem-based learning.*

Keywords: *problem-based learning, problem situation, problematic issue, creative activity, electric circuit, physical experiment.*

Introduction: We should first clarify the terms “problem” or “problem situation”, which formed the basis of problem-based education. In many cases, we perceive the terms “problem”, “problem” and “problem situation” as synonymous. And in fact, they are different from each other. The meaning of the word “problem” is interpreted as ”a difficult question, a task that requires a solution, a study “[2,page , 1512], a problematic ”approximate, an exact solution to the problem does not yet exist “[2, page 1512], and the word ”situation“ is interpreted as ”situation, situation, sum of circumstances" [2,page 1804]. In the Explanatory Dictionary of the active words of the current Uzbek language, the term “problem” is presented in the sense of “something puzzling, a work that needs to be solved or identified” [3]. A problem is a situation that arises in the process of fulfilling a practical situation, or an action in a fate in which there is an inconsistency of necessary and certain knowledge, methods or actions,” says the Russian scientist A. M. Matyushkin [4]. As can be seen, in various explanatory dictionaries, educational and scientific literature, the term “problematic” is interpreted differently. Hence, it turns out that there are different approaches to the definition of the term” problem".

The theory of problem-based learning entered World pedagogy in the second half of the 20th century. The first ideas on problem-based learning were founded by the american pedagogue J. Dewey [5, p.105]. This matter is also studied by Russian pedagogical scientists such as M.I. Makhmutov., V.Okan., I.Ya. Lerner., A.A.,Matyushkin. The didactic theory of problem education was studied by Matyushkin and others, and in their research work it was recognized as “the improved technology of problem-based learning.”

RESEARCH MATERIALS AND METHODOLOGY

Research methodology: At the Republican Educational Center under the Ministry of Public Education of the Republic of Uzbekistan, in cooperation with leading scientists, practicing teachers and methodologist of the country and international experts, a “national educational program” of general secondary education was developed, and this program was developed in the social (Internet) network (https://t.me/dastur_muhokamasi-2020). In the period of 2020-2022 years was laid in a wide public discussion. The methodological scientific basis of the national curriculum is based on a systematic – activity approach in education, which provides for the implementation of conceptual (systematic) approaches to education, developing students ' research skills [6].

The Decree of the President of the Republic of Uzbekistan dated May 11, 2022 No. 134 states that "textbooks and teaching methodological complexes improve on the basis of the requirements of the time and ensure the full introduction of the national curriculum into the educational process" [1].

According to the methodological basis of the above regulatory documents, the need to develop forms and methods for introducing problem education into the educational process is among the most urgent problems.

RESEARCH RESULTS

On the basis of the national curriculum, textbooks and teaching aids in several subjects (such as Natural Sciences (Science), Physics, Chemistry, Biology) were published. Problematic educational technologies are reflected in the textbooks and methodological teaching aids of these natural sciences. For example, there are some questions from the first grade Natural Sciences textbook: "What is the heat?", "What is the light?", "What is the Sound and its formation?", "What is the action?, How can make an object move?". In teaching topics such as problem situation, problem question, problem conversation, great emphasis is placed on the methodologies of conducting small research work. Let's go on, there are series questions from the second grade Natural Sciences textbook: "What is the energy ?"," What is the light and heat?", "What is the making sounds? What is the antique telephone?", "Study of the types of movement!", "What is a magnet?". The study of magnetic effects in solving problem situations posed in the teaching of topics such as methods of bringing the student to the work of practical activities are presented [7 - 8].

According to the methodological basis of the national curriculum, in the development of research skills in students, the development of forms and methods of teaching using problem types of Education(transfer of knowledge through problem Conversation, problem questions and assignments, small research work)is of great importance. At this point, we bring a methodology for using problematic educational technology in teaching the topic "electrical conductivity and dielectrics" in physics of 7 grades .

In the plan for organizing the lesson, attention is paid to the following

1.The purpose of the educational lesson is determined. These are: the study of conductors, dielectrics and insulators of electric charge; the formation of natural - scientific literacy on the application of conductors and dielectrics.

2.To effectively conduct the lesson, educational resources are prepared and placed on a demonstration table such as a current source, two electrometers, various metal conductors, various dielectrics, a light bulb corresponding to the source voltage, a switch, connecting wires, and a lemon acid, salt, sugar.

3.The use of innovative techniques: brainstorming, problem-based learning, question and answer, work in small groups, demonstrative experience.

4. The final results that students should achieve in the lesson, we will assume before passing the lesson. The content of the final results that students should achieve in the lesson is presented in Table 1.

Table 1

The final results that students should achieve in the lesson

	Final sub results all students…	**Final sub results Most students…**	**Final sub results Some students…**

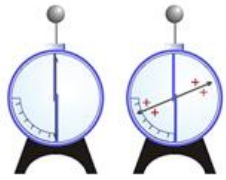
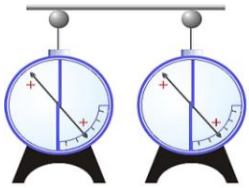
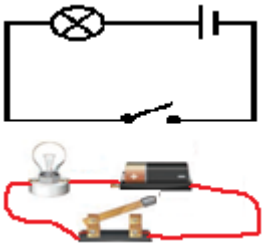
A	He knows conductor and dielectric.	Explains conductors and dielectrics with examples.	He can distinguish and explain objects into conductors and dielectrics.
B	He knows that some liquids, conduct electric charges, like metals.	Can distinguish conductors and dielectrics and explain by examples.	Distinguishes and explains whether materials are conductors or insulators.

Demonstration experiments are carried out in order to create a problematic situation in the lesson

1-experience. Take two identical electrometers and place them in different places on top of the demonstration table. One of them is electrified, and the second is non-electrified (Fig1). We bring them closer together. Pupils follow this experience. A problematic question. If you put them side by side, the charge will not pass from one to the other. Explain the reason? Pupils ' opinions are listened to. A: air does not conduct electric current, air is dielectric.

2-experience. These electrometers are interconnected by a metal conductor. It is observed that the electric charge of the first electrometer is transferred to the second electrometer (Fig. 2). A problematic question. How was the second electrometer charged? Students' opinions are listened to.

Answer: the metal conducts electricity well. As a result, part of the charge (electrons) on the first electrometer passes through the metal to the second electrometer.

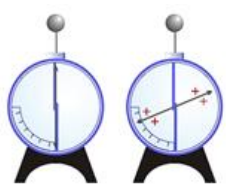
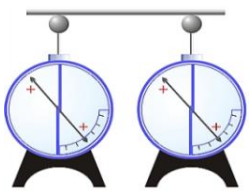
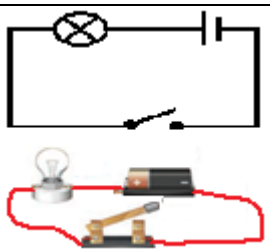
			
1-fig	2-fig	3-fig	4-fig

In the lesson, visual experiments are carried out in order to create a problem situation

1-experience. Take two identical electrometers and place them in different places on top of the display table. Of them, one is electrified and the other is in an electrified State (Fig. We bring them closer together. Readers follow this experience. Problematic question. If you put them side by side, the charge will not pass from one to the other. Explain the reason? Readers ' opinions are listened to. A: the air does not conduct electricity, the air is dielectric.

2-experience. These electrometers are interconnected by a metal conductor. It is observed that the electric charge of the first Electrometer went to the second Electrometer (fig. Problematic question. How is the second Electrometer charged? Readers ' opinions are listened to.

A: the metal conducts electricity well. As a result, part of the charge(electrons)on the first Electrometer passes through the metal to the second electrode.

			
1-fig	2-fig	3-fig	4-fig

3-experience. The chain shown in Figure 3 is assembled. The chain consists of a current source, a light bulb and a switch. With a key connection in the chain, the light bulb lights up (fig. Readers will be asked to explain the cause of the light bulb burning. Readers' opinions are listened to. Then it is recommended to view the animation of the experiment by QR code (fig. 4)

Discuss in groups

1. If we put a rubber or plastic object in the space where this switch will be connected, will the light bulb light up?

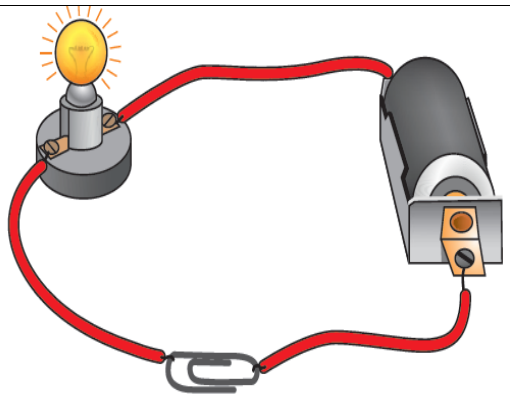
2. Does the flow of charges also pass through all substances?

3. Some substances do not conduct an electric charge? Why?

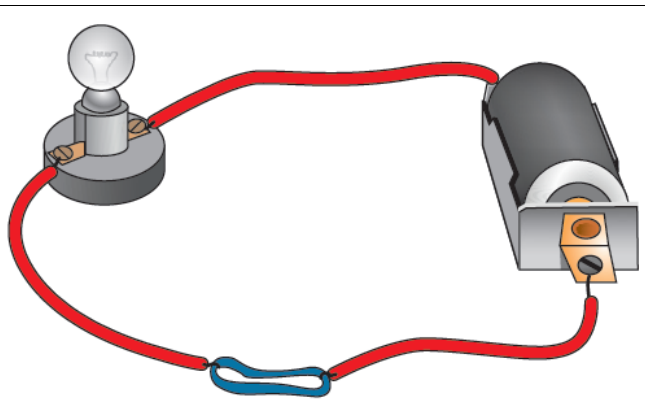
Pupils' opinions are listened to.

It is explained that substances are divided into conductors and non-conductors into two types according to their ability to conduct an electric charge. It is explained that substances that conduct charges themselves are called electrical conductors, and substances that do not charge themselves are called electrical conductors or insulators.

Learning new knowledge and skills



5-fig



6-fig

4-experience. We make a slight change to the electrical circuit, which consists of a current source (current element), an electric bulb, a switch and connecting wires (assembled on the basis of Figure 3). Instead of a key in the chain, that is, we connect a metal scraper to the connecting wires. Even in this case, the burning of the electric bulb is observed (fig. 5). The result of the experiment is discussed in groups. Based on this experiment, it is concluded that a charge is passing through the connecting wires and the scraper. After the experiment carried out, the conductors are given a definition.

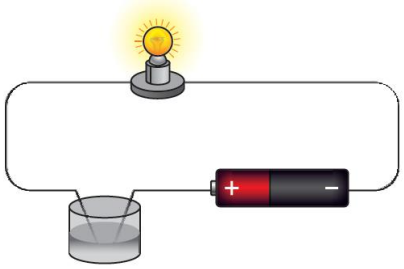
Substances that conduct an electric charge are called conductors. The entry of all types of metals into the conductors is explained.

5-experience. Instead of a metal scraper in the above experiment, that is, the ends of the wires are connected by a rubber thread. In this case, light bulb flammability is observed (fig.6). Hence, rubber does not conduct electrical charges. After the experiment carried out, a definition is given to the dielectric (insulator).

Substances that do not conduct an electric current(charge) from themselves are called dielectrics. And items made of dielectrics are called insulators. Dielectrics include all kinds of bottles, plastics, rubber, rubber, ceramic, air etc.

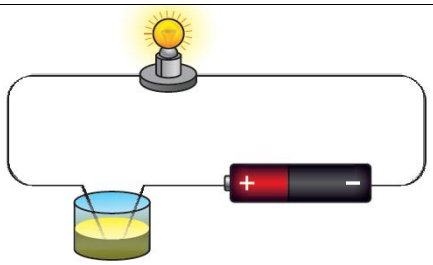
They are covered with a dielectric so that the electrical charges in the conductors do not cross each other. For example, it is explained that the top of the electrical connecting wires in the mobile phone charging device is covered with an insulator.

Application of new knowledge and skills



Salt water

7-fig



Lemon acid

8-fig

The implementation of small research work will continue.

6-experience. Water is poured into a glass and mixed with a little amount of salt. As a result, a saline solution is prepared. Instead of a scraper in the above experiment, we connect copper plates to the ends of the connecting wires, and when lowering these plates into a saline solution, the burning of the electric bulb is observed (fig 7).The result of the experiment will be discussed in the group. In this experiment, it is concluded that salt water has passed an electric current (charge) through the solution.

7-experience. If possible, the experiment can be re-conducted by pouring lemon acid instead of salt melting in the above experiment. In this, too, the burning of an electric bulb is observed when copper plates at the ends of the connecting wires in the chain are lowered into lemon juice (fig8). The result of the experiment will be discussed in the group. In this experiment, it is concluded that an electric current(charge current) passed through lemon acid.

8-experience. Instead of a saline solution, two metal electrodes are lowered into clean (distilled) water and experimented. Readers observe in the experiment that the light bulb does not burn. Question. Why didn't the light bulb burn? Readers point out that through clean water, electrical charges are not in motion, that is, that clean water does not conduct electric current is its dielectric

9-experience. And in the next experiment, add a little sugar to clean (distilled) water and mix. When two metal electrodes are lowered into the sugar water, the pupils observe that the bulb is not burned. **Question.** Both salt and sugar soaked in clean water dissolve. But we observed that only a vine passed through one of them. This, How do you explain?

We give important conclusions on the topic covered in the lesson

1. Objects are divided into conductors and dielectrics, according to the degree to which they conduct electric current.

2. Insulators are objects made of dielectrics.

The experiments carried out during the lesson serve as an important tool in the formation of natural-scientific literacy and practical competencies in students.

Experience-the knowledge gained in the course of the test is assessed based on the students ' answers to handouts. The text of the questions in the handouts is given in **Table 2**.

№	Questions	Answers	Overall score
1	How to increase the electrical conductivity of water?		10

	Give examples (3 of each) of the most commonly used electrical conductors and dielectrics		20
3	Does the human body also conduct electricity? Can you explain why?		20
4	Why is it more dangerous to touch electrical equipment and wires with wet hands than with dry hands?		30
5	Why do electrical workers wear rubber shoes and rubber gloves?		20

As test facilities, 7th and 15th general secondary schools in Gulistan (Syrdarya region), 27th and 43rd general secondary schools in Gijduvon District (Bukhara region), 35th and 86th general secondary schools in Yangi Namangan (District of Namangan region) were taken and a total of 385 students attended it.

The results of the experimental test are determined on the basis of formative assessment. In this case, the correct answers to the question asked as: 5 grades if 85 points or higher, 4 grades if 70 points to 84 points, 3 grades from 30 points to 70 points, 2 grades if below 30 points, and the results of the experimental test are presented in Table 3.

Table 3

Experimental objects	Groups		Scores			
		All pupils	5	4	3	2
Namangan region	Exp.group	68	9	21	34	4
	Control group	65	6	16	36	7
Sirdarya region	Exp. group	68	8	22	33	5
	Control group	64	3	19	35	7
Bukhara region	Exp. group	56	9	24	20	3
	Control group	59	5	22	28	4

In the conducted pedagogical experiment-test work, it was observed that the application of problematic types of education in the educational process increased by 9.9% in students of experimental groups compared to control groups of the mastering pointer.

In place of the conclusion, it can be said that the result of the research carried out shows that the use of problematic types of teaching in the effective organization of educational cognitive activity, firstly, the systematic creation by the teacher of problem situations in lesson processes, encourages in the learning process to anticipate various situations that may arise in the minds of students.

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