



## TECHNOLOGY FOR DEVELOPING STUDENTS' MOTIVATION TO LEARN THE ELEMENTS OF LOGIC

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***Abstract** This article discusses the problem of teaching students to think logically, to think logically and to draw the right conclusions from logic, that is, to motivate them to organize the elements of mathematical logic, and to use logical operations in solving mathematical examples and problems. For this purpose, a set of issues related to the formation of positive motivation in students to organize the elements of mathematical logic has been developed, which are divided into the following groups.*

*The first group of questions is based on the basic starting materials organized in the mathematics course. However, a good knowledge of the elementary mathematics course is not enough to solve the problem, because in order to get the right answer, it is necessary to show the student's ingenuity. These issues not only help to deepen and deepen the understanding of the topic, but also provide flexibility of thinking in students.*

*The second group of issues consists of issues with varying levels of complexity, i.e, issues with primary, secondary, and tertiary complexity. The division of problems into levels of complexity is based on the number of logical steps that need to be performed to solve them.*

*The third group of questions focuses on developing students' ability to find errors in feedback.*

*A fourth group of issues is proposed as students face a number of challenges in organizing the elements of mathematical logic. The fourth group of questions is aimed at developing students' ability to find errors in feedback and helps them develop critical thinking.*

*Keywords Mathematics, logic operations, teaching methods, methods, reasoning, logic, motivation, sophistry, truth, falsehood, cognitive motives and social motives.*

## INTRODUCTION

Teaching mathematics in close connection with other disciplines allows students to develop secular knowledge so that they can work effectively in any field in the future.

Modern, advanced educational technologies and non-traditional methods of teaching are being introduced into the educational process. Therefore, we would like to quote some of the methods developed by Mathematical Science in teaching the elements of mathematical logic.

Today, in the learning process, the teacher must not only impart a certain amount of knowledge, but also teach students to independently acquire new information and process it creatively. In this situation, serious attention should be paid to the problem of formation of mathematical and logical literacy in students of higher education institutions.

In general, the ability to reason and think logically develops very strongly in the process of learning mathematics. In such a situation, the main burden on the formation of logical literacy in students falls on the mathematics teacher. At the very least, having an elementary set of logical concepts and actions allows students to better organize mathematics.

Thus, the use of logic elements in the teaching of mathematics is important today.

One of the important tasks is to improve the content of the elements of mathematical logic, to apply their application to students at a high level, as well as to improve the methodology of teaching mathematics while ensuring the integration of topics.

Thus, the experience gained in enhancing these tasks leads to a number of contradictions related to the logical preparation of students:

- The contradiction between the need for students to know the elements of mathematical logic and the actual level of their logical literacy;

- The contradiction between the orientation to the formation and development of individual groups of abilities, rather than the whole set of logical and general logical skills created by the need to create an integrated system of teaching logic in higher education institutions;

- expediency of long-term study of logic.

Effective mechanisms for the development of students logical thinking through the teaching of natural sciences, integrated interactive learning technologies, virtual and experimental projects are being established in the world's leading educational institutions to develop students' intelligence and outlook. There is also a clear need to form and develop logical thinking in students in the teaching of mathematics. The formation of students' logical thinking as a whole system includes the purpose of teaching, teacher activity, student activity, learning outcome, learning content, form, methods and tools, and it is in turn related to the motivational environment of teaching.

### **MAIN PART**

The main description of the motivational environment of teaching consists of motives. The motive is related to the learner's inner attitude to the learning process and his or her interest in different aspects.

There are the following types of motives: cognitive motives and social motives. If the student has a focus on the content of the subject during the study, then the existence of cognitive motives, if the student has a focus on another subject during the study, then it is possible to talk about social motives.[1]

In turn, both cognitive motives and social motives can have different levels. Cognitive motives, broad cognitive motives (orientation to acquire new knowledge, evidence, events, laws), learning cognitive motives (orientation to the acquisition of knowledge, ways of independent learning), independent learning motives (orientation to acquire additional knowledge, then little improvement) focus on creating a custom program).

Social motives can have three levels: broad social motives (obligation and responsibility, understanding the social significance of the flow), narrow social motives (knowing and seeking the approval of others), social partnership motives (different ways of communicating with another person).

We will look at an issue related to the formation of positive motivation in students to organize the elements of mathematical logic.[2]

We divide the set of problems aimed at the formation of motivation in students to organize the elements of mathematical logic into the following groups.

First group issues. The problems of this group are based on the basic materials organized in the elementary mathematics course, as well as in the computer science course. However, a good knowledge of the elementary mathematics course is not enough to solve these problems, because in order to get the right answer, it is necessary to show the ingenuity of the student.

**Issue 1.** None of the 5 apples should be given to 6 children without 6 equal children.

**Solution:** Divide each of the 3 of the given 5 apples into two equal parts and get 6 equal parts and distribute each of them to the children; then we divide each of the remaining 2 apples into three equal children and distribute the resulting children to each of the children. The matter was settled and no apple was divided into six children.

**Issue 2.** Express the number 100 using 6 identical numbers.

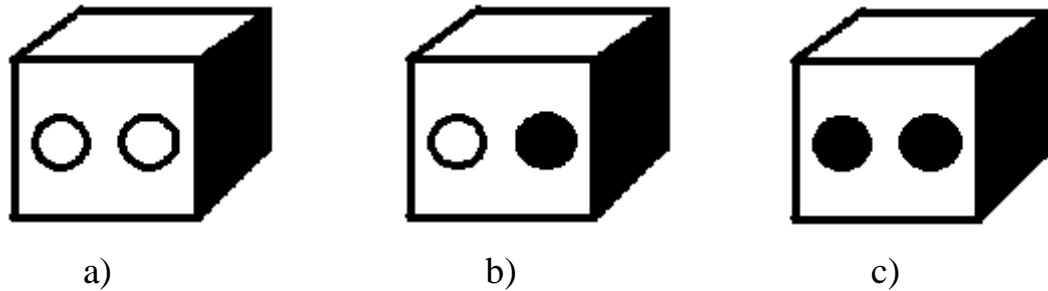
Answer:  $99\frac{99}{99}$

The first group of problems includes a small number of questions, mainly on the topic of fractions of the elementary mathematics course. These issues not only help to deepen the subject deeply and consciously, but also provide flexibility of thinking.

The second group of issues. To solve these problems (unlike the first group of problems) does not require special knowledge in mathematics, but students will be

able to conduct a logical analysis of the situation, distinguish between proven and unproven, draw conclusions from known evidence using logical reasoning.

**Issue 3.** The first box has two whites, the second has two blacks, and the third has one white and one black ball. There is a picture on each box, but they give the wrong information about the balloons inside the box. From which of the boxes is it possible to determine the color of the balls in the remaining boxes if one ball is taken at risk?



**FIGURE 1**

**Answer:** b) from the box.

**Issue 4.** City A is only true, city B is only false, and city C is alternately true and false (i.e., one of the two statements made by them is true and the other is false). The duty officer of the fire department was informed by phone:

"The fire has started, come quickly!"

"Where?" asked the guard.

- C was in the city.

Where should the fire truck go?

**Answer:** A city.

Now we bring the logical problems that can be solved using logical operations.

**Issue 5.** Three partners met in the cafe: sculptor Akbayev, violinist Karayev and artist Mallayev. It is good that one of us has white hair, the other has brown hair, and the third has black hair, but none of us has the right hair color for our family, said one of the partners. "You are right" - said Akbayev. What color is their hair?[3]

**Solution:** We describe the possibilities of hair coloring of Akbayev, Karayev and Mallayev in the form of 2 pictures. Here, the letters next to the lines indicate the color of the known human hair o - white, q - black, m - brown.

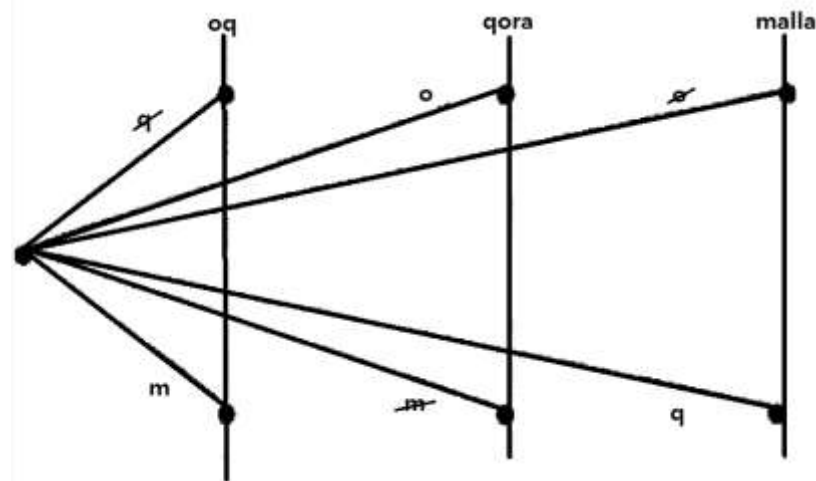


FIGURE 2

Akbaev told his dark-haired friend that he was right. So, Akbaev is not black-haired. In the picture, we can see that Akbaev has brown hair by deleting the letter q from the first vertical line. None of the other two partners have brown hair, and if we open the letter m in the second vertical line, we can see that Karayev is white, with hair, which means that Mallayev's hair is black.

**Issue 6.** Anwar, Botir, Vali and Yorkin took the first four places in the competition. When asked how many places they held, the three answered as follows: 1) Anwar was neither the first nor the fourth; 2) The brave second; 3) The guardian is not the last. How many seats did each of the children take?[4]

**Issue 7.** There is milk, lemonade, kvass and water in the bottle, glass, cocoon and jar. It is known that water and milk are not in the bottle, the lemonade container is between the cocoon and the kvass container, the liquid in the jar is neither lemonade nor water. A glass is standing next to a jar with a jar and milk. In which container is each liquid poured?

Let us now consider the issues in which the condition has both right and wrong considerations.

**Issue 8.** The three comrades Anvar, Arif and Sarvar were playing ball in the yard and one of them broke the glass. Anvar said: "I didn't break the glass". Arif said: "Sarvar broke the window". It turned out later that one of the assertions was true and the other was false. Which of the children broke the glass?

**Issue 9.** A cross was held in the woods. In discussing its results, the first squirrel said: “The first place was taken by the rabbit, the second place was taken by the fox”. The second squirrel protested: “The rabbit took the second place, and the deer took the first place”. In response, the two insisted that one part of each squirrel's statement was true and the other was false. Who was first and who was second in the cross?

Issues 5 - 9 have different levels of complexity, for example, 5 and 8 issues have primary complexity, 6 and 9 issues have secondary complexity, and issue 7 has tertiary complexity, which allows for a differentiated approach in teaching mathematics. The division of problems into levels of complexity is based on the number of logical steps that need to be performed to solve them. It is also possible to solve these problems graphically.

Such issues help students develop purposefulness and validity of thinking.

*Third group issues.* Such problems consist mainly of mathematical sophisms.

**Issue 10.** There were 30 apples in two baskets in the store. The price was set as follows: one pair of apples in the first basket should be sold for 1 som, and three apples in the second basket for one som. So, you have to buy all the apples in the first basket and get  $30 : 2 = 15$  soms, for the apples in the second basket you have to get  $30 : 3 = 10$  soms, a total of  $15 + 10 = 25$  soms.[5]

The seller thought I should take two apples from the first basket and three apples from the second and sell five for 2 soms. So he mixed the apples in the two baskets and started to buy  $30 * 2 = 60$  apples, 5 of them for 2 soms. As a result, he sold it for  $2 * (60 : 5) = 24$  soms, or 1 som, where did 1 som go?

**Solution:** from the second basket (3 apples for 1 som) the seller gets 10 times when he gets 3 pieces. He sold 20 apples from the first basket while adding two apples from the first basket to every three apples. In this way he sold 5 of them 10 times for 2 soms and received 20 soms. After that, there were 10 apples left in the first basket; he would get 5 soms when he sold 2 of them for 1 som, but the seller

sold 5 of them for 2 soms and as a result received 4 soms and therefore he lost 1 som.

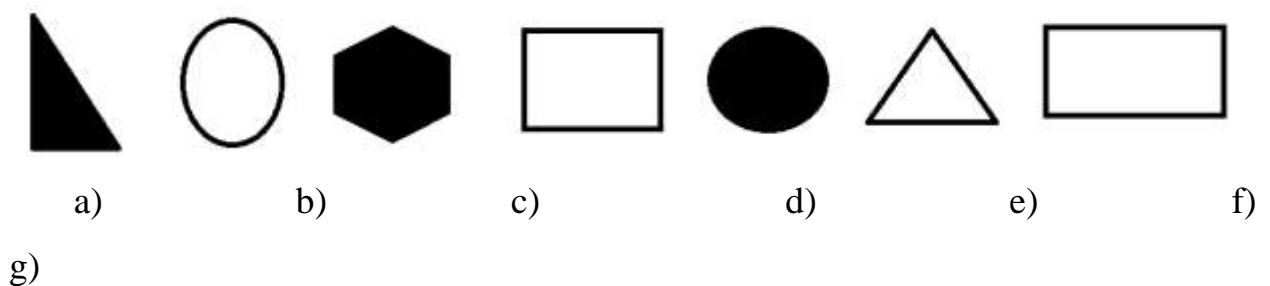
**Issue 11.** Find the error in the comment: consider the equation of the correct number:

$35 + 10 - 45 = 42 + 12 - 54$  In both parts of the equation we subtract the common factor from the parentheses:  $5 * (7 + 2 - 9) = 6 * (7 + 2 - 9)$  both parts of the equation  $(7 + 2 - 9)$ . The result is  $5 = 6$ .

This group of questions focuses on developing students' ability to find errors in feedback and helps them develop critical thinking.

As students face difficulties in organizing the concepts and actions of logic, *the fourth group of the following issues* is proposed. The purpose of these problems is to carry out the propaedeutics of separate problems of mathematical logic.[4]

**Issue 12.** Which of the assertions about the figures depicted in the picture is true and which is false?[6,7]



**FIGURE 3**

- 1) Some of the figures in the picture are not circles.
- 2) No figure in the picture is a polygon.
- 3) At least one figure in the picture is black.
- 4) An arbitrary figure depicted in the picture - a square or a circle.
- 5) At least one of the figures in the picture is white and not a right rectangle.

**Issue 13.** The following numbers are given: 372; 3344; 48; 33733; 5327; 33; 1333.

Separate the following from them:

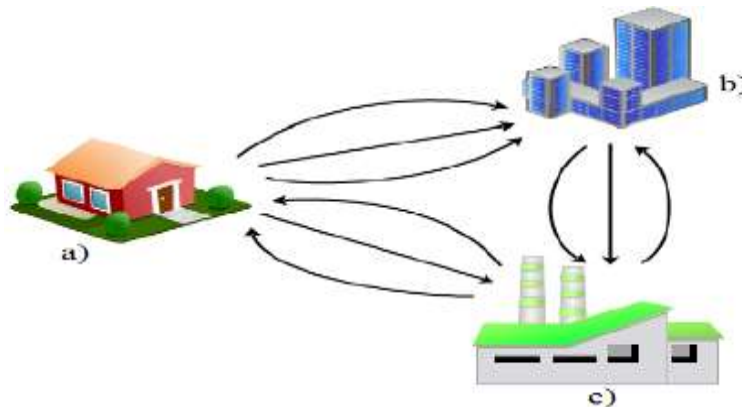
- 1) more than 200 and less than 2000;

- 2) less than 50 or more than 10,000;
- 3) those in which the number 3 occurs at least twice;
- 4) containing three copies of the number 3 occurring three times.

**Issue 14.** Create assertions that deny the assertions given.

- 1) The arithmetic mean of three consecutive natural numbers is equal to the first number.
- 2) The number 2,7 is not the root of the equation  $x + 1,2 = 4,9$ .
- 3) It is incorrect that the right fraction is greater than 1.

**Issue 15.** Follow the assignment conditions using FIGURE 4



**FIGURE 4**

a-House, b-City, c-Factory

- 1) How many different ways can Begzod leave the house and go to the factory?

**Solution:** There are 3 ways to get from home to the city **and** there are 2 ways to get from the city to the factory **or** there is 1 way to go directly from home to the factory. So Begzod can go from home to the factory in  $3 * 2 + 1 = 7$  different ways.

- 2) How many different ways can Begzod leave his house and go to the city?
- 3) How many different ways can Begzod leave the factory and go to the city?
- 4) How many different ways can Begzod leave the city and go home?

By solving the proposed problems, students form cognitive and social motives.[8,9,10]

## CONCLUSION

The following important conclusions can be drawn from the above groups of issues:

1) In solving these problems, students develop such qualities as flexibility, purposefulness, assertiveness and critique of the mind, as well as the accuracy and validity of their opinions, the logic of the conclusions drawn. In addition to the main task (formation of motivation to organize the elements of mathematical logic), the proposed issues perform another important developmental task.

In addition, factors such as the unusual content of the problems, the novelty of the solution methods, and the possibility of solving the problems in several ways allow to increase the level of cognitive activity of students.

2) The problem of organizing the motivation of students to organize mathematical logic, that is, the propaedeutics of simple concepts and simple logical operations of mathematical logic was solved.

3) The list of proposed issues can be further expanded. For example, in the first group, the numbers 5 and 6 in problem 1 can be replaced by another pair of numbers, each problem group can be filled with similar problems, and new problems can be suggested.

4) We know that the elements of logic should be a special organic subject in higher education institutions and should be taught in conjunction with a mathematics course during the teaching process.

However, before students can organize the elements of mathematical logic, it is necessary to arouse in them an interest in it.

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