CONDITIONS FOR THE FORMATION OF LOGICAL THINKING IN YOUNGER ADOLESCENTS

УСЛОВИЯ ФОРМИРОВАНИЯ ЛОГИЧЕСКОГО МЫШЛЕНИЯ У МЛАДШИХ ПОДРОСТКОВ

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Abstract

The article describes the development of the author's program "Inference", which includes plot-logical tasks of non-medical content. The program is designed for conducting extracurricular activities in order to form logical actions of reasoning in younger adolescents. The paper describes eight types of plot-logic problems: the structural variants of their construction are revealed and the levels of complexity are described. The results of 32 classes (September – May) are presented.) with an experimental group of sixth-graders in relation to the results of a control group of sixth-graders who do not participate in developmental classes. The data obtained indicate the effectiveness of the developed program.

Аннотация

В статье изложена разработка авторской программы «Умозаключение», включающей сюжетно-логические задачи неучебного содержания. Программа предназначена для проведения внеурочных занятий с целью формирования логических действий построения рассуждений у младших подростков. В работе

характеризуются восемь видов сюжетно-логических задач: раскрываются структурные варианты их построения и описываются уровни сложности. Приводятся результаты проведения 32 занятий (сентябрь – май) с экспериментальной группой шестиклассников в соотнесении с результатами контрольной группой шестиклассников, не участвующих в развивающих занятиях. Полученные данные свидетельствуют об эффективности разработанной программы.

Keywords: younger teenagers, logical thinking, plot-logical tasks of non-academic content, the program "Inference", extracurricular activities.

Ключевые слова: младшие подростки, логическое мышление, сюжетно-логические задачи неучебного содержания, программа «Умозаключение», внеурочная деятельность.

1. Introduction

In accordance with the new Federal educational standard of basic schools [15], Russian schools are developing programs for the development of universal educational actions, the development of which forms cognitive meta-subject educational results, associated, in particular, with the ability to build consistent and consistent reasoning, making various inferences and making informed conclusions.

Our research was aimed at developing and testing the content of the cycle of classes in order to create conditions for the formation of logical actions in younger adolescents associated with the construction of reasoning.

When developing the content of developmental classes, we took into account the peculiarity of the stages of development of thinking in primary and secondary school, shown in our research (see, for example, [3]).

Thus, the results of the study of inferences [1], [6], [7] and the ability to carry out consistent conclusions from these judgments [2], [11], [12], [14] suggest that learning in primary school is the main period the formation of analytical actions of mental activity associated with the analysis of the conditions of tasks for the search for essential relationships.

Research materials related to the study of the logical thinking of adolescents [3], [4], [8] and the peculiarities of their reasoning [5], [10], [13], [15] indicate that teaching in middle grades is the main the period of the formation of reflexive actions of mental activity, associated with the clarification of the characteristics of the applied methods of solving logical problems.

On the basis of this, it was assumed that in the classroom for the development of thinking in adolescents, conditions should be created that would facilitate the comprehension of schoolchildren of their own actions to solve problems.

Such conditions are not only tasks where you only need to find an answer to a question regarding the proposed conditions. But also, mainly, such tasks where it is required to choose a question to the conditions of the problem (when it is offered how many variants of the question), or to choose the missing part of the condition (from several proposed). In other words, the basis of the proposed cycle of classes are tasks where the student needs to comprehend his own way of acting when solving problems.

Thanks to the implementation of these conditions in developing classes in the middle classes, favorable opportunities are created for the formation of a reflexive position in schoolchildren in mental activity, in particular, in the construction of reasoning.

In contrast to the performing position, which is directly related to the search for a solution and obtaining the required result, the meaning of the reflexive position consists in addressing the peculiarities of search actions, in highlighting, evaluating and correcting their methods as a special reality of mental activity.

At the same time, it is generally accepted that teaching in the middle grades of school, on the one hand, is based on verbal-logical thinking, and, on the other hand, it essentially determines its development.

In accordance with these ideas, the content of developmental activities for the formation of schoolchildren's ability to build reasoning consisted of plot-logical tasks of non-educational content, in which the logical relations of objects and their properties are presented in a specific form, in the form of known life situations. Such tasks are interesting to schoolchildren, encourage them to think.

It should be noted that the organization of developmental lessons based on plot-logical tasks is directly aimed at improving the techniques of inferential thinking, and indirectly at the formation of reflexive actions of mental activity, since, as noted above, students are offered tasks related to changing the structure of tasks. In such cases, the student is forced to turn to his own search mental actions in order to change them in accordance with the new conditions.

2. Materials and methods

The discussed cycle of classes is based on the material of eight types of plot-logical tasks: "More or less", "Same letters", “What age?”, “Different, the same”, “Further, more to the right”, “Repeat”, “Or, or”, “Degree of kinship”. The tasks of these types differ in the content and attitude of judgments in the conditions.

2.1. Problem solving characteristics

So, solving the problems "More or less" is associated with the determination of the severity of the features of certain characters, for example: "Alik is more fun than Yulia. Who is the most unhappy? "

Solving the problems "Same letters" is associated with the determination of the ratio of places that certain letters occupy in the proposed words, for example: "In a notebook, they wrote words with a pen and a pencil:

PART REMOTE BALL

Words written with a pen have the same second letter. What word is written in pencil? "

Solving the problems "What age?" connected with the definition of the relationship of the characters by age, for example: “In many years Igor will be a little older than Kolya is now. Which of the boys is younger? "

Solving the problems “Different, the same” is associated with the definition of the relationship of coincidence and differences in the properties of the characters, for example: “Katya, Liza and Nina were swimming. Two girls went to the Dynamo sports complex, one to the CSKA sports complex. Lisa visited the CSKA sports complex. What sports complex did Katya visit? "

The solution of the problems "Further, to the right" is associated with the determination of the relationship of the location of the characters in space, for example: "With a pencil, pen and felt-tip pen, they wrote the words:

LESSON PAIR BUSINESS

A word written with a pencil is farther from a word written with a pen than a word written with a felt-tip pen. How is the word PAI R written? "

The solution of the problems "Repeat" is connected with the determination of the relations of the sequence of letters in the presented words, for example: "Vova and Kostya made words from cubes with letters. First, Vova composed the word KOL. Then he rearranged the letters and got the word LOK. Kostya first composed the word PIR, and then rearranged the letters in it in the same way as Vova. What word did Kostya get? "

The solution of the problems "Either, or" is associated with the definition of the relationship of features that exclude each other, for example: "There were three books on the table: one had fairy tales, another had a story, and the third had stories. In some book there were 200 pages, in some - 150, in some - 100 pages. First they read either a book with fairy tales, or a book with 150 pages, then - either a book with 200 pages, or a book with fairy tales. How many pages were there in the book with fairy tales? "

Solving the problems "Degree of kinship" is associated with the definition of kinship relations between the proposed characters, for example: "Mikhail is uncle Stepan. Stepan is Igor's brother. Who is Igor Mikhail related to? "

2.2. Structural forms of problems

In each of the noted types of tasks, the schoolchildren were offered, on the one hand, different combinations of judgments in the structure of complete tasks: in one combination, the judgments in the condition and the question were affirmative, in the other, the judgments in the condition were negative, and in the question they were affirmative, in the third - the judgments in the condition were affirmative, and in the question negative.

On the other hand, different design of incomplete problems was proposed: in one of them, it was required to select an absent question, in the other, an absent component of the condition.

The solution by children of different variants of tasks is necessary to create more favorable conditions for the development of the ability to reason. The search for an answer when solving differently structured tasks involves the implementation of different types of search activities, which allows schoolchildren to better understand the mechanism of inference, which consists in searching for a new judgment by correlating these judgments.

Consider the marked options for constructing problems of each type.

2.3. Problems "More, less" (options for conditions and levels of difficulty)

In the problems "More or less", the above-mentioned five variants of conditions are possible: the first three are associated with the content of the relationship between the qualities of the characters, the last two - with a change in the structure of the problems.

In the first version (the easiest one), affirmative statements are used in the condition of the problem and its question, for example: “Misha and Kolya swam across the river. Misha swam faster than Kolya. Which of the boys swam slower? " (Answer: Kolya).

In the second (more difficult) variant, a negative judgment is used in the problem statement, and an affirmative one in its question, for example: “Vova and Zina wrote letters. Vova did not write as beautifully as Zina. Which of the guys wrote the letters more beautifully? " (Answer: Zina).

In the third option (the most difficult), an affirmative statement is used in the problem statement, and a negative statement in its question, for example:

“Lyuba and Natasha washed the dishes. Natasha washed cleaner than Lyuba. Which of the girls did not wash the dishes as cleanly as Natasha? " (Answer: Lyuba).

In the fourth variant, the structure of the problem changes – its question becomes unknown: it is required to determine which question is suitable for the given components of the problem condition, for example:

“Vova and Galya were jumping. Galya jumped higher than Vova.

Which question can be answered by the condition of the problem:

1) How many jumps did Galya make?

2) To what height did Vova jump?

3) Who jumped lower than Galya? "

Among the proposed questions, only question 3 can be answered.

In the fifth variant, the structure of the problem also changes, - one of the components of its condition becomes unknown: it is required to determine what information is missing in the condition so that the question posed can be answered.

For example, the following problem: “Seva and Igor were riding bicycles. Which of the boys went faster?

What do you need to know to answer the question of this problem?

1) The boys were driving on the highway.

2) Igor had a new bike.

3) Seva was driving slower than Igor ”(Answer: option 3).

There are four difficulty levels depending on how many relations of character properties are presented in the content of the tasks.

The problems of the first level of complexity contain information about one relation of the characters' qualities, for example: “Lesha and Katya glued envelopes. Lesha pasted more envelopes than Katya. Who has pasted less envelopes than Lesha? " (Answer: Katya).

The problems of the second level of difficulty contain data on two relationships of the characters' qualities, for example: “Borya, Seryozha and Kolya planed sticks. Borya slapped his sticks more than Seryozha, and Seryozha - more than Kolya. Who slapped the sticks the most? " (Answer: Borya).

The problems of the third level of complexity contain data on three relationships of the characters' qualities, for example: “Katya, Nina, Liza and Natasha were embroidering scarves. Katya embroidered more scarves than Nina, Liza - less than Natasha, Natasha - less than Nina. Who embroidered scarves least of all? " (Answer: Lisa).

The problems of the fourth difficulty level contain data on four relationships of the characters' qualities, for example: “Misha, Petya, Oleg, Vasya and Vanya were shooting at a shooting range. Misha shot worse than Oleg, Oleg - worse than Vanya, Vasya - better than Vanya, Petya - better than Vasya. Who was the best shot? " (Answer: Petya).

2.4. Problems "Same letters" (options for conditions and difficulty levels)

In the tasks "Same letters" options for constructing conditions are implemented as follows.

The first option uses affirmative judgments, for example:

“They wrote the words on the blackboard with crayons:

BED BASIS GAIT

Blue and white words have the same first letter, white and red have the second. What word is blue? " (Answer: BED).

In the second variant, a negative judgment is used in the problem statement, for example: “One word was written in a notebook on Wednesday, another on Monday, and the third on Friday:

GENDER BONE GALLON

Words written on Monday and Wednesday have the same third letter, while words written on Wednesday and Friday have the first. On what days was the word " GALLON " not written? (Answer - Monday and Wednesday).

In the third variant, the structure of the problem changes, and its question becomes unknown: it is required to determine which question is suitable for these components of the problem condition, for example:

“The words were written on the blackboard with crayons:

LIGHT LETTER GET

Blue and white words have the same first letter, white and red have the second.

Which question can be answered by the condition of this problem:

1) Who wrote the word LIGHT?

2) When did you write the word GET?

3) Who wrote in red chalk?

4) What color is the word LETTER written in chalk? "

Among the proposed questions, only question 4 can be answered.

In the fourth variant, the structure of the problem also changes, - one of the components of its condition becomes unknown: it is required to determine what information is missing in the condition so that one can answer the question of the problem, for example:

“The words were written on the blackboard with crayons:

DONG LINGER BIG

The white and green words have the same fourth letter. Which word is green?

What do you need to know to answer the question of this problem?

1) The word BIG is not white.

2) The green word is not the BIG.

3) Green and red words have the same second letter.

4) White word either DONG or LINGER”(Answer - option 3).

Depending on how many relationships are presented in the content of tasks (i.e., coincidences of letters in place in words), three levels of complexity are distinguished.

The problems of the first level of difficulty contain information about two coincidences of the places of letters in words, for example:

“They wrote the words on the blackboard with crayons:

MARE MIRACL WIG

Blue and white words have the same first letter, white and red have the second. What word is blue? " (The answer is the word MIRACL).

The problems of the second level of difficulty contain information about three coincidences of the places of letters in words, for example:

“They wrote the words on the blackboard with crayons:

PARTIAL PET WELL

Red and blue words have the same first letter, red and green have the last, blue and green have the second. What word is green? " (The answer is the word WELL).

The problems of the third level of difficulty contain information about four coincidences of the places of letters in words, for example:

“They wrote the words on the blackboard with crayons:

WATCH CRISP UPROAR WEEP APT

Blue and green have the same first letter, red and yellow have the second, purple and green have the last, blue and red have the third. What color is the word UPROAR? " (The answer is yellow).

2.5. Tasks "What age?" (conditions and difficulty levels)

In the tasks "What age?" options for constructing conditions are implemented as follows. In the first version, the problem presents the entire composition of its components, the necessary judgments and the question, for example:

“Klava and Lena lived in the same house. In many years, Klava will be a little older than Lena is now. Which of the girls is younger? " (Answer: Klava).

In the second variant, the structure of the problem changes, - one of the components of its condition becomes unknown: it is required to determine what information is missing in the condition so that it is possible to answer the question of the problem, for example:

“Lyonya and Petya lived on the same street. Several years will pass. Which of the guys is younger?

What do you need to know to answer the question of this problem?

1) Lyonya will be older.

2) Petya will be older.

3) Lyonya will be much older than Petya now.

4) Lyonya will be older than Petya.

5) Petya will be older than Lyonya ”(Answer - option 3).

In the third variant, the structure of the problem changes, and its question becomes unknown: it is required to determine which question is suitable for these components of the problem condition, for example:

“Boris and Grisha were building a house. Many years ago Boris was a little younger than Grisha is now.

Which question can be answered by the condition of this problem:

1) What was the house built from?

2) How old was Grisha?

3) Where was the house built?

4) Which of the guys is older?

5) What size was the house built? "

Among the proposed questions, only question 4 can be answered.

Depending on how many relationships (characters) by age are presented in the content of the tasks, three levels of difficulty are distinguished.

The tasks of the first level of complexity contain information about two relationships of people by age, for example:

“Several years ago Sergei was much less years old than Evgeny is now. Which of the guys is older? " (Answer - Eugene).

The tasks of the second level of complexity contain information about three relationships of people by age, for example: “In a few years, Tanya will be much older than Katya a few years ago. Which of the girls is older? " (Answer - Katya).

The problems of the third level of difficulty contain information about four relationships of people by age, for example: “Many years ago Misha was a little younger than Petya's birthday this year. In many years, Petya will be a little older than Igor's birthday this year. Which of the boys is the youngest? " (Answer - Petya).

2.6. Tasks "Different, the same" (options for conditions and levels of difficulty)

In the "Different, the same" tasks, the options for the conditions are implemented as follows.

In the first version (the easiest one), affirmative statements are used in the statement of the problem and in its question, for example:

“Katya, Liza and Lena sent letters: two to Kaluga, one to Moscow. Lena corresponded with a friend from Moscow. Where did Katya send her letters? " (Answer: to Kaluga).

In the second (more difficult) variant, a negative judgment is used in the problem statement, and in its question it is affirmative, for example:

“Misha, Sasha and Kolya fired from a bow: two from a distance of 20 meters to the target, one from a distance of 30 meters. Sasha did not shoot from a distance of 20 meters. From what distance to the target did Kolya shoot? " (Answer: from a distance of 20 meters).

In the third option (the most difficult), an affirmative statement is used in the problem statement, and a negative statement in its question, for example:

“Vera, Natasha and Nina sewed buttons: two to the coat, one to the jacket. Vera sewed buttons to the jacket. Which of the girls did not sew buttons to their coats? " (Answer: Faith).

In the fourth variant, the structure of the problem changes, and its question becomes unknown: it is required to determine which question is suitable for these components of the problem condition, for example:

“Yura, Dima and Tolya played basketball. Two boys hit the ring 10 times, and one - 12 times. Yura and Dima got into the ring the same number of times.

Which question can be answered by the condition of the problem:

1) What color was the ball?

2) From what distance did Yura make throws on the ring?

3) Who hit the ring 12 times? "

Among the proposed questions, only question 3 can be answered.

In the fifth variant, the structure of the problem also changes - one of the components of its condition becomes unknown: it is required to determine what information is lacking in the condition so that the question of the problem can be answered.

For example, such a task:

“Marina, Zhenya and Larisa washed cups. Two girls washed 3 cups and one washed 4 cups. How many cups did Marina wash?

What do you need to know to answer the question of this problem?

1) The cups were made of porcelain.

2) The cups were pink.

3) Larisa washed more cups than Zhenya ”(Answer: option 3).

There are four levels of difficulty depending on how many judgments about the similarities and differences of the characters' properties are presented in the content of the tasks.

In the problems of the first level of complexity, one such judgment is presented, for example:

“Seryozha, Misha and Grisha solved examples. Two solved examples for addition, one for subtraction. Misha and Grisha solved different examples. What examples did Seryozha solve? " (Answer: addition examples).

In the problems of the second level of difficulty, two judgments about the similarity - the difference in the properties of the characters are presented, for example:

“Masha, Dasha and Rimma wrote words: two girls were English, one was French. Masha and Dasha, Dasha and Rimma wrote words in different languages. Who wrote the French words? " (Answer: Dasha).

In the problems of the third level of difficulty, three judgments about the similarity - the difference in the properties of the characters are presented, for example:

“Vitya, Alik, Fedya and Vadim went by public transport: two boys - on a tram, two - on a trolleybus. Vitya and Alik, Alik and Vadim were traveling by different types of transport, Fedya was riding a trolleybus. What was Vadim riding? " (Answer: by tram).

In the problems of the fourth difficulty level, four judgments about the similarity - the difference in the properties of the characters are presented, for example:

“Olya, Ella, Nastya, Dunya and Nyura bred fish in aquariums: three girls - golden, two - red. Ella and Nastya, Dunya and Olya, Nastya and Dunya, Olya and Nyura bred different fish. What kind of fish did Nastya have? " (Answer: red).

2.7. Tasks "Further, to the right" (variants of conditions and levels of difficulty)

In the problems "Further, to the right", the variants of conditions are implemented as follows.

In the first variant (the lightest), the spatial relation "above - below" is used, for example:

“We wrote two words in blue and red pencils:

SEA

LAKE

The blue word is higher than the red one. With what pencil did you write the word LAKE? " (Answer: in red).

In the second (more difficult) option, the spatial relationship "left - right" is used, for example:

“They wrote two words in yellow and brown pencils:

COW HORSE

The yellow word is to the left of the brown one. What word did you write in brown pencil? " (Answer: the word HORSE).

In the third variant (the most difficult one), the spatial relation "closer - further" is used, for example:

“Three words were written in black, green and orange pencils:

NUMBER LETTER NUMBER

The black word is farther from the word NUMBER than the green one. What word did you write in black pencil? " (Answer: the word NUMBER).

In the fourth variant, the structure of the problem changes, and its question becomes unknown: it is required to determine which question is suitable for these components of the problem condition, for example:

“We wrote two words in pen and pencil:

SISTER BROTHER

The word written in pen is to the right of the word written in pencil.

Which question can be answered by the condition of the problem:

1) What color was the pencil?

2) How long was the handle?

3) What word is written in pencil? "

Among the proposed questions, only question 3 can be answered.

In the fifth option, the structure of the problem also changes, - one of the components of its condition becomes unknown: it is required to determine what information is missing in the condition so that it is possible to answer the question of the problem, for example:

“They wrote two words in red and yellow:

HAMMER BUCKET

What paint is written the word HAMMER?

What do you need to know to answer the question of this problem?

1) The bucket was small.

2) The hammer was wooden.

3) The red word is to the left of the yellow one. (Answer: option 3)".

Depending on how many spatial relationships are presented in the content of the tasks, four levels of complexity are distinguished.

The problems of the first level of complexity contain information about one spatial relation (above or below, to the left or to the right, “closer to” or “further from”).

For example, a task like this:

“Misha and Sonya wrote by word:

AIRPLANE SHIP

Misha's word is to the right of Sonya's. Who wrote the word SHIP? " (Answer: Misha).

The problems of the second level of complexity contain data on two spatial relationships, for example:

“Katya, Vera and Lyuba wrote three words:

TABLE

CABINET SOFA

Katya's word is higher than Vera's, and Lyuba's is to the right of Katya's. Who wrote the word CABINET? " (Answer: Vera).

The problems of the third level of complexity contain data on three spatial relationships, for example:

“Misha, Nina, Vova and Lyuba wrote by word:

TURNIP

TOMATO CUCUMBER CARROT

Misha's word is higher than Nina's. Vova's word is to the left of Misha's. Lyuba's word is farther from Nina's than Vova's. Who wrote the word CUCUMBER? " (Answer: Vova).

The problems of the fourth level of complexity contain data on four spatial relationships, for example:

“Borya, Lida, Seva, Galya and Sasha wrote by word:

SQUIRREL FOX

BEAR HEDGEHOG WOLF

Bori's word is higher than Lida's. Seva's word is to the right of Bori's. Seva's word is lower than Gali's. Sasha's word is closer to Lida's than to Seva's. What word did Lida write? " (Answer: the word Hedgehog).

2.8. Tasks "Replay" (variants of conditions and levels of difficulty)

In the tasks "Repeat" the variants of conditions are implemented as follows.

The first option uses affirmative judgments, for example:

“Alik and Borya made words from cubes with letters. First, Alik composed the word DREAM. Then he rearranged the letters and got the word NOS. Borya first composed the word MIR, and then rearranged the letters in it in the same way as Alik. What did Bori do? " (Answer: the word ROME).

In the second (more difficult) variant, a negative judgment is used in the problem statement, and an affirmative one in its question, for example:

“Katya had cubes with numbers, Lenya had letters. Katya first put the cubes like this - 7 2 9 6, then rearranged them and it turned out - 2 7 9 6. Lenya first arranged the cubes like this - DVOR, and then rearranged them differently from Katya. What could Lenya have done? " (Answer: Lenya could have gotten many options, for example, the word VODR).

In the third option (the most difficult), an affirmative statement is used in the problem statement, and a negative statement in its question, for example:

“Yegor and Nina arranged the cubes: Yegor - with signs, Nina - with numbers. Egor first arranged the cubes like this – & # ! ?, then rearranged them and it turned out like this – # & ? !. At first, Nina's cubes stood like this - 6 8 4 7. And then she rearranged them in the same way as Yegor. What could not have happened with Nina? " (The answer is that Nina's cubes cannot be arranged like Yegor's, i.e. like 8 6 4 7).

In the fourth variant, the structure of the problem changes, and its question becomes unknown: it is required to determine which question is suitable for these components of the problem condition, for example:

“Zhenya and Masha were arranging cubes with letters. Zhenya first put the word ATOM, then rearranged the cubes and got the word AOTM. Masha made the same permutation in the word KROV.

Which question can be answered by the condition of this problem:

1) What color were the cubes?

2) How big were the cubes?

3) What did Masha do after the rearrangement?

4) How many cubes with letters were there? "

Among the proposed questions, only question 3 can be answered.

In the fifth option, the structure of the problem also changes, - one of the components of its condition becomes unknown: it is required to determine what information is missing in the condition so that it is possible to answer the question of the problem, for example:

“Dima and Marina were arranging cubes with letters. Dima first composed the word AIST, then rearranged the letters and got the word ATIS. Marina rearranged her cubes in the same way as Dima. What did she do?

What do you need to know to answer the question of this problem?

1) Marina had four cubes.

2) Dima rearranged three letters.

3) First, Marina put the cubes like this - LAKE ”(Answer - option 3).

There are three difficulty levels depending on how many images (letters, numbers, signs, etc.) are rearranged. In problems of the first level of complexity, two images out of four are rearranged, for example:

“Lena and Kirill were arranging cubes with numbers. Lena first put the cubes like this - 7 5 3 6, then rearranged the cubes and it turned out - 6 5 3 7. Cyril first arranged the cubes like this - 3 8 2 9. Then he rearranged them. What did he do? " (The answer is 9 8 2 3).

In problems of the second level of complexity, three images out of four or out of five are rearranged, for example:

“Sonya and Lara were arranging cubes with letters. First, Sonya put the cubes like this - D V K Z T, and then rearranged them in a different way - D Z V K T. Lara first put the cubes like this - R M S N L, and then rearranged them in the same way as Sonya. What did Lara do? " (Answer - Lara got R N M S L).

In the problems of the third level of difficulty, four images out of four or out of five are rearranged, for example:

“Misha and Alla arranged cubes with numbers and letters. First, Misha put the cubes like this - 8 2 4 6, and then rearranged them in a different way - 2 6 8 4. Alla first

put the cubes like this - P H B T, and then rearranged them in the same way as Misha. What did Alla do? " (Answer – H T P B).

2.9. Tasks "Either, or" (options for conditions and levels of difficulty)

In the tasks "Either, or", the variants of conditions are implemented as follows.

In the first option, affirmative statements are used in the condition and in the problem question, for example:

“Three cats - gray, white, black - were sitting: one in the room, one in the corridor, one in the bedroom. In the morning, they fed either a black cat, or a cat sitting in the bedroom, in the evening - either sitting in a bedroom, or a white one. Where was the gray cat? " (The answer is in the bedroom.)

In the second option, affirmative statements are used in the problem statement, and negative statements are used in the question, for example:

“Katya, Masha and Nadya are friends. Some of them studied at a music school, some in a sports school, some in an art school. Either Katya, or someone at the music school, received fours, fives - either someone at the music school, or Nadya. Who hasn't attended a music school? " (Answer - Katya and Nadia).

In the third variant, the structure of the problem changes, and its question becomes unknown: it is required to determine which question is suitable for these components of the problem condition, for example:

“There were three trees: pine, spruce and linden. One of them had three birds, the other had five, the third had six. First they drew either a pine tree, or a tree with five birds, then - either a tree with six birds, or a pine tree.

Which question can be answered by the condition of this problem:

1) How many birds were sitting on the spruce?

2) How many birds were perched on a linden tree?

3) How many birds were there on the pine? "

Among the proposed questions, only question 3 can be answered.

In the fourth variant, the structure of the problem also changes, - one of the components of its condition becomes unknown: it is required to determine what information is missing in the condition so that it is possible to answer the question of the problem, for example:

“Egor and Lyonya are translators. Some of them read newspapers, some magazines, some in English, some in French. In the morning, either newspapers or something from English were translated. Who read the magazines?

What do you need to know to answer the question of this problem?

1) Egor translated during the day.

2) In the afternoon, either Lenya translated, or someone from English.

3) In the morning I read Lenya ”(Answer - option 2).

Depending on how many judgments with a dividing union ("either, or", "either, or", "or, or") are presented in the content of the tasks, there are three levels of complexity.

The problems of the first level of complexity contain two judgments with a separating union, for example:

“Misha and Gena rested: someone on the river, someone on the lake, someone for one day, someone for two. In August, either Misha was resting, or someone was on the lake. In June, either someone rested for two days, or someone on the lake. How many days did Gena have a rest? " (The answer is one day.)

The problems of the second level of complexity contain three judgments with a separating union, for example:

“Mikhailov, Sergeev and Vladimirov performed at the concert. One sang folk songs, the other - city romances, the third - opera arias. At first, at the concert, they listened to either Mikhailov, or arias, then they listened to either arias, or Sergeev, then listened to either Sergeev, or folk songs. What was Mikhailov singing? " (The answer is folk songs).

The problems of the third level of difficulty contain four judgments with a dividing union, for example:

“In the garden, apple, pear, plum and cherry trees had to be watered. Some of the trees wanted to be watered at 6 o'clock in the morning, some at 7, some at 8 and some at 9. First, they planned to water either the apple trees or at 9 o'clock in the morning. Next, watering was scheduled either at 9 o'clock, or drain. Then they consulted about watering, either plums, or at 8 in the morning. After all, a decision was made to water

either pears or at 9 am. What time did you want to water the cherries? " (The answer is at 9 am).

2.10. Tasks "Degree of relationship" (options for conditions and levels of difficulty)

In the tasks "Degree of Kinship", the options of conditions are implemented as follows.

In the first version (the easiest one), affirmative statements are used in the condition of the problem and in its question, for example:

“Alexander is the son of Boris. Who can be Boris Alexander? " (Answer: father).

In the second (more difficult) variant, a negative judgment is used in the problem statement, and an affirmative one in her question, for example:

“Mikhail is not Larisa's brother, but her relative. Who can Larisa Mikhail have - a grandmother, a sister, or can no one have? " (Answer: may be a grandmother).

In the third option (the most difficult), an affirmative statement is used in the problem statement, and a negative statement in its question, for example:

“Constantine is Nina's uncle. Who cannot be Nina Constantine - mother, niece, or can no one be? " (Answer: cannot be the mother).

In the fourth variant, the structure of the problem changes, and its question becomes unknown: it is required to determine which question is suitable for these components of the problem condition, for example:

“Vladimir is Nikolai’s grandfather. Nikolai is Igor's friend.

Which question can be answered by the condition of the problem:

1) Who is Nikolai's brother?

2) Who is Vladimir's friend?

3) What is Nikolai Vladimir related to? "

Among the proposed questions, only question 3 can be answered.

In the fifth option, the structure of the problem also changes, - one of the components of its condition becomes unknown: it is required to determine what information is missing in the condition so that it is possible to answer the question of the problem, for example:

“Boris works with Victor. Who may be Victor Boris? What do you need to know to answer the question of this problem?

1) Boris is older than Victor.

2) Victor is taller than Boris.

3) Boris is Victor's brother ”(Answer: option 3).

There are four levels of difficulty depending on how many kinship relationships are presented in the content of the tasks.

The tasks of the first level of complexity contain information about one relationship, for example:

“Alexey is Dmitry's father. Who can be Dmitry Alexey? " (Answer: son).

The problems of the second level of complexity contain data on two kinship relationships, for example:

“Ekaterina is Marina's mother. Marina is Nikita's sister. Who can be Nikita Ekaterina? " (Answer: nephew).

The problems of the third level of complexity contain data on three family relationships, for example:

“Mikhail is Margarita's father. Margarita is Nikolai's sister. Nikolai is Victor's father. Who may be Victor Michael? " (Answer: grandson).

The tasks of the fourth level of complexity contain data on four kinship relationships, for example:

“Arkady is Igor's brother. Igor is Larisa's father. Larisa is Oleg's sister. Oleg is the son of Yegor. Who may be Yegor Arkady? " (Answer: brother).

3. Results

A study was carried out on the basis of this program. in which, at each lesson, children solved 12 problems of the same type with different options for conditions and different complexity. The study involved two groups of sixth graders: the experimental group consisted of 53 schoolchildren, and the control group consisted of 57 schoolchildren.

Classes with the pupils of the experimental group were held after school hours once a week during the academic year - a total of 32 classes were held. At the beginning of the academic year (September) and at the end (May), on the basis of the "Conclusions"

methodology [3], diagnostics of the formation of the ability to build logical reasoning was carried out. Diagnostic data are presented in the table.

Table.- The number of students in the control and experimental groups who solved all the tasks of the diagnostic method in September and May.

Groups	The diagnostic period	
	September	May
Control	25 (43,9%)	30 (52,2%)*
Experimental	22 (41,5%)	36 (67,9%)*

Note: * p <0.05.

The data presented in the table allow us to note the following.

First, the number of pupils in the control and experimental groups who successfully solved all the problems of the "Conclusions" diagnostic method in September is approximately the same, respectively: 43.9% and 41.5% (the difference in these indicators is statistically insignificant).

Secondly, for the period September - May, the number of pupils in the control and experimental groups increased by different amounts, respectively: by 8.2% and 26.4%. As a result, in May, there were 52.2% of such pupils in the control group, and 67.9% in the experimental group - the difference in these indicators is statistically significant at p <0.05).

4. Conclusion

So, this article sets out the content of research work aimed at developing and preliminary approbation of a lesson program designed to form in younger adolescents (in particular, sixth graders) logical thinking associated with the implementation of various kinds of inferences.

It was shown that the program is based on the material of eight types of plot-logical problems of varying degrees of complexity and with different constructive options. At the same time, it is important to note that in some classes, schoolchildren solve these problems, in others they check the proposed solutions.

The data obtained in the framework of preliminary approbation of the materials of developmental classes, despite the preliminary nature of the work, allow us to assert that the possibility of differentiation of younger adolescents with varying degrees of development of logical thinking.

In general, the developed program creates favorable conditions for sixth-graders to achieve a higher than usual level of formation of cognitive metasubject educational results, reflecting the development of logical actions necessary to build consistent and consistent reasoning.

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