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**FORMATION OF REFLECTION AND DEVELOPMENT OF
CRITICAL THINKING IN MODERN JUNIOR SCHOOL**

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Abstract

The features of the formation of reflexive skills and the development of logical actions of critical thinking of schoolchildren of graders 2 – 4 were studied. The goal of the research is to study the age dynamics of critical thinking and reflexive skills. Hypothesis – mastering by the third-graders the main educational program (MEP) and the non-educational authorial program “Intellectica plus” is more conducive to the formation of reflexive skills and the development of critical thinking in children than by mastering only the MEP. The study involved in total 214 younger schoolchildren: 51 – in the second grade, 111 – in the third grade (62 - control group, 49 - experimental group), 52 – in the fourth grade. The work included three stages. Stage 1 (September): the initial diagnostics of reflexive skills and critical thinking was conducted with pupils of the second, the fourth, and both groups of the third grade. Stage 2 (September - May): pupils of the experimental group of the third grade master the program “Intellectica plus” in 32 extracurricular activities with nonacademic material. Stage 3 (May): final diagnostics. The study showed that children in the experimental group demonstrated significantly better results in solving the problems of the use of reflexive skills of a substantial nature and on the implementation of high-level critical thinking than children in the control group. The following was revealed: the formation of reflection significantly contributes to the development of critical thinking in primary school.

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1. Introduction

A necessary tool for interacting with any information is critical thinking, aimed at analyzing the perceived information in order to establish the degree of its objectivity. In the course of such analysis, various logical actions are performed - actions with judgments according to the rules of logic. Performing such actions allows you to justify or refute the proposed statements.

If logical actions lead to the right conclusion, then, in this case, critical thinking will be demonstrative (Facione & Facione, 2007). In this case, critical thinking is realized as scientific thinking associated with the knowledge of the essential laws of change of the object studied (Lindberg, 2007).

If logical actions to substantiate a statement lead to an incorrect conclusion, then such critical thinking will be unproven (Ennis, 2011). In this case, critical thinking is in the role of ordinary, everyday thinking associated with the superficial knowledge of the object studied (Dawson, 2000).

Reflexive skills are a kind of metacognitive skills. This study examines the reflexive skills associated with the consideration, control and evaluation of the way to solve problems (Larkin, 2010).

If reflexive skills are associated with figuring out what actions were performed in solving problems, what is their specific composition, then it means that a person views and controls only the observed features of actions. In this case, reflexive skills are externally oriented towards solving the problem and are distinguished by their formal nature.

If reflexive skills are associated with finding out why actions for solving a problem are performed in this way, and not in the other one, then the person considers the reasons for these actions. In this case, reflexive skills are characterized by an internal focus on the process of solving the problem and are distinguished by substantial nature (Zak, 2007).

The development of critical thinking is characterized by the transition from performing logical actions that produce incorrect conclusions and non-demonstrative justifications to performing logical actions that produce correct conclusions and evidentiary justifications (Paul & Elder, 2007).

The formation of reflexive skills is associated with a transition from their formal nature to a substantial one, i.e. with the change of their external orientation in relation to the solution of the problem to an internal orientation (Zak, 2007).

2. Problem Statement

The problem of this research is connected with the peculiarities of critical thinking and the characteristics of the reflective skills of pupils in the modern primary school of Russia. In particular, it is necessary to characterize the age dynamics of critical thinking carried out by logical actions associated with correct conclusions and incorrect ones, and the age dynamics of reflexive skills of a substantial and formal nature among schoolchildren of 2-4 grades.

3. Research Questions

How are the logical actions of critical thinking, producing correct and incorrect conclusions, distributed among the pupils of the mentioned grades?

How are reflexive skills of a formal and substantial nature distributed among schoolchildren of the second and the fourth grades?

How the development of critical thinking and the formation of reflexive skills among the third-graders are connected in different learning conditions: when mastering only the content of the main educational program (MEP) and when mastering the content of the MEP and the content of the nonacademic program "Intellectica plus"?

It was assumed that mastering the content of the MEP and the content of the nonacademic program "Intellectica plus" by the third grade schoolchildren contributes to the formation of reflexive skills of a substantial nature in children and mastering the logical actions of critical thinking producing the right conclusions more than learning the content of the MEP only.

4. Purpose of the Study

Examine the features of critical thinking, carried out by logical actions associated with correct and incorrect conclusions, and reflexive skills of substantial and formal nature in younger schoolchildren during mastering the primary school MEP and the program "Intellectica plus".

5. Research Methods

The study involved in total 214 younger schoolchildren. 51 of them studied in the second grade, 111 - in the third grade (62 - control group, 49 - experimental group), 52 - in the fourth grade.

The study included three phases. Stage 1 (September): pupils of the second and the fourth grades, as well as the third grade (control and experimental groups) solve diagnostic problems to determine the features of critical thinking and the nature of reflexive skills. Stage 2 (September - May): the third grade pupils (experimental group) master the program "Intellectica plus". Stage 3 (May): re-diagnostics of reflection and critical thinking.

5.1. The "Inferences" task

In the first and the third stages of the study, the "Inferences" task was used to diagnose critical thinking, which included 12 plot-logic tasks of different degrees of complexity.

Problems 1–4 have the first degree of complexity, for example: "Anya, Katya and Vera played with balls. Two girls played with big balls, one with a small ball. Katya and Vera had balls of the same size. Which ball was Katya, - small or big?"

Problems 5 – 8 have the second degree of complexity, for example: "Galya, Masha, Dasha and Lena embroidered. Three girls embroidered leaves, one girl embroidered flowers. Masha and Galya embroidered different things. Galya and Lena embroidered different things. What did Galya embroider?"

Problems 9 – 12 have the third degree of complexity, for example: "Nina, Valya, Inna, Kostya and Marina gathered fruits in the garden. Three of them gathered apples, two of them gathered pears. Kostya and Marina gathered the same fruits. Marina and Vanya gathered different fruits. Vanya and Nina gathered different fruits. What did Inna gathered?"

If a pupil solved none of the problems or solved one or two problems of the first degree of complexity, then this (as was established by individual experiments) indicated that with respect to the

solved problems, he carried out critical thinking associated with logical actions leading to correct conclusions. But, since not all the problems of the first degree of complexity were solved, it was considered that there was a critical thinking of zero level.

If a pupil solved all the problems of the first degree of complexity or solved one or two problems of the second degree of complexity, then, since all the problems of only the first degree of complexity were successfully solved, it was considered that there was a critical thinking formed at a low level.

If a pupil solved all the problems of the first and second degrees of complexity or solved one or two problems of the third degree of complexity, then, since all the problems of the first and the second degrees of complexity were successfully solved, it was considered that there was a critical thinking formed at a middle level.

If a pupil solved all the proposed problems, it was considered that there was a critical thinking formed at a high level.

5.2. The “Exchanges” task

For the diagnostics of reflexive skills, the task “Exchanges” was applied. The basis for the construction of this task was the abovementioned provisions on two types of reflexive skills. In accordance with these provisions, we developed a two-part experimental situation (Zak, 2007).

In the first part, it was proposed to solve three problems of two classes (the first and the third problems should be solved in one way, the second problem – in the other). In the second part, in the case of correct solution of all, it was proposed to group them.

If the grouping was based on random characteristics of the conditions of actions in solving problems, it was thought that reflexive skills of a formal nature were used.

If the grouping was based on the necessary characteristics of the conditions of actions (their uniform method for solving problems), then it was considered that reflexive skills of a substantial nature were used.

The task “Exchanges” includes problems in which it is required to change letters in places according to certain rules, for example: transform to P L V to V P L in two actions. One action is changing in places any two letters. Solution: 1) V L P, 2) V P L or 1) L P V, 2) V P L.

After explanations of the teacher and solving training problems, the children were asked to solve three main problems (each in two actions):

- 1) A O I E --- O A E I
- 2) R S P N --- P N R S
- 3) W Y Z X --- Y W X Z

Then they needed to choose one of five opinions of these problems:

- 1) all the main problems are similar;
- 2) all the main problems are different;
- 3) the 1st and the 2nd main problems are similar, and the 3rd differs from them;
- 4) the 1st and the 3rd main problems are similar, and the 2nd differs from them;
- 5) the 2nd and the 3rd main problems are similar, and the 1st differs from them.

Then it was required to briefly explain the reasons for the choice.

Some children after the correct solution of three problems choose the opinion 4. As shown by individual experiments, this indicates that children used reflexive skills of a substantial nature, realizing an internal orientation towards solving problems, since they considered the similarities and differences in their actions when solving them. As a result, they were able to put problems with the same method of solution into the same group: it is needed to change the adjacent letters in places.

Some children after the correct solution of three problems choose the opinion 1, noting, for example: "... all problems are similar, because everywhere it is necessary to change letters in places...". Some children choose opinion 2, noting, for example, "... all problems are different, because there are different letters ...". Some children choose opinion 3, noting, for example: "... problems 1 and 2 are similar, and 3 differs from them, because there are the last letters of the alphabet in problem 3...". Some children choose opinion 5, noting, for example, "... problems 2 and 3 are similar, and 1 differs from them, because there are vowels in problem 1...".

These facts indicate that in the process of solving problems the reflexive actions of a formal nature, not a substantial one were used, since the children referred only to the external features of the conditions of the problems, without considering the features of the ways of solving them.

In cases where a pupil did not solve one, two or three problems of the "Exchanges" task, it was considered that reflexive skills associated with the successful solution of problems were not used.

5.3. The program "Intellectica plus"

At the second stage of the study, an experimental group of the third grade, during the school year, in extracurricular hours, one hour per week in 32 classes, solved the search problems of the nonacademic content of the program "Intellectica plus". This program is a modification of the program "Intellectica" for the third grade (Zak, 2008, 2018).

The noted modification of the program "Intellectica" is connected with the inclusion of **problems** in its content, where a child needs to change the activity position "I solve the problem" to the reflexive position "I check the solution of the problem".

6. Findings

The tables below contain the data reflecting the results of solving the problems "Inferences" and "Exchanges" by the second-graders, the control group (C) of the third grade, the experimental group of the third grade (E) and the fourth-graders.

6.1. Performance of the task "Inferences"

The data in table 1 show that the number of children with a high level in the experimental group is significantly (by 21.6%) more than the number of such children in the control group, respectively: 49.0% and 27.4% - the difference between these indicators is statistically significant ($p < 0.01$).

Table 01. The result of solving logic problems by pupils of the 2nd grade, the 3rd grade (C), the 3rd grade (E) and the 4th grade in September and May

Levels of critical thinking	Groups							
	2nd grade		3rd grade (C)		3rd grade (E)		4th grade	
	Sept.	May	Sept.	May	Sept.	May	Sept.	May
Zero	25,5%	17,6%	16,1%	6,4%	18,4%	0,0%	7,7%	0,0%
Low	37,3%	33,4%	35,5%	22,7%	34,8%	20,4%	19,3%	7,7%
Medium	29,4%	35,3%	33,9%	43,5%	32,5%	30,6%	44,2%	50,0%
High	7,8%	13,7%	14,5%	27,4%**	14,3%	49,0%**	28,8%	42,3%

Note: ** – < 0.01

These facts prove the confirmation of the hypothesis of the study: classes of third-grade pupils in the MEP and the "Intellectica plus" programs are more conducive to the development of logical actions of critical thinking that produce correct conclusions than their classes in the MEP only.

Analysis of the data in the table shows that as a result of primary school education, the majority of children have mastered medium and high levels of critical thinking associated with logical actions that produce the right conclusions.

6.2. Performance of the task "Exchanges"

Table 02. The results of the use of reflective skills in the process of performing the task "Exchanges" by pupils of the 2nd grade, the 3rd grade (C), the 3rd grade (E) and the 4th grade in September and May

Characteristics of the use of reflective skills	Groups							
	2nd grade		3rd grade (C)		3rd grade (E)		4th grade	
	Sept.	May	Sept.	May	Sept.	May	Sept.	May
Lack of the use of reflective skills	9,8%	2,0%	1,6%	0,0%	2,0%	0,0%	0,0%	0,0%
The use of formal reflective skills	84,3%	86,2%	87,1%	80,6%	87,8%	61,2%	78,8%	63,5%
The use of substantial reflective skills	5,9%	11,8%	11,3%	19,4%*	10,2%	38,8%*	21,2%	36,5%

Note: * – < 0.05

The data in table show that the number of children with substantial reflexive skills in the experimental group is significantly (19.4%) more than the number of such children in the control group, respectively: 38.8% and 19.4%, 4%, - the difference between these indicators is statistically significant (p < 0.05).

This fact confirms again the hypothesis of the study: the third grade classes in the MEP and the program "Intellectica plus" are more conducive to the formation of substantial reflexive skills than their studies in the MEP only.

The data in table show that after four years of study, there were no children who did not use reflexive skills, as well as after three years of study; those who used formal reflexive skills became a little more than three fifths (63.5%); who used substantial reflective skills - a little less than two fifths (36.5%).

Thus, as a result of primary school education, most children use reflexive skills of a formal nature, while a smaller part of the children uses reflexive skills of a substantial nature.

7. Conclusion

The data obtained as a result of the performed experiments allow us to answer the questions posed before the study and make the necessary conclusions.

It is shown that in the grades 2–4 the children carry out critical thinking associated with logical actions that produce the right conclusions, formed at different levels: zero, low, medium and high.

It is established that as a result of study in primary school, the majority of children have mastered medium and high levels of critical thinking.

It is noted that in any primary school grade, some children do not use reflexive skills, some children use formal reflexive skills and some children use substantial reflexive skills.

It is revealed that as a result of study in primary school, most children use formal reflexive skills, and a smaller part uses substantial reflexive skills.

In general, the performed experiments confirmed the hypothesis of the study: indeed, classes of the third grade pupils in the MEP and the program “Intellectica plus” are more conducive to the formation of substantial reflexive skills and the development of critical thinking.

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