

DIDACTIC POSSIBILITIES OF THE MRT APPROACH IN MATHEMATICS TEACHING IN GENERAL SCHOOLS

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Abstract.

The article analyzes the didactic possibilities of the MRT (Concrete-Pictorial-Impressive) approach in mathematics education in grades 5-6 of secondary schools. This approach, based on J. Bruner's theory of cognitive development, provides for a gradual transition of students from concrete-visual thinking to abstract-logical thinking[1]. Experimental results have shown that teaching based on the MRT approach significantly increases the effectiveness of students' mastery of mathematical concepts[2].

Keywords:

MRT approach, CPA model, cognitive development, mathematics education, mBlock v5.4.3, grades 5-6.

Introduction. Today, cognitive processes in students in grades 5-6 of secondary schools are undergoing a period of transition from concrete-figurative thinking to abstract-logical thinking[1]. According to the results of the PISA 2022 international assessment program, although Uzbek students have achieved relatively high results in implementing standard algorithms, they face serious difficulties in the ability to transform real-life situations into mathematical models. In particular, modeling (formulating) - that is, the ability to transform a real-life situation into a mathematical model - remains the most difficult area for students. Therefore, there is a need to teach mathematical concepts in a visual, interactive and practical form. The MRT (Concrete-Pictorial-Abstract) approach (CPA - Concrete-Pictorial-Abstract in international literature) is aimed at solving this problem[2]. In recent years, our country has carried out significant work to strengthen the material and technical base of schools. According to statistics, the level of computerization of secondary schools has increased from 45% to more than 90% in the last five years. However, the growth of technical support should be in line with the content and methodology of education. In this regard, the integration of the mBlock v5.4.3 visual programming environment and the MRT approach is an urgent pedagogical problem[2]. Students in grades 5-6 experience a psychophysiological transition from concrete-figurative thinking to abstract-logical thinking[3]. During this period, explaining mathematical concepts using traditional methods is often difficult. The MRT (Concrete-Pictorial-Abstract) approach (in international literature, CPA) is aimed at solving this problem[4].

The MRT approach is the basis of the Singapore mathematics education methodology, which is based on J. Bruner's cognitive theory[1].

This approach gradually leads the student to abstract mathematics:

- Concrete stage. The student experiences mathematical concepts through a “body” that is real, tangible, or controllable in a digital environment
- Pictorial stage. In this stage, tangible objects are replaced by graphic images or diagrams.
- Abstract/Symbolic stage. The highest stage, in which the student represents the concept through numbers, letters, and formulas.

In the “Pictorial” stage of learning, students begin to learn mathematical concepts through concrete tangible objects. For example, to add 2 to 1, the student takes 2 apples and adds 1 more apple to them. He counts the apples and determines that there are 3 apples in total. In the next “Pictorial” stage, the apples are replaced with pictures from the textbook. They draw pictures of the apples in a notebook and try to determine their total number. In the “symbolic” stage, students express their reasoning from the previous stage using symbols, that is, numbers and operations, and equality signs, as in $2 + 1 = 3$ (see Figure 1). Thanks to the first two approaches, in the final stage, students are able to visualize and better understand the essence of the addition operation.

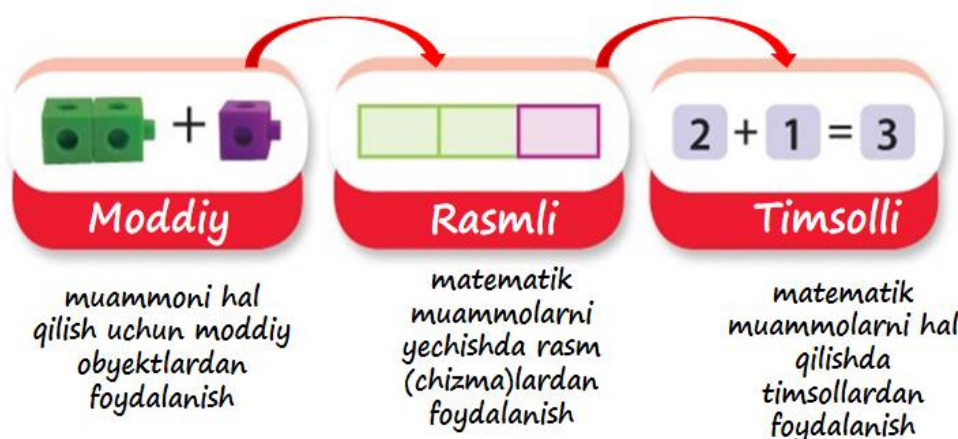


Figure 1. Stages of the MRT (Material-Image-Representational) approach

Research methodology. The MRT approach was used in the study in integration with the mBlock v5.4.3 visual programming environment. Figure 2 below shows the visual modeling process using the mBlock v5.4.3 workspace and the “Equations” section of the platform as an example.

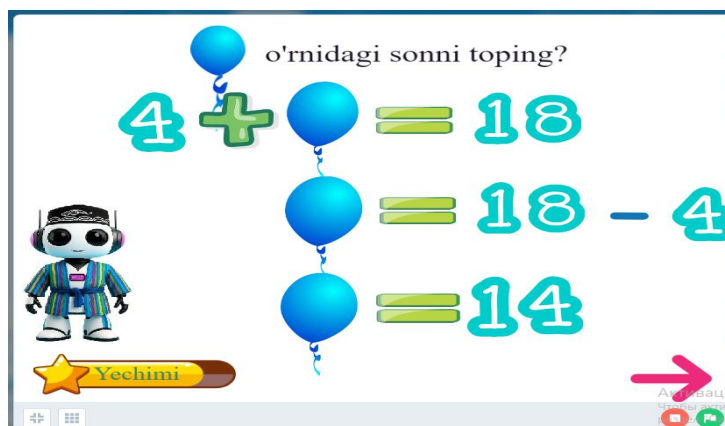


Figure 2. (Grade 6 textbook. Eslang. Example 1. Page 2). EQUATION. Example of visual equation solving in mBlock v5.4.3

Such a programming approach allows students to more clearly understand the algebraic transformations in the process of solving equations. In order to visually and interactively explain the topic of equations to students, “Example 1 (page 2) given in the Eslang section” from the 6th grade mathematics textbook was selected as a sample task (see Figure 3).

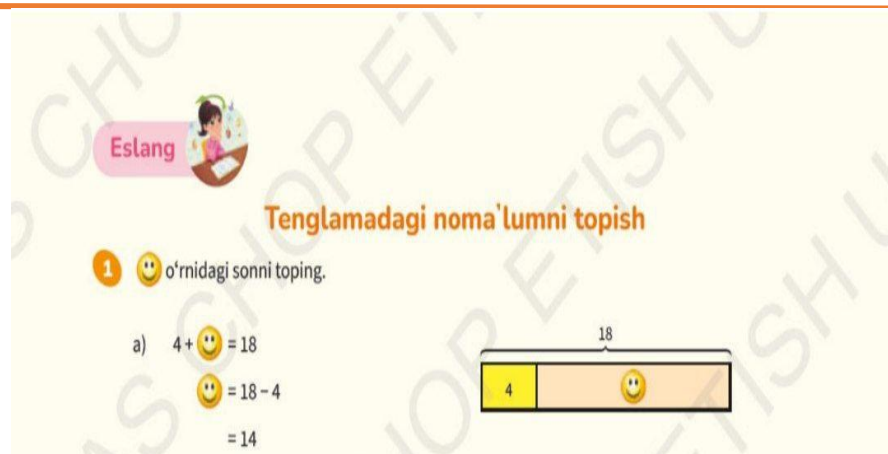


Figure 3. (Grade 6 textbook. Remember. Example 1. Page 2). From the textbook “AHA! Mathematics”

This example was expressed in the mBlock v5.4.3 software environment through digital modeling and animated visualization. In this approach, the elements of the equation are placed on the screen in the form of graphic objects, and when the “Solution” button is pressed, the process of solving the equation is displayed through step-by-step dynamic movements. In this case, the change of signs in the process of transferring the terms of the equation from one side to the other (for example, the transformation of “+” into “-” or “-” into “+”) is explained through visual animation. As a result, students have the opportunity to understand the content of algebraic transformations not only theoretically, but also on the basis of demonstrative and dynamic modeling. From a pedagogical point of view, such an approach facilitates the perception of abstract mathematical concepts by students, develops their logical thinking, and helps to more deeply master the algorithm for solving equations. Thus, visual modeling of this example from the 6th grade textbook using the mBlock v5.4.3 platform serves as a practical example of the effective use of digital technologies in mathematics education.

Conducting experimental work. The experimental work was conducted at the 6th general education school in the Izboskan district of Andijan region with the participation of 136 students of grades 5-6. The experimental group (69 students) used the MRT approach and the platform developed based on the mBlock program, while the control group (67 students) received traditional teaching methods[2].

Results. The results obtained at the end of the experiment were as follows:

< / Score >	Experimental group	Control group
Average score (5-point scale)	4,05	3,39
Average percentage	81,0%	67,8%
Knowledge quality difference	+13,2%	-

The efficiency factor was $K=1.10 > 1$. In the experience Group, the quality of knowledge was 13.2% higher than in the control group. Gamification elements such as "APPLE GAME" and "MASTER ROBOT" on the platform have significantly increased students' interest in mathematics[2].

Conclusion. The MRT approach is an effective pedagogical strategy that is consistent with the psychophysiological characteristics of 5th and 6th grade students. It acts as a methodological bridge during the transition from concrete-visual thinking to abstract-logical thinking[1]. The integration of the MRT approach with visual programming environments such as mBlock v5.4.3 further expands its didactic capabilities and allows students to increase their level of mastery of mathematical knowledge by an average of 13.2%[2].

REFERENCES:

1. Bruner J. The Process of Education. – Cambridge: Harvard University Press, 1960. – 97 p.
2. Ruziyeva M.M. Umumta'lim maktablarida matematika fanini dasturlar yordamida o'qitish samaradorligini oshirish metodikasi (5-6-sinflar kesimida): Magistrlik dissertatsiyasi. – Andijon: Andijon DPI, 2026. – 108 b.
3. Vygotsky L.S. Mind in Society. – Cambridge: Harvard University Press, 1978. – 159 p.
4. Abduqodirova P.T. Matematika ta'limida raqamli platformalardan foydalanish metodikasi. – Andijon: Andijon DPI, 2022. – 142 b.