CONTINUITY AND DEVELOPMENT OF IDEAS OF DEVELOPMENTAL LEARNING IN MATHEMATICAL EDUCATION: PRIMARY AND BASIC SCHOOL

Shuhrat Djalilov
Associate Professor

Dilshod Saidov
Master's Student
Samarkand branch of Tashkent International Kimyo University
(Samarkand, Uzbekistan)

Abstract:
The article is devoted to the analysis of the problems of succession and continuity in mathematical education between primary and secondary schools. Methodological approaches to the study of numerical systems, as well as issues of forming conceptual thinking and developing students are considered. The main directions of the methodology for studying natural numbers and fractions are described, ensuring the unity of the logic of presentation and methodological approaches. Particular attention is paid to the development of a system of educational tasks that contribute to the systematization of knowledge and skills of schoolchildren. Based on the analysis of psychological, pedagogical and methodological literature, the specificity of the concept of continuity as a necessary condition for developmental learning aimed at forming mathematical literacy and functional competence of students is highlighted.

Keywords: Continuity, mathematical education, developmental learning, primary school, numerical systems, methodology, mathematical literacy, functional competence.

An active search for ways to implement the ideas of developmental learning in school mathematics courses has found its expression in the development of various programs, textbooks, and teaching aids for both primary and secondary schools. On the one hand, this characterizes a new stage in the development of mathematical education, which is determined by the rejection of a uniform, unitary secondary school. But, on the other hand, new contradictions arise between primary and secondary schools related to the problem of continuity and succession in teaching mathematics. The essence of these contradictions is as follows. As is known, fundamental scientific research on the problem of the relationship between learning and development was carried out on primary school students. In this regard,

primary school has a solid psychological and pedagogical base for the implementation of ideas of developmental learning at the methodological level. However, these ideas have not yet been adequately developed in the mathematics course for grades 5-6. Secondary school methodologists see the solution to the problem of continuity between primary and secondary schools in the creation of a unified concept of mathematical education, the main principle of which is the priority of the developmental function. However, when declaring the priority of the developmental function of education, we must not forget that it is in the primary grades that the ability to learn should be formed, on the basis of which their further mathematical education will be built. Thus, in the concept of humanitarian-oriented mathematical education [3] it is stated that "the initial stage of teaching mathematics has two main goals: internal (didactic) - preparing students for further education - and external (pragmatic) - the formation of mathematical literacy" [3,60]. Paying special attention in the concept to the external goal, the author believes that the content of primary mathematical education should be "relatively closed". In other words, the pragmatic goal - the formation of mathematical literacy corresponds to the thesis about the sufficiency of primary education for everyday life of a person.

In this concept, education in grades 5-6 is also assigned a preparatory role, where the discussion is already about the functional literacy of students. The closest to this concept is the statement by M. V. Lomonosov that “mathematics should be studied because it puts the mind in order.” But, as A. A. Stolyar rightly noted, “mathematics in itself does not put the student’s mind in order, even with an optimal selection of content: “The result is carriers of isolated data of knowledge, without adequate mental development” [5, 6]. It follows that it is not enough to convince society and the school itself of the need for targeted work on the development of students; it is necessary to arm it with the means and methods that allow this goal to be achieved. At the same time, it is necessary to take into account that an important aspect of the development of students is the formation of their conceptual thinking, the ability to rise from the real-subject level to the level of abstract concepts. For this, the content of the subject must be systemic, that is, representing a certain interrelation of concepts. The child assimilates this system of concepts in the process of educational activity, which requires awareness of the educational task, the performance of various mental operations (analysis, synthesis, comparison, classification, generalization) associated with the search for its solution. The main content-method line of the course "Mathematics" studied in primary and secondary school is the number line. It groups around itself a significant number of concepts of this course related to the development of the concept of number. Therefore, it is necessary to develop a unified mathematical approach to the study of natural numbers and fractions, which will ensure continuity in the study of the course "Mathematics" at two levels of education.

Thus, in the theory of numerical systems, continuity appears as a unity of historical and logical development. Practical human activity, on the one hand, and the internal needs of mathematics, on the other, determined the development of the concept of number.

To characterize the concept of continuity in the framework of mathematical education, learning must be considered as a process of formation of a person's personality through mastering the basics of mathematical knowledge and skills, mathematical activity. To characterize continuity in education, a comprehensive, systematic approach is needed, which reflects: the logic of constructing the main content-methodological lines of the course, taking into account the relationship and development of the concepts studied by schoolchildren.

Let us consider some ways of implementing continuity in the study of natural numbers and fractions at the initial and basic stages of education. In modern programs and textbooks, the methodology for studying natural numbers and fractions is carried out within the framework of the concept presented by N.B. Istomina, the main goal of which is the development of students' thinking in the process of mastering mathematical content. Based on this, the methodology for studying natural numbers and fractions in the 5th grade, as well as rational numbers in the 6th grade, was developed.

Thus, the main directions of the methodology for studying natural numbers in elementary grades were further developed in the study of natural numbers and fractions in the 5th grade.

The implementation of this methodology in textbooks for grades 5 and 6 found its expression in replacing explanatory texts with problem situations in the form of practical tasks. Completing these tasks requires the active use of techniques for choosing, comparing, classifying, transforming, constructing; rejection of reproductive repetition. Priority is given to educational tasks that establish relationships between the concepts of the mathematics course for grades 5 and 6 with the concepts that students previously learned in elementary grades.

Let us briefly characterize the content of the course "Mathematics" in terms of numbers and the general focus of the methodology for studying natural numbers and fractions in elementary, fifth and sixth grades.

1st grade. Relationships of "same", "more", "less" (establishing a one-to-one correspondence). The relationship between cardinal and ordinal numbers. Natural series of numbers from 1 to 9, the principle of its construction. Counting and counting by one. The meaning of addition and subtraction. Concepts of whole and part. "Increase by ...", "decrease by ...". Components and results of addition and subtraction. Commutative property of addition. Two-digit numbers, their place value structure.

2nd grade. Associative property of addition. Three-digit numbers, their place value structure. The meaning of multiplication. Names of the components and the result of multiplication.

Multiplication by 0 and by 1. Commutative property of multiplication. The concept of "increase by ...".

3rd grade. Associative property of multiplication. The meaning of division. Names of the components and the result of division. The relationship between multiplication and division. The concept of "decrease by ...". Multiple comparison. Impossibility of division by zero. Dividing a number by 1 and by itself. Multi-digit numbers. Concepts of place value and class. Relationship of place units. Place value addends.

4th grade. The meaning of division with remainder. Methods of division with remainder. Relationship between components and the result of division (with and without remainder).

5th grade. Natural numbers. Review of the basic concepts, properties, and methods of operation that were studied in the primary school mathematics course. Divisors and multiples. Prime and composite numbers. Divisibility criteria. Factorization into prime factors. Greatest common divisor. Least common multiple. Common fractions. Fraction as part of a whole. Representation of fractions on a coordinate ray. The main property of a fraction. Comparison of fractions. Fraction as a result of dividing natural numbers. Addition and subtraction of mixed numbers. Multiplication and division of common fractions.

6th grade. Common and decimal fractions. Rational numbers. Positive and negative numbers. Coordinate line. Opposite numbers. Absolute value of a number. Comparison of rational numbers. Addition and subtraction of rational numbers. Multiplication and division of rational numbers.

The first steps in developing the concept of number in primary school children are associated with their performance of certain actions with subject sets. The quantitative characteristics of subject groups are realized by the child in the process of establishing a one-to-one correspondence between subject sets. In this case, the quantitative characteristics of the number are expressed in the concepts of "as much", "more", "less".

Acquaintance of students with a ray, a segment and a method of measuring length using various measures allows us to introduce the concept of a "number ray" and use it as a visual aid for comparing numbers, and then for adding and subtracting them.

The set-theoretic interpretation of the sum serves as a mathematical basis for explaining the meaning of addition. It is easily translated into the language of subject actions, which allows us to rely on children's experience, counting skills and the operations of counting and counting when forming ideas about the meaning of addition.

In the second grade, in the topic "Multiplication", much attention is paid to explaining to children the meaning of this action as a sum of identical terms and a new mathematical notation. For this purpose, various types of educational tasks are offered:

- to highlight the features of similarity and difference of these expressions;

- to correlate a drawing and a numerical expression;
- to write a numerical expression based on a given drawing;
- to select a numerical expression corresponding to a given drawing.

The numbering of multi-digit numbers in the third-grade course is presented by the topic: "Multi-digit numbers". The main methods of mastering the decimal positional number system are: analysis of these numbers from the point of view of their place value composition, identification of features of similarity and difference in specific numbers, construction of series of numbers in accordance with certain rules.

The content of the fourth-grade program also corresponds to the thematic principle. The sequence of studying the topics allows you to organically include previously covered material in each subsequent topic and thereby build knowledge, skills and abilities into a certain system. The topic "Natural Numbers" is the first topic in the 5th grade, the main goals of which are to systematize, generalize and develop students' knowledge of natural numbers: to introduce new concepts, the perception and assimilation of which students were prepared in elementary grades.

The goals of continuity are realized when studying all the issues included in the program. For example:

- when repeating the primary school mathematics course, the concept of "natural number" is introduced (in elementary grades this term was not introduced, it was about numbers that are used for counting);
- the concepts of "coordinate ray" (in elementary grades - "number ray"), "coordinate of a point", "unit segment" (in elementary grades - "measure") are introduced;
- students generalize at the verbal and symbolic level the change in the results of actions depending on the change in components and get acquainted with rounding methods (preparatory work for such a generalization was also carried out in elementary grades); - the study of divisibility properties is based on the knowledge, skills and abilities formed in the elementary course of mathematics when studying the property of "dividing a sum by a number".

When explaining the task, the child can only repeat the textbook text, which says how equal fractions are obtained, that is, repeat the example given in the textbook.

This knowledge and skills are developed and improved in the sixth grade, where at the beginning of the school year the topic "Ordinary and decimal fractions" is studied. The main goals of this topic are to expand students' understanding of the possibilities of writing numbers in various equivalent forms; to develop skills in calculating with ordinary and decimal fractions.

Further development of students' knowledge of numbers occurs in the topic "Rational numbers", where they become familiar with positive and negative numbers, and they develop an idea of a rational number.

Thus, the continuity in the study of mathematics between elementary school and grades 5-6 is expressed:

- in the unity of the logic of the presentation of the content. The thematic principle of the course structure ensures the study of mathematical content in the organic connection of each topic with the previous one. This creates conditions for repeating previously studied issues at a new level, allows comparing and correlating them in a variety of aspects, generalizing and systematizing them. At the same time, if primary school students rely more on life experience, intuition, then students of grades 5-6 actively apply already formed concepts and methods of action; - in the unity of methodological approaches to the study of mathematical concepts, properties and methods.

Each of these areas is implemented in a system of educational tasks that reflect the goals, content, methods and forms of training and determine the nature of the student's educational activity. The development of a methodology for studying natural numbers and fractions, ensuring the continuity and succession of the course "Mathematics" in elementary and 5-6 grades of school, was carried out on the basis of an analysis of psychological, pedagogical and methodological literature. The specificity of the concept of continuity as a necessary condition for development, designed to play a significant positive role in the construction of content-targeted continuous education in line with the unified concept of developmental learning, is highlighted.

References

1. Nicolescu B. N., Petrescu T. C. On the continuity mathematics curriculum between primary and secondary school //Procedia-Social and Behavioral Sciences. – 2015. – T. 180. – C. 871-877.
2. Imomalievich R. I. Synergetics: The Path from General Systems Theory to Self-Organization //Global Scientific Review. – 2023. – T. 22. – C. 317-324.
3. Эргашева М. Таълимнинг тизимли таҳлили //Общество и инновации. – 2021. – Т. 2. – №. 4. – С. 88-97.
4. Gasteiger H. Early mathematics in play situations: Continuity of learning //Mathematics and transition to school: International perspectives. – Singapore : Springer Singapore, 2015. – С. 255-271.

5. Мардонов Р. С., Ризаев И. И. Проблемы в инновационном развитии (на примере Узбекистана) //Географические и экономические исследования в контексте устойчивого развития государства и региона. – 2022. – С. 244-246.
6. Usmonov F. N. The place of rational and creative thought in turning the virtuality into reality //Paradigmata poznani. – 2014. – №. 2. – С. 31-33.
7. Rashchikulina E. N. et al. Students' Training for the Realization of the Principle of Continuity in the Development of Children's Cognitive Abilities //Indian journal of science and technology. – 2016. – Т. 9. – №. 37. – С. 102-174.
8. Muhammadiev K. Potentiality and virtuality in the philosophy of modern times //Theoretical & Applied Science Учредители: Теоретическая и прикладная наука. – 2022. – №. 3. – С. 1000-1004.
9. Тураев Б. О., Ризаев И. И. Особенности проявления искусственного интеллекта в бытии человека //Новые информационные технологии и системы (НИТиС-2022). – 2022. – С. 361-363.
10. Kubayeva S. Language Games in cognitive processes: constructive-semantic approach //Conferencea. – 2023. – С. 156-159.
11. Hasanova L. T., Ernazarov T. R. Human spiritual potential and popular culture //Theoretical & Applied Science. – 2021. – №. 2. – С. 16-18.
12. Daro P., Mosher F. A., Corcoran T. B. Learning trajectories in mathematics: A foundation for standards, curriculum, assessment, and instruction. – 2011.
13. Аликулов С., Ризаев И. И. Образование и современные технологии //Моделирование и конструирование в образовательной среде. – 2021. – С. 27-31.
14. Begaliev J. Socio-philosophical foundations of the anthropological concepts of Abu Raikhan Beruni //Science and innovation in the education system. – 2023. – Т. 2. – №. 7. – С. 63-66.
15. Van Oers B. Educational forms of initiation in mathematical culture. – Springer Netherlands, 2002. – С. 59-85.