

THE ESSENCE OF INTEGRATION IN SCHOOL MATHEMATICS EDUCATION AND ITS PSYCHOLOGICAL ROLE IN TEACHING

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Abstract:

This article discusses the main functions of integration in mathematics education, the essence of integrative processes, the distinction between the concepts of "Integration of Sciences" and "Integration of Scientific Knowledge," and how the meaning of the word "integratio" and the mathematical term derived from it do not fully capture their content. The article also presents the opinions of several scholars on the concept of integration. Additionally, it addresses the application of geometric methods in algebra and their role, the importance of geometry in mechanics and physics, the role of integration in the development of spatial imagination, and in the formation of mathematical intuition.

Keywords: Integration of Sciences, integrative process, function, integratio, culture, geometric, algebra, integration of scientific knowledge.

Introduction

In secondary schools, the teaching of mathematics as a leading subject is one of the necessary conditions for the intellectual and psychological processes that students need to achieve. The mathematics course for general education schools is based on the specific psychological characteristics of mathematics and the high integrative potential of mathematical knowledge.

In scientific literature, there is no clear and unified definition of the concept of integration in education. For example, the concepts of "Integration of Sciences" and "Integration of Scientific Knowledge" are not equally strong. This is because the first is a broader integrative concept, while the second is understood as an organizational part of integration.

In the development of the concept of integration, the following can be said: At the end of the 19th century in Europe, the word "Integration" was only interpreted as mathematical integration. By the middle of the 20th century, the meaning of the concept of integration was described in two ways. That is, the first interpretation was mathematical integration, and the second was understood as the merging or expansion of something.

The concept of integration is derived from the Latin word "integration," which means restoration, completion, renewal. This word in the Roman language does not fully convey the meaning of integration. In any case, such a translation allows for interpreting integration as a process independent of human involvement that restores something or naturally unites parts into a whole that did not exist before. However, in the "Latin-Russian Dictionary," the word "Integratio" is interpreted as activity, and it is said that through this activity, the previously broken wholeness or connection of something—specifically the physical and spiritual state of a person or an object—is restored. That is, integration is understood in terms of restoring something to its previous state or re-establishing something that was previously lost.

The meaning of the word "Integrino" and the conclusions derived from it do not align with the content of mathematical terms.

In mathematics education, integration is expressed as the sum of parts. The further development of the concept of integration is closely connected with the rapid development of systemic concepts.

For example, in D.N. Ushakov's terminology dictionary, integration is defined as follows: "Integration is the process of combining elements or parts into a whole during the development process."

In a foreign language dictionary, a slightly different definition is given: "Integration means restoration, completeness, and the combining of elements or parts into a whole."

N.I. Kondakov defines the concept of integration as follows: "Integration is the process of combining elements into a single whole and restoring a certain unity."

According to V.A. Ignatova, "Integration is the process and result of the interaction of separate differentiated elements within a whole system, leading to their stable functioning."

Based on the definitions of integration given above, the following meanings of the concept of integration can be outlined:

- Integration as the interrelationship that ensures the unification of the elements forming the concept;
- Integration as the synthesis of elements into another system;
- Integration as the merging of differentiated parts within the whole process of development.

Based on the various interpretations of the concept of integration, the following generalized conclusion can be drawn. Integration can be understood as a process that indicates the interconnection of distinct and completely different parts of a whole and leads to the study of their interrelations. It is appropriate to generalize it in this way.

It is difficult to say that the conceptual integration in the field of education is fully developed. This is because there is no clear definition of the concept of "educational integration" in pedagogical literature. All the existing definitions of educational integration only cover specific aspects of education.

The integration of mathematics education has led to the need to find new ways of establishing connections between algebra and geometry. One of these ways is the application of geometric methods in algebra. The strengthening of the role of geometry in mathematics education is explained by the growing demand to develop students' creative thinking, with its main components being intuition and imagination, which are closely related to geometric concepts and methods.

The role of geometry in the development of mechanics and physics is crucial. Geometric concepts play a fundamental role. In mechanics and physics, motion

and processes mainly take place in space. For example, kinematics and geometric optics, the structure of crystals, the spatial models of complex molecules, the symmetry of living organisms, and so on can be mentioned.

In mathematics education, spatial imagination and the concept of mathematical intuition play an important role. The influence of geometry can be seen in the following situations.

- Geometric knowledge was decisive in the emergence and development of mechanics and mathematical analysis.
- The concept of integration, which comes from finding the area and volume of figures or objects, was associated with quantities that define area and volume.
- The concept of differentiation arose mainly from problems related to the tangents of curves and similar issues.
- The graphs of functions play an important role in the development of mathematical analysis concepts and have maintained their significance. Analysis is considered the source of geometry. For example, the concepts of "division point" and "range of a variable" are clearly represented in analysis.
- The theory of differential equations is often explained geometrically.
- The main idea of functional analysis is that functions in a given class are considered points in a "functional space," and the relationships between functions are interpreted as geometric relationships between corresponding points.

Geometry influences algebra, even arithmetic, and number theory. For example, the concept of the vector space is used in algebra. In number theory, many problems that cannot be solved through computation are solved through geometric methods. Here, the graphic methods of computation can be emphasized.

Many scientific problems are solved using geometric methods. For example, the problem of measuring the length of segments led Pythagoras to discover irrationals and later develop the real numbers. Similarly, problems such as measuring the length of a circle, the area of a circle, and the volumes of spheres and pyramids led Greek scientists to introduce the concept of limits into science. The problems of finding the tangential equation of a curve and calculating the area of a curvilinear trapezoid helped G. Leibniz and I. Newton discover differential and integral calculus. Furthermore, geometric methods of representing spatial figures have become the foundation of visual arts. Euler's

problem on the Königsberg bridges laid the foundation for a new direction in geometry, which became graph theory.

One of the main concepts in algebra is the concept of groups, which originated from geometric concepts of symmetry and motion. Symmetry groups play an important role not only in mathematics but also in physics, chemistry, biology, crystallography, and other sciences. In recent decades, algebraic geometry has been rapidly developing, and this branch of mathematics studies algebraic structures using geometric methods. Due to the advancement of computer technology, a new field of geometry called computational geometry has emerged and is successfully developing. In general, modern science cannot be imagined without geometry, especially its branches such as topology, analytic geometry, differential geometry, algebraic geometry, and graph theory.

Thus, the integration of mathematics education is necessary both within mathematics itself and for establishing connections between mathematics and other subjects, to ensure psychological harmony and coherence. In the educational process, integration should be a leading tool for continuous education and ensuring continuity.

It must be an essential condition for establishing interdisciplinary and intradisciplinary connections. Of course, it is important not to forget the significant role of the integration of mathematics education in improving the quality of education.

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