

The Modern Concept of Integration Processes in Science

Barno Abdulhaqovna Amirullaeva

Researcher at the A. Avloni National Institute of Pedagogical Mastery

Kuchkar Xusanovich Sherxalov

Physics teacher at the Samarkand Region National Pedagogical Mastery Center

Abstract. This article discusses the current pressing issues in science, the importance of teaching based on the integration of disciplines, integrated education, the stages of development of integrated education, the modern concept of integration processes, and the characteristics of integrative processes.

Key words: *Integration, interdisciplinary connections, differentiation, integrative tendencies, heterogeneous, modern concept of integration processes.*

Introduction

The 21st century is characterized by the rapid growth of scientific knowledge. Humanity is entering a new phase of its development – the information stage. Human life and activity are primarily associated with the creation, processing, and utilization of information, marking a phase in the development of civilization. Currently, two parallel processes in science are distinctly identified. One of them is the differentiation of scientific knowledge into various fields, which leads to the emergence of very narrow and specialized research problems. At the same time, integrative tendencies in science are growing stronger, leading to the birth of new disciplines and interdisciplinary knowledge systems. The processes of integration and differentiation correspond to two tendencies of cognition: on one hand, the desire to describe the entire world, and on the other hand, a deeper understanding of the regularities of various structures and systems.

It is known that both of these processes are closely interconnected. The dialectic of the relationship between the processes of differentiation and integration manifests everywhere. In fact, any object of reality can be viewed as an expression of the integration of its components, their unity, or the cohesion of its elements. The unity of integration and differentiation not only reflects the unity and diversity of the world, and the analytical and synthetic approaches in cognition, but also embodies the unity of individuality, specificity, and generality. The differentiation of knowledge is largely determined by the necessity to reflect the uniqueness and characteristics of the objects of knowledge, whereas, on the other hand, integration reflects the need to distinguish the commonalities of the objects being studied.

Review of the Literature. In the works of B.M. Kedrov, the relationship between the processes of integration and differentiation of scientific knowledge in different historical periods is explored. According to the scholar, in ancient times and the Middle Ages, integration prevailed, while in the modern era (the 16th to mid-19th centuries), the differentiation of sciences dominated. However, from the late 19th century onwards, attention to interdisciplinary integration began to intensify [1]. In the 19th century, the integration of scientific knowledge led to the discovery of the law of conservation of energy, the development of universal methods in thermodynamics, and the unification of the theories of electricity and magnetism. These discoveries, along with the periodic law and the discovery of cell structure, contributed to the success of science at the beginning of the 20th century, particularly in the creation of the theory of relativity: the concepts of space, time, and mass, M. Planck's discoveries, and the development of a unified theory of weak and electromagnetic interactions. In our time, the integration of scientific knowledge has ensured the emergence of a new unifying direction in science—synergetics—revealing common laws in various fields of natural science. Many scholars, analyzing the contemporary processes of integration and differentiation in science, reasonably emphasize the primary importance of the integration of disciplines. "What can now be conditionally called the 'explosion of integration' is in fact a unique 'integration revolution,'" writes A.D. Ursul [2].

Research Methodology. The integration of scientific knowledge is a natural process, which, according to B.M. Kedrov, is conditioned both by the needs of social development and by the "ideological" needs that arise within science itself. In recent years, the trend of integration in modern science and practice has become more noticeable. Specifically, in pedagogical literature, there is a growing focus on integral processes that influence all levels of school education. The interpenetration of integration and differentiation in science provides the objective basis for developing interdisciplinary connections in the process of improving the scientific system of education.

Problems related to the integration of knowledge, the study of integration as a general scientific concept, its mechanisms, factors, levels, components, tools, and the identification of the most important characteristics and functions in various types of systems have been addressed in several works.

The integration of the educational process, in our view, on one hand, involves the mutual enrichment of knowledge from various fields and the unity of knowledge and skills, and on the other hand, the continuity between different stages of the education system, which merge into a single ascending ladder that encompasses all stages of a person's life and professional development. Thus, V.A. Ignatova, in her work "Formation of Ecological Culture in Students: Theory and Practice" [3], suggests the following principles that enable the implementation of integration into the content of education or specific academic subjects, which are also relevant to our disciplines:

the unity and integrity of the world and all its lower systems;

the unity, integrity, and integration of the development of knowledge and reality, the integral nature of thinking;

the unity and integrity of the individual (the unity and interconnection of all its aspects) and the logic of its development;

the unity and integrity of the educational process and the logic of its construction;

the unity and integrity of the content of education and specific academic subjects;

the purposeful direction of the topic and the logic of its construction.

In many pedagogical studies, integration is considered as one of the variants of interdisciplinary connections.

Analysis and Results. In the 1980s, interdisciplinary connections were interpreted as one of the ways to implement the ideas of integration. The psychological mechanisms of knowledge based on interdisciplinary connections are inherent in the mechanisms of mastering relationships, existing in the process of generalizing information related to different scientific knowledge systems. As a result, the integrity and systematization of students' knowledge is ensured. The maximum integration of scientific knowledge should be reflected in the three main components of the content structure of each academic subject:

in the system of knowledge that has qualitatively changed as a result of interdisciplinary connections;

in the system of skills that acquire distinct characteristics in the educational and cognitive activities implementing interdisciplinary connections;

in the system of relationships formed with educational knowledge in the process of synthesizing knowledge from different subjects [4, p. 27-28].

I.D. Zverev emphasizes that “science is the foundation for shaping the content of education”. He later writes: The rapid development of scientific knowledge, the improvement of the content of education, and the philosophical and methodological generalization of these, all play a special role in the development of a person’s creative potential, helping the modern student to independently enrich their knowledge and navigate the rapid flow of political, scientific, and technical information. Therefore, the components of the content of education that reflect the trends of the integration of scientific knowledge are of primary importance here. Their significance is connected with the decisive role of the integration processes of science in shaping modern scientific thinking and human worldview. In the creation of the theory of general secondary education content, it is an important

step to identify didactic equivalents that correspond to the integration processes of modern science [4].

From the above, we can conclude the characteristics of the integrative processes in the content of disciplines (Table 1).

№	Characteristics
1	Integration is built as the interaction of heterogeneous (different in nature) elements that were previously distinct from each other.
2	Integration is related to the qualitative and quantitative changes of the interacting elements.
3	Integration has its own logical and substantive foundation (the construction of integration primarily involves searching for a common basis to unite the heterogeneous (different in nature) elements of knowledge, seeking and justifying the criteria for the unity of various sets).
4	The pedagogical relevance and relative independence of the integrated process: the interaction of the heterogeneous elements of the content of education, placed on a single logical and substantive basis, leads to the emergence of a certain integrity that performs relatively independent functions in the educational process; at the same time, the implementation of the integration process generates new interactions.

Conclusion. Summarizing the above, we can conclude that the need for integrative processes in modern education is related to the increasing influence of scientific and technological knowledge on societal development, as well as on the state of the sciences. Integration is one of the key features in shaping the strategy for updating the content of education.

References

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