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Synergetics and its Application in the Educational System

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Abstract: The article considers the education system as an open complex system, and its development is analyzed based on synergistic principles. It is stated that the role of synergetics in education is twofold, that is synergetic approach to education and synergetics as educational content. Issues of manifestation of self-organization, nonlinearity, bifurcation, coherence, chaos, and other synergistic categories were discussed in the educational system.

Keywords: synergy, self-organization, nonlinearity, bifurcation, coherence, chaos, attractor

INTRODUCTION. We live in a complex time where everything is interconnected, with unstable development, globalization processes, and various crises. The current global crisis has not spared the education sector. The problems in modern education arose as a result of one-sided instructions, limitation to a narrow range of knowledge without interaction, and sharp, strict delimitation of natural-scientific and humanitarian sciences. Such limitation does not allow people to imagine the existence as a whole, to express the same, similar reaction to the deepening environmental problems, moral rules, and political and economic situations. We may struggle to solve some problems and not achieve the desired results due to the lack of ability to understand the problems in a complex way, to understand the interaction and impact between events with the help of our limited imaginations in various fields. Therefore, the reforms carried out in the field of education should be based on the ideas of the integrity of knowledge, and the fundamentality of education, and should take into account the interaction and coherence between disciplines. The function of modern education should not be limited to the traditional method of imparting social and natural knowledge and teaching experiences but should be to prepare a person to act in times of crisis. A synergistic approach to the development of the educational system is important in solving the mentioned problems.

MAIN PART. In the second half of the last century, science began to deal with the theory of complex systems, and the doctrine of synergetics, a theory of self-organization, emerged. Taking into account that many elements of the system are involved in the process of self-organization and the progress of this process depends on the organized activity of these elements, this field of scientific research was founded by the German physicist and mathematician G. Hacken called synergetics. The term synergetics is derived from the Greek word synergetics, which means to act together, cooperatively, or in concert. Synergetics is an evolutionary doctrine that realizes coherence, connection, and synthesis between natural-scientific and humanitarian sciences, and studies the laws of self-organization and co-evolution of complex systems of various natures. First of all, the phenomena of self-organization were studied within the framework of natural sciences, that is physics, chemistry, and biology. Currently, the research scope of synergetics is effectively used in psychology, medicine, economy, sociology, and other fields, leaving the scope of natural and scientific sciences in the research of man, society, and culture. The teaching of synergetics, aimed at solving new scientific problems, is being formed as an interdisciplinary research method. Synergetics has both methodological and heuristic functions. The synergetic theory

is a new methodological basis for studying and predicting the future, creating global models of development, a method of integration of natural-scientific and humanitarian education, and is a new concept of the phenomenon of self-organization. The scientific landscape of the world is a new methodological tool in the study of nature and society and acts as a bridge connecting the categories of generality and specificity, scientific and philosophical imaginations. The scientific view of the world is a synthetic education that combines various hypotheses and ideas from various fields of science based on the most fundamental scientific theories. Synergetics is a scientific direction that studies the formation of ordered structures from chaos and disorder, and establishes organic connections between disciplines and unites them. Its goal is to identify common ideas, methods, and laws in various fields of natural science and sociology. Synergetics is becoming a doctrine that forms the basis of the modern concept of the scientific landscape of the universe. In complex thermodynamic systems, at small values of the external influence, flows and thermodynamic forces are linearly connected. The classical traditional approach to the control of non-thermodynamic complex systems is deterministic, and as a result of an external influence (cause) the system develops linearly and the expected results (effect) can be predicted and achieved. But in practice, many attempts are unsuccessful, and if the path of internal development arising from the specific, internal characteristics, and nature of complex systems is resisted, or interrupted, such effects may not give the expected result or lead to negative consequences. Development processes in complex systems can occur in the form of non-linear abrupt changes (according to the law of growth). From this, it follows that it is impossible to forcefully determine the path of development of complex systems. On the contrary, it is necessary to study and understand how the system can be brought to this path, allowing the system to develop in the direction it chooses. From the point of view of synergetics, the question of the development of an externally controlled system appears as a question of self-directed development. Self-management is one of the postulates of a synergistic approach to managing the development of complex ordered systems. The future of society is largely determined by the education system that educates the young generation. Education organized based on synergetic principles is the most effective and allows one to fully reveal the individual's abilities. The role of synergetics in education is twofold. First of all, synergetics is manifested as an educational method, which implies a synergistic approach to education, organization of education, and training processes synergistically. In educational synergetics, the quality of education can be improved by analyzing the educational system using synergistic perspectives. Synergistic ideas, principles, and methods can be used in the teaching of all subjects, because self-organization, new qualitative changes, and other issues are certainly encountered in the content of any individual subject. In the second case, synergetics is manifested as the content of education, and it is envisaged to implement synergetic education by imparting synergistic knowledge and spreading it widely. In the leading countries of the world, synergetics is being taught as a new direction in schools, universities, and training institutions, and the necessary educational literature on synergetics is being created.

The main categories and concepts of the new synergetic paradigm include nonlinearity, self-organization, openness, complexity, bifurcation (branching), coherence (harmony), attractor, chaos, randomness, and others. Self-organization is one of the most basic concepts of synergetics. Self-organization in education means self-education (teaching). The meaning of this is not to give knowledge ready-made, but to increase knowledge, perfect it, find a quick way in the system of networked knowledge, and master the methods of self-education.

Non-linearity manifests as non-linear communication in education. The synergetic paradigm teaches a person to communicate with nature, himself, and others in a new way. A nonlinear system is a bifurcation of the evolutionary path, its sensitivity to small effects is a nonlinear situation, which is associated with uncertainties or selection. In this sense, synergetics can be seen as a reliable way to manage a nonlinear situation. From the point of view of synergetics,

education is not a transfer of ready-made knowledge from one person to another, but a process that takes place in a non-linear situation consisting of open communication, positive and negative communication, consensus, and cooperation between the teacher and the student. Based on the teaching of synergetics, education should be interesting, stimulating, and enlivening. The main issue here is how to push the system to the path of development acceptable to the man with the help of a small external influence, and how to ensure self-directed and self-supporting development. The second issue involves the transformation of the state of chaos, that is, the chaotic, spontaneous activity of the student into creative activity. According to synergistic concepts, phase transitions occur in the educational process, that is, in this process, the student's personality is formed in a new, perfect way. Based on the synergetic concept, the factors of chaos, randomness, and disorder in the system are not only factors that destroy the state of order or reduce the level of order, but in some cases, they can also stimulate the formation of new ordered structures. Therefore, teaching a person to live in uncertain (abstract), unstable, chaotic conditions and teaching him that these factors can be used in solving problems is one of the important issues of modern education.

The educational system is a complex system consisting of a lot of one or different interacting parts and elements. Unordered or less ordered states in systems are called "chaos". Chaos in the education system is manifested in the decrease in the quality of teaching, in the disconnection between education and spirituality, education and science, in students' lack of interest in learning, in the fact that the offer of educational services for the preparation of certain specialties does not correspond to the requirements of the labor market, etc. Under the influence of external and internal forces, interactions between system elements are established, and cooperative and organized actions are created based on the concept of synergy. As a result of this, ordered states, structures (structures) arise in the system from non-ordered states. These structures can be temporal, spatial, temporal and spatial, functional structures. Such structures occur in non-equilibrium open systems that are far from equilibrium. Open complex systems constantly exchange matter, energy, and information with the external environment. In thermodynamically open systems, energy dissipation, that is, when a part of the external energy is converted into internal thermal energy, such systems are called dissipative systems. In dissipative systems, the outflow of entropy can balance the increase in entropy. In this case, as a result of the decrease in entropy, ordered structures called dissipative are formed. The educational system is also an open system within the larger social system, which exchanges information, knowledge, resources, and materials with the social environment. So the open education system is also dissipative. In the course of the evolution of the system, the cooperation and connection of separate disciplines increased, and new disciplines and directions appeared on the border of separate disciplines. A synthesis of humanities and natural sciences is emerging. Dissipative structures occur only in systems described by nonlinear equations. Nonlinearity is an important and general feature of processes occurring in non-equilibrium states. The emergence of new ordered structures usually occurs based on a bifurcation scenario. During a crisis in education, there is a bifurcation (branching) point, and its further development can go through one or another path, because for complex systems, according to synergistic ideas, there are usually several alternative development paths and options to choose from. Although there are many paths of evolution, choosing a specific path of development during branching is characterized by predetermining and predicting the course of processes.

CONCLUSION. In the analysis of the open education system, taking into account its unique synergistic features and properties allows us to determine the parameters of educational processes that adapt to the market conditions of the educational system in the socio-economic environment. The future of society is largely determined by the education system that educates the young generation. Education organized based on synergetic principles is the most effective and allows one to fully reveal the individual's abilities. Based on the teaching

of synergetics, education should be interesting, stimulating, and enlivening. Based on the synergistic theory, the educational system is also a complex open system, and a small impulse, idea, or thought aimed at the evolution of the system can quickly develop and grow to the macroscopic level, i.e. the level of social thought, social resonance can cause the system to jump to a new quality level.

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