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## **Self-organization and creativity: modes of synergistic reasoning in cognitive and educational activity**

**Abstract**

The paper identifies epistemological basis of the concept of Synergetics, the task of which is to cognize the general principles of self-organization in different systems. It discovers the theoretical basis of self-organization processes in various natural, social and technological phenomena, which create a new field in complex systems research. By applying interdisciplinary approach, it is shown that self-developing systems are subject to hierarchic organization of subordinate levels, they are able to create new levels and, hence, to acquire the new entity. It is pointed out that such organization manner requires a new kind of understanding, reasoning, and methodologic reflections. The parameters of synergetics as a transdisciplinary field, tied with the search of algorithms and patterns of evolution and coevolution of complex systems and being researched in the context of various ontologies are defined. The emphasis is put on the creative content of synergetics, which finds its realization in education. It is proved that the process of education and interaction between student and teacher is a non-linear situation of an open dialogue, of direct and reverse relationship. The paper identifies the essential elements of synergistic reasoning as a realization of creative potential of a human in cognition and educational activity.

**Keywords**

synergetics, open, interdisciplinary, non-linear, reasoning, creativity, education

**JEL: Z0****1 Formulation of the problem**

The dynamic development of the global world shows social reality in the economic, political, and cultural dimensions in the plurality of manifestations, the comprehension of which requires new methodological approaches. The methodology of synergetics allows us to comprehend the changes, the speed of which is ahead of their comprehension. The influence of comprehensive informatization enhances the activity of thinking, the mobility of theoretical discourses, social behaviour and value systems, causing the relevance of methodological reflections of synergetics. The development of contemporary science and technology activates the study of complex systems that are in the process of continuous development, carrying out the transition from one type of self-regulation to another. As

a result, all spheres of social life of a person are complicated, the comprehension of which makes it necessary to use the methodology of the synergetic approach for the understanding and interpretation of the phenomena of natural and social life as processes of self-organization. This is especially important in order to ensure productive transitions into qualitatively new conditions, leading to the birth of a new one. From the viewpoint of synergetics studies in the context of methodological culture of thinking, the task is to identify the opportunities of complex processes management in social and economic environment, which nature is global, non-linear and inclined towards self-organisation by its nature. In this case, the problem of synergistic thinking as a solution technique of problem-based learning is actualized in its spontaneous complexity of educational modernization.

## 2 Analysis of recent research and publications

The problem of synergetics and the study of self-developing systems has become a topical issue in current situation, when crisis which happen in life of one generation have revealed controversy, no control and unpredictability of the world development. The depth and unexpectedness of global crises have become a challenge for science, for social philosophy in particular, where open and complex systems characterized by ability to self-development turn into special objects, education in particular. In the latter half of XX century the study of the processes of self-organisation have formed the theory of “dissipative structures” by I.Prygozhyn, the “theory of catastrophes” (or theory of abrupt state change of dynamic system) by R.Tom and R.Arnold; the evolutionary theory of “autopoiesis of living systems” by H.Maturani and F.Varela. It is necessary to mention the “tektology” by A.Bogdanov, the “theory of systems” by L.Bertalanffy and other achievements in non-linear logics and mathematics. Among the special transactions of local and foreign researchers of problematics of synergetics as a methodology of cognition of social processes in context of expanding of cultural and educational systems, it is worth mentioning the works by V.Budanov, V.Styogin, S.Proleev, V.Kremen, M.Druk, S.Sysoeva, I.Dobronravova, S.Ierohin, L.Shashkova, N.Klimontovych, L.Horbunova etc. The separate place is occupied by the interaction between synergistic reasoning and the creative content of educational process by O.Knyazeva, S.Kurdumov, E.Morena and V.Romanov. Therewith, in most of publications, the content and criteria of creative content of synergetics and the conditions of its action space expansion are interpreted in a questionable and debatable manner, beginning with identification of synergetics with reasoning and finishing with the understanding of synergy as a coordinated action. Mentioned above causes the need of systematization of theoretical approaches and of identification and substantiation of conceptual basis of synergetics and identification of its creative content.

**The purpose of the article** is to justify the theoretical basis of the paradigm formation of synergistic reasoning in context of development of creative process of education during the educational system modernization and reformation

## 3 Main findings

The modern civilization development is premised on a wide range of factors. Crisis and convulsions that happen in life of one generation have revealed controversy, uncontrollability and unpredictability

of world development. The profundity and unexpectability of global convulsions have become a challenge for science, which can't manage to cognate the new processes and phenomena in the system of conventional terms and categories. Open and complex systems, whose definitive peculiarity is the ability of self-development, predominantly become their objects. In context of cognition of such objects, one of the most important places is taken by synergetics, which is out to cognize the general principles which form the basis of self-organisation processes in different systems, including social ones. They require a new level of understanding and unorthodox approaches. So, what is the essence of synergetics not only as a self-organisation theory or methodological paradigm, but also as a reasoning system?

The research of complex systems has intensified drastically along with naissance of the theory of information, cybernetics and theory of systems. Therefore, the complex system can be viewed in the process of constant development, resulting with a shift from one self-regulation type to another. Self-developing systems are subject to hierarchic organization of subordinate levels, they are able to create new levels and, hence, to acquire the new entity and new parameters of order and types of direct and reverse relationship [3]. Such organization manner requires a new kind of reasoning and methodologic reflections.

Budanov (2006) claims that, nowadays, the synergetics is integrated into the branch of humanities, such new directions as social synergetics and evolutionary economics emerged, it is used by medical workers, psychologists and pedagogues, its development is supported in linguistics and history, the project of synergistic anthropology is now being realized [p.81]. And all these activities must provide the existence of the unitary scientific worldview. Synergetics aspires to create the “joint field” of interdisciplinary communication, to form the principles of new world picture – both naturalistic and socio-humanitarian – cultural, educational and spiritual ones. Thus, even human subjectivity, which is traditionally a philosophic question, can be explained by the dynamics of complex systems. Human intentions and aspirations correspond to “brain dynamics attractors, which make the very influence on human actions and behavior.” [p.90], - as Mainzer (2009) insists.

In contemporary philosophic-methodological literature the synergetics is represented as an interdisciplinary branch of science, which was formed under the influence of analogue reasoning and comparative analysis, which comprise the most important component of multi-dimensional philosophic reasoning. Epistemological and heuristic value of analogue models lie in the fact

that each of them becomes according to Drjuk (2004) "... a conceptual tool, methodological key to integration of phenomena in other naturalistic and humanitarian areas ...", [p.102] Including not only philosophy, sociology and psychology, but education, cognition and reasoning systems.

The contemporary synergetics-based worldview development states a range of new and quite difficult problems. As a whole, they create the new situation around. The research on open and unstable with respect to the environment developing systems became active. Irreversibility of processes of development and instability of complex systems in certain conditions create the self-organisation of both natural and social processes, which, according to Rovinskij (2006) "... provide an efficient transition into qualitatively new states of being, promoting the birth of the new ones." [p.164-165].

In order to characterize the synergetics, it is worth noting the accent on the creativity, made by I.Prygozhyn. It is necessary to proceed from a recognition that a mind "proceed from disorder to order in process during its work". Herewith, an important thing is that the mind "rest the resources of disorder inside" until the very end of process and the "order" is not considered as a "victory". The mind is characterized by instability, chaos and freedom, in other words, the order, the chaos and the creativity are interconnected. The future is uncertain; "it is true both for nature, it is also true for our level of existence. This uncertainty lies on the very middle of human creativity. The time become a "construct" and the creativity is our measure of action within this "construction" [p.105] – this is I.Prygozhyn (2003) conclusion.

We believe that the new worldview expands the socio-cultural and economic life space and forms the new view on the basic notions, such as "chaos", "development", "reality", "education", "creativity" etc. In the context of synergetics the "social life" is a stream of irreversible changes directed into the future and wearing either benefit, or harm to one's life. In spite of such limitations, the artistic (creative) individuals transform the manner of activity so that it changes the social organization and leads it to a completely new level. The study of development patterns of this phenomenon is a quite complex task and methodological mode of synergetics allows the human society to act from the positions of rather purposive reasoning reflections in context of intellectual field of creativity search strategies.

K. Meinzer, the German researcher, asserts that the description of the complex is impossible without understanding of nonlinearity of contemporary nonlinear models. In conditions of the global world the "lineal reasoning", which has been dominating in the whole range of science

branches, becomes essentially insufficient and even dangerous. Psychologists, scientists, sociologists, politicians etc. must learn how to consider people as complex "nonlinear beings", that possess their minds and bodies. "We must keep in mind that historical and political monocausality can lead to dogmatism, loss of tolerance and fanaticism... – Meinzer (2009) indicated – The approach to study the complex systems cause new ethic and epistemological consequences. It gives a chance to predict and cease the chaos of difficult nonlinear world and use the creative opportunities of synergic effects." [p.91-92] While expanding the "field of reflections" over the activity, they test the commensuration between the incoming knowledge about the object and "value- and target-oriented structures", as Stepin (2003) puts it. The principle of responsibility plays a special role in situations when synergistic constructive abilities are brought in the complexity of social cognition.

The author stresses that synergetics transforms our worldview and way of thinking. It reveals the most unusual sides of the world: its unsteadiness, nonlinearity and openness (regarding the different variants of the future), increasing complexity of formations and ways of their unification into firm evolutionary entities (regarding the laws of coevolution). Prigozhin (2003) underlines that the opportunity to "look" into the world from "another point of view", made by synergetics, pave the way to the opportunity to see the complex – nonlinear environments with new abilities, more complex form and structure specter. In this context, the synergetics can be viewed as a "positive heuristics", as a method of experimentation with reality. It is not a tool which gives us the predefined solutions, but a "door" leading both to the natural and human reality and "waiting" for a respond from that very reality. Synergetics is a way not only to "open", but to "create reality", a mean to see the world in other way and to "settle down", to integrate into this world. It gives an opportunity to get a new angle on the old problems, to "rearticulate" the questions, to "reconstruct" the problematic fields of science. The self-organisation paradigm (the synergistic paradigm) "determine a new dialogue between a human and nature" [p. 24-41]. This paradigm also leads to a new dialogue between human and himself and other people.

In its turn, the dialogue opens the prospects for a productive and exploratory mentality. From the philosophical and gnosiological point of view, the notion "dialogic reasoning" (joint reasoning activity) is a manifestation of human natural need of communication. The mechanisms of this need are enrooted in the remote basis of human existence. "For a human, - Shylkov (2013) says, to be and to exist means to be and to exist for others and with others. A human can comprehend his life

and existence only if he is in dialogic relations with other people" [p. 398]. This aspect is actively used in productive education process.

The author of this article is convinced that along with "dialogic mentality", it is worth to mention the "game" moment of the synergistic cognition and reasoning paradigm. Such a "game" helps to get free from the past and to create the new. According to Knjazeva (2010): "Nonlinear (synergistic) situation – is a game with reality. It is a certain type of physical experiment, or either mental or existential game, traveling around a field of multi-way decisions about the future" [p. 78]. It is important to mention that in this "game" nothing is definite, except the very rules of the game. It permits a human to construct and to transform his own being. At the same time, the impression game is a process of communication, dialogue and understanding with a peculiar secrecy. In general, the "game reasoning is an assimilation, imagination, impression and the condition of human activity, existence, sense making and a complex of specific rules and measures" [p. 417].

Hence, a synergetically thinking person is a person who "plays" (*Homo Ludens*). Synergetics in this case acts as a type of "intellectual yoga". Formulating models around the complex, it ruins the "model" itself, the very process of its creation. Synergetics makes everything flexible, open, multi-valued. Synergetic action is an action that proceeds from its own forms of formation, its own forces, abilities, potentials. This action is stimulating, it conditions the desire of creation and transformation (recreation), if we follow Kremen (2012).

An example of such a creation, as this article claims, is a synergetic approach to education. The training procedure, the interaction of a student and a teacher is a nonlinear situation of open dialogue, direct and reverse connection, a solidarity education action, the entry (as a result of solving problem situations) into one "self-consistent tempo world". This situation is the awakening of student's own strengths and abilities, initiating him on one of his own ways of development. In synergetic education, the knowledge is not simply "superimposed" on the structures of the individuals or, what is more, imposed on them. Synergetic education acts "from the inside", it stimulates personal, hidden reflections of creative thinking. It is a way of discovering reality, finding ways to the future. The experience of a creative approach to education and training shows that for the productive functioning of the ideas (principles, concepts) of synergetics, it is necessary to use reasoning images. They can be transformed, subject to spontaneous processing on the "field" of individual consciousness, thus acting as a heuristic means in inquiry and creative activity. The latter is characterized as the ability to create, produce

something new. The main difference between reproductive and creative renovation is that the first one supports life in certain spatial-temporal parameters, and the second one forms new forms and meanings of life. Kremen (2012) believes that the systems, that are capable of creative renovation, are not locked up in the life process, their existence continues, continues until the potential of creativity is exhausted.

As the author puts it, the essence of synergetic reasoning is conditioned by one of the most important ideas of synergetics about the creative, constructive role of chaos in the evolution of complex systems. Synergetics substantiates "ubiquity", "behind the being" and "primacy" of chaos. The structure arises in chaos and from chaos, which is organized and organizes. By means of destruction it creates, because "the desire to destroy is a creative aspiration." The chaos is extremely diverse: it is a way to get into a relatively stable structure of evolution, and the "glue" that connects the parts into a single and stable evolving whole, and the "mechanism" of adaptation to changing environments, and the way to upgrade a complex organization in nature, society and the human mind. "Immersion" into chaos is a path to innovation, within which cognitive structures are regarded as "emergent, situational", claimed by Knjazeva (2010), which arise on a "chaotic" basis.

Certainly, an important achievement of synergetics, meaningful both for cognition and for thinking, is the emphasis on the fact that everything in the universe is subject to the rhythms of life. There can be no quick and long-term growth without the threat of falling and destruction. Only by obeying the rhythms of life, complex systems can maintain their integrity and develop dynamically. In other words, self-organization as global evolution covers the whole semantic field of development of the natural and socio-cultural world. And if all this is self-organization, then it is necessary to construct in logical connection all the constituent elements, indicate the beginning of the process, determine its orientation, etc. And in this case, synergetic reasoning appears to be the most productive to solve the problems. After all, in the context of intellectual and cognitive evolution of a person, society (and other complex systems) is considered not as an entity that is purposefully formed, but as complex, able to self-organization, the environment of human life, which arises from their lives and included in it, according to Kremen (2012).

It is obvious that every person in different situations reveals physical, emotional, intellectual and spiritual personality. Awareness of the interaction of these "subsystems of individuals" enables the person to manifest himself as a holistic person. The principle of integrity connects the subsystem of one person with similar subsystems

of other people. As a result, all individuals are interdependent in this type of social communication. Similarly, different structures and organizations in a human society can be considered. When a person reasons "holistically" and "synergistically," he realizes all the levels of interaction of the macrosystem; family, group, organization, whole society, etc. These macrosystems affect one another. In synergy, this leads to overall success. If individuals seek to reveal their individuality too much, then there is excessive competition happens that can lead to a disbalance between their own inner world and the external natural environment. However, the world is unique, and all its parts interact with each other.

#### 4 Conclusions

Summarizing, the author insists that synergetics as a science of self-organization of time and space nonlinear systems creates a new way of organization, it requires a new understanding of synergetics as a new methodology and new reasoning reflection. Synergetics is the result of an interdisciplinary approach in contemporary

science, which involves the co-coordinated use of images, methods, models of disciplines of different profiles. Synergetics is characterized by creativity, since it determines the process of the birth of smth new ("order from chaos"). Analysis of the principles of synergetics (complexity, openness, nonlinearity, etc.) demonstrates its constructive possibilities in the complexity of the sociality of knowledge. Synergetics as "positive heuristics" is a way not only for cognition, but also for a way to see and understand the world in a new way. The inclusion of the methodology of synergetics in the process of cognitive and educational activity is a condition for the productive functioning of the educational process. At the same time, synergetic reasoning is born as a result of the constructive role of chaos (freedom, creativity) in the evolution of complex systems. In the context of intellectual and cognitive human evolution, society (and other complex systems) is seen as a complex, capable of self-organization formation. Methodological reflections of synergetic reasoning facilitate the productive interaction of all elements in the complex systems.

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