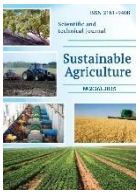
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Possibilities and Limitations of the Use of the System-Synergic Approach in Pedagogical Research for the Development of Creative Abilities

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a r t i c l e i n f o

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a b s t r a c t

The article discusses the possibilities and limitations of the use of the system-synergetic approach in pedagogical research. The two most important aspects of the problem are highlighted: the adaptation of the ideas of synergetic as a new cognitive model in the content of education and the application of its mathematical apparatus in the study of the educational process and its management. It is emphasized that the use of the system-synergetic approach should not be reduced to a simple paraphrasing of pedagogical concepts. If it becomes an effective means of studying pedagogical phenomena, helps in analyzing and evaluating, then its use in pedagogy is justified and will lead to a change in the pedagogical process. As a result of the adaptation of his ideas, pedagogical concepts need to be interpreted more deeply, new models of educational content have been developed, hidden patterns of the educational process have been discovered, and achievements have been made in solving such urgent problems as modeling educational systems, predicting and managing their development. Considering the adaptation of the ideas of synergetic as an innovative direction of scientific and pedagogical research, it is impossible to abandon the positive previously discovered by classical dialectics. These are two interconnected and complementary forms of understanding the laws and regularities of the educational process.

1. INTRODUCTION

In the middle of the 20th century, the theory of systems, the theory of self-organization (synergetics), the theory of information and control, formed the core of non-classical science and became the most important transdisciplinary cognitive models of our time. Their formation is associated with the names of L. von Bertalanffy, I. Prigogine, G. Haken and N. Wiener. Among these models, the central place is occupied by the theory of self-organization, which is aimed at studying the behavior of open nonlinear dissipative systems in thermodynamic equilibrium. The object of his research is the development of these systems, the general principles of their self-organization and evolution, the specific features of the change in their qualitative states, mechanisms, dynamics and spatio-temporal distribution of the process. The development of the system is considered as a change in its states, in which the stages of instability (bifurcation, when the level of disorder and entropy of the system are sufficiently high) and stability (when the level of order is high and entropy is low) periodically repeat and replace each other. Chaos and order are two limit states of the system, equally catastrophic for its existence. Any developing system always balances between them. And this balance, achieved through the coordination of the processes of competition and cooperation of elements, is the key to its "stable" future. And in cases of instability, a weak external resonance effect can lead to major internal changes and change the trajectory of the development of the system. On the basis of post-non-classical science, a set of approaches, techniques, methods and methods of studying various phenomena and processes of the surrounding world was formed - from the pulsation of the Universe to the degradation of the improvement of the inner part of the human spiritual life. Among the approaches, one of the most important is system-synergistic. Based on the methodological foundations of classical dialectics, he puts his laws into mathematical form.

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The use of the mathematical apparatus of nonlinear dynamics has allowed synergists to solve a number of basic practical problems and develop many models of natural and technological processes that more realistically and adequately describe the features of their development. These include, for example, autocatalytic processes in chemistry, competitive relationships in ecosystems, "nuclear winter" models, "growth limits", "beyond growth", and others. At the same time, synergism is one of the interpretations used by modern science to understand the complex structure of existing reality, one of which is the possibility of understanding the holistic picture of phenomena.

And it is not at all excluded that new, more advanced cognitive tools will soon be found to describe them.

2. LITERATURE REVIEW

In the late 1990s of the last century, the possibilities of using a system-synergistic approach in the study of the socio-humanitarian sphere began to be actively discussed. And not only is it discussed, but it is also effectively used in theoretical and methodological solutions to economic and socio-ecological problems, theories of bifurcation management, modeling social processes and management (S. P. Kapitsa, V. V. Leontiev, K. Mainzer, N. N. Moiseev, E. Peters and others.). However, despite the sufficiently deep substantiation of the legitimacy of this approach, along with socio-humanitarian research, there were very good obstacles to its use, so its widespread introduction into the humanitarian sphere was often limited by its laws and regularities in certain pedagogical situations. From this point of view, several main problems facing the science of pedagogy can be identified:
- the main object of pedagogical research is the use of the system-synergistic approach as a methodological basis for analyzing, forecasting, modeling and designing the educational process, studying its contradictions and laws;
- its scientific application in pedagogical innovations, justification of teaching and education methods and technologies;
- development of didactic aspects of adaptation of his ideas to educational content;
- use this approach as a basis for integration at theoretical and methodological levels of different knowledge;
- to study the dynamics of the process of formation of personal qualities of students and their knowledge activity;
- application of synergetic ideas in the management of the educational process;
- the possibility of using the mathematical apparatus of synergetics in modeling and forecasting the development of local, regional, state education systems and global levels.

3. RESULTS AND DISCUSSION

In the process of mental activity, stages of instability and stability alternate. These stages are necessarily repeated many times in each individual lesson, when studying each topic, a separate module or the entire course of study. Instability and chaotic behavior during learning are inevitable with new educational material, solving non-standard situations, and any novelty in the learning process. The art of the teacher, his management activity is to help students overcome these conditions more quickly and through the "thorns" of instability lead them to the final goal. However, at each stage of education and at each of its sub-levels, these processes have their own characteristics associated with the age, intellectual and cultural characteristics of students, and the state of the educational environment.

It must be admitted that repeated attempts to give a mathematical description of the cognitive process using nonlinear dynamics methods have not yet been successful.
It is not difficult to project the mathematical apparatus of synergetics on the analysis, identification of patterns, modeling, design and prediction of the educational process, the main authors of which are M. A. Danilov, V. I. Zagvyazinsky, I. Ya. Lerner, F. F. Korolev, M. N. Skatkin. Thus, in the publication of V. I. Zagvyazinsky “Contradictions of the Educational Process” there is a philosophical understanding of the educational process. Taking into account its dialectical nature, the author reveals the driving forces and tendencies of the UVPN, its general principles and describes the means of organizing the joint activities of teachers and students aimed at revealing contradictions, as well as resolving inevitable contradictions [4]. The patterns revealed before and without synergism UVPLAR reflect all the known rules of the theory of self-organization of open complex systems. However, its mathematical modeling, even in the simplest scenario, requires taking into account the fact that the controlled and controlling parties are individuals, even if the system consists of only two subjects “teacher – student”. The success of achieving goals largely depends on their personal qualities, creative abilities, intellectual and cultural development, psychophysiological characteristics and capabilities. In the processes of self-organization and organization of activity, in our case, there are a lot of direct and inverse relationships, manifested not only in the influence of the teacher's activity (control system) on the activity of the student (controlled system), but also in the active feedback effect. For a quantitative description of such interaction, knowledge of a large number of parameters is necessary:

- external:

- civilizational needs of communication systems;
- the influence of social or natural factors, etc.);

- internal:

- the existing base of the trainee and the training;
- their potential, personal qualities;
- cognitive needs;
- internal and external motives of activity;
- the content of activity;
- characteristics of the object of knowledge;
- the content of education, ways of its formation
and information content;
- patterns of assimilation of all types of information;
- educational and upbringing technologies, teaching methods, etc.

With group or collective exercises, the number of parameters increases several times. However, it is not enough to create a mathematical model of pedagogical process management, even to take them into account in full. It is necessary to identify more controlling factors, the small fluctuations of which can lead to large changes in the educational process for the better or for the worse. And not just to identify, but to measure and organize them, to find mathematical functions that allow describing the influence of each parameter on the dynamics of the process. And this is not an easy task, for both laws, regularities and quantitative estimates of individual parameters and their interrelations are stochastic yes V. A. Ignatova.

In addition, after determining and assessing the contribution of each parameter to the UVP, it is necessary to construct and solve a system of equations characterizing the course of the process, analyze the solution and find the most effective method by changing the parameters. conditions for "soft" control of UVP in the current conditions.

The issues of modeling internal control, quantitatively predicting its results, choosing the most effective system of student activity in certain conditions, and organizing internal control management for the above reasons remain open and are mainly solved on the basis of the teacher's intuition. Therefore, the use of system ideas - a synergistic approach is possible only as a methodological basis. At the same time, in no case should we dismiss this as a positive dialectical methodology brought to pedagogy. Dialectics and synergism do not exclude each other. These are two interconnected and complementary forms of understanding the laws and laws of the educational process.

4. CONCLUSIONS AND PROPOSALS

Despite the identified problems and existing difficulties, the use of the mathematical apparatus of synergetic and its ideas in education, in our opinion, is very relevant and promising, especially in modeling and forecasting the development of educational systems at the local, regional, state and global levels. The reason for this statement is the development of methods for mathematical modeling of social processes and systems.

At the same time, the development of a system-synergistic approach should not be a paraphrase of long-known truths in pedagogy, abridged in order to translate them into a non-post-classical scientific language, as some authors sometimes pass off their works as innovations. What is required is not the adaptation of the post-non-classical language to the pedagogical process, not a declaration on the need to apply a system-synergistic approach to the composition of science, but a description of the educational and training process, but a search for its specific methods, an effective program for solving various urgent educational and training problems.

Perhaps this approach will help to qualitatively form a system of various pedagogical concepts, develop new models of educational content, discover hidden patterns and mechanisms of the pedagogical process, that is, create fundamental reforms that are so necessary for education today.

The introduction of a system-synergistic approach to the discipline of pedagogy can be considered an innovative direction within the framework of this research. However, it should be remembered that only a harmonious combination of innovative and traditional methods can give a comprehensive idea of the educational process [6]. In fact, we are talking about the need to develop and apply an integrated approach to the study of pedagogical objects and phenomena, taking into account the specific characteristics of the relationship between the researcher and the object of study as subjects of the educational process.

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