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PARADIGMSYSTEMIC IN THE EDUCATIONAL SCOPE - APPLICABILITY IN THE KNOWLEDGE SOCIETY

Adelcio Machado dos Santos

Abstract: In order to direct efforts towards improving education, some concepts in the fields of research need to be addressed, thus, it is possible to observe the meaning of teaching quality in a process. The school is the universe where knowledge meets the craving for knowledge, which needs to be well understood, at the same time seeking new ways of teaching and systemic thinking has been gaining increasing space in the educational context. In this sense, the theory of systems arises, which has its foundation located in the book by this biologist entitled *General Theory of systems*, given birth in 1968, principles that are mainly focused on Physics, Sociology and Biological Sciences, in addition to general models for any of the sciences involved. Technological changes and innovations, in the Knowledge Era, happen at such a fast pace that Knowledge Management is essential in organizations, especially in the educational field.
Keywords: Systems Thinking. Education. Age of Knowledge.

INTRODUCTION

Systems Thinking can be understood as the ability to perceive, model and evaluate the consequences of actions in an expanded way in time and space. In the modern world, there is an increasing need for new ways of teaching, thinking and acting. However, the difficulty to implement innovations is one of the obstacles encountered in implementing new ideas. Individuals trust their old, tried and tested ways of acting empirically. In this context, the organizational universe resembles the universe as it is known, both in structural form and in its dynamics. In an integrated understanding of this organizational universe, Systems Thinking presents itself as a promising possibility, since it seeks to understand these macro and micro views according to a whole greater than the sum of segmented understandings.

In the 60's, Peter Senge presented the approaches referring to the Fifth Discipline, which serve as a basis for the Systems Thinking presented in this article. With the emergence of Systems Thinking based on Senge's ideas, it is intended to increase systematic teaching methodologies, as will be demonstrated.

TRANSFORMATIONS IN EDUCATION

With the growing development of new technologies, significant changes have taken place in the conception of administration, leading it to evolve into a continuous search to achieve its objectives, with efficiency becoming the main foundation of the administrative effort.

Traditionally resistant political and economic concepts gain new connotations, it can be said, according to Drucker (*apud* MELO, 1979, p.10) that "capital without the human element is sterile, while people can cross mountains without it", since "human development requires the rapid growth of human talents and their employment in opportunities; requires higher-order leadership as well as followers who can make the leader's vision a reality.

This way, it is possible to observe that the realThe meaning of teaching quality needs to be the same for those involved in the process, both directly and indirectly. Even if they have different, but not antagonistic, perceptions, the concept, in what is fundamental, has to be unique.

In order to obtain this quality, according to Melo (1979), investments in education must obey a very sophisticated strategy so that they actually offer the results expected of them.

The pursuit of excellence in education fundamentally encompasses the pedagogical practice, the direction of the activity and the systemic complex that surrounds this activity.

By understanding the school in an integrated and dynamic way, under the prism of a systemic thinking and capable of providing it with conceptual instruments that allow it to operate with methodological discipline and pedagogical independence, it is a question that needs to have as an answer clear proposals, known and accepted by those involved in this process.

Changes in education go beyond the curriculum, through the processes and people that make education work. Immersed in major environmental changes, education needs to undergo major changes. In this context, highlight Libâneo, Oliveira and Toschi (2003), changes are produced in interests, needs and also in school values.

An understanding of change has been built through study and experience together with Systems Thinking, which implies a different way of seeing human communities and how they actually change (ANDRADE *et al,* 2006).

The educational process, according to Lima (1984), works as a variable placed in the middle to produce a certain type of regulation in the subject's activity, which means that education is a self-activity of the educator dependent on his previous schemes. It is up to the teacher, in this context, to make the students able to face all the obstacles that will arise.

According to Moran (2006), with conventional teaching processes and with the current spread of attention to urban life, autonomy and personal organization, essential for distance learning processes, are increasingly difficult.

The sciences and their technological consequences have had an unprecedented development in the history of humanity in recent years, a time of the genesis and development of the informational revolution, via microelectronics (GATTI, 2005).

Within this context, it presents itself as an important tool for the process of searching for new knowledge, and the interactivity possible by the network creates new conditions for the exchange of ideas with reduced costs, which makes it possible to form discussion groups and establish extremely fruitful conversation, being useful for the transmission of new teachings.

It is possible to understand how a sustained change process has the basic characteristics of a continuous learning process. Initially this is in the form of a spiral, with each cycle taking place in successive evolutions. Second, it is experiential, with knowledge and creative achievement being built on the basis of available prior knowledge and experience. Third, it is based on creative methodology, where collective construction takes place from a creative tension involving the opposition of a systemic understanding of the present reality and a deeply desired vision of the future. Fourth, it seeks to evolve the organizational system through adaptive change or creative restructuring. And finally, it needs to be supported by skills, capabilities, environments and innovations in organizational architecture.

Thus, the management process through change encompasses the following phases: understanding the current reality; visualize the future; build strategies; promote change; rethink the organization; sustain change and learn on an ongoing basis. According to Andrade *et al* (2006), in each of them systems thinking has a role to play.

Systems Thinking often ends up being used to produce linear results. And what happens when, in addition to one-dimensionalization, it is presented as a "competitive advantage" - which happens more frequently than one might imagine. In many cases, models have been seen and used as merely mechanical-productivist "tools for change". That is, they have been used indispensable, but not sufficient.

SYSTEMIC THINKING

Systems are organizations, cities, communities, over time, these organizations have presented problems, as they have not developed the ability to adapt and creatively renew themselves for the new world.

The history built by the history of the contextualization of mechanistic thinking, which found its limits at the beginning of the 20th century, from then on a new way of thinking was necessary. The characteristics of Systems Thinking have been incorporated over the years into a specific way of looking at the world's problems. Thus, a gradual change of emphasis took place, moving the new way of thinking away from the characteristics of the mechanistic method, characterizing a new paradigm.

To perceive reality in this new way is to perceive it in a systemic way. According to Andrade *et al* (2006), everyone follows the same path where learning is the process that connects the world with the minds. This set of ideas and results is called mental models.

In this context, the approach proposed by Senge (1999) stands out. Such an approach comprises a body of methods, tools and principles oriented towards systemic interrelationships and process thinking. The main ideas of this Thought refer to the vision of processes in place of the vision of objects, the use of the organism and the flow and transformation in place of the machine as a dominant metaphor, the understanding that the main characteristics of a whole are found in the relationships rather than the parts, and the increasing importance of the pattern of organization in relation to the structure.

Senge's (1999) five disciplines refer to bodies of theories, methods and tools. This way, they are bodies of knowledge to develop the skills of aspiration, reflection and conversation, and conceptualization at the individual and collective levels, as shown in Table 1.

	Individual	Collective
Aspiration	Personal Domain	Shared Vision
Reflection and conversation	mental models	Group Learning
conceptualization	Systems Thinking	

Table 1: The five disciplines

Adapted from: Senge (1999, p.40-45)

Systematically understanding a social reality requires recognizing the *Mental Models* that create it. As for the *Shared Vision,* it means that Systems Thinking efforts can lead to a feeling of incapacity in the face of complexity. As *for Group Learning,* it explains why Systems Thinking is practiced in a group. Systems Thinking presents itself most effectively when it happens collectively.

Andrade et al (2006) emphasizes that the *five disciplines* are the result of an integrated whole, built on the study of previous knowledge, stitched together in a coherent way.

Senge (1999) points out that change programs can fail because they clash with people's beliefs and assumptions, since an organization is a product of the way people think and interact, change programs must take into account reality. and the need to change the organization's culture to establish a new level of organizational capabilities.

SYSTEMIC THEORY AND COMPLEXITY

Systems Thinking has been expanding unevenly for a long time. In some periods, Systems Thinking underwent a very intense development, as can be seen in the 1950s, proposed by the Austrian biologist Ludwig Von Bertalanffy. According to Muniz and Faria (2001), Bertalanffy presented a vision of reality that reorients several sciences, from physics to the social sciences.

For Bertalanffy, systems thinking plays a dominant role in different fields of knowledge,

from industrial companies to pure sciences, and for a better understanding of these, several courses, congresses, conferences, publications over the last decades have been dedicated (MARTINELLI; VENTURA, 2006).

The proposed object for this theory was a formulation of valid principles for systems in general, regardless of the entities that constitute them. Therefore, one would no longer speak of physical, chemical or other entities, starting to speak of the totalities that these entities constitute, of the organization of these systems (VASCONCELOS, 2002).

Each science must develop its own structure to discipline itself, thus demonstrating the importance of General Systems Theory with its possible approaches that, even if not competitive, are complementary.

It is demonstrated by Martinelli and Ventura (2006) that this diversity of studies in different fields of science needed to be studied by a group that was able to integrate them into a coherent and consistent whole. It was for this purpose that a group of scientists from different areas emerged, seeking to form a society that could integrate these various studies and sciences.

SYSTEMIC METHODOLOGIES

The term methodology has its origin in the Greek *méthodos* and can be understood as the study of methods and can also include studies of different types of systemic approaches.

For a better understanding of the objective of the domain of systems science, it is first necessary to find its theoretical framework. Each referential determines the scope of the systemic properties that can be explained through its instruments, generating a taxonomy of the systems. Martinelli and Ventura (2006) also argue that the different methodological frameworks were developed from different perspectives and motivations and essentially there are two classic approaches, the deductive and the inductive.

Deduction and induction are above all means of reasoning or argumentation and, as such, are ways of reflection and not of mere thought. Reasoning is understood this way as something ordered, coherent, logical, and can be both inductive and deductive.

The deductive approach is based on a general axiomatic characterization to later introduce additional requirements. Deduction is the argument that makes explicit particular truths contained in universal truths. The starting point is the antecedent, or the "universal truth" and the point of arrival is the consequent, or the "particular truth", which in turn is contained in the "universal". There is thus a downward connection.

Deductive reasoning can also be expressed through the categorical or hypothetical syllogism. The deductive process, on the one hand, takes the researcher from the known to the unknown with a very small margin of error, however, on the other hand, it can be considered limited in scope, since the conclusion cannot have contents that exceed that of the premises.

In order to dispel the idea that the deductive arguments are obvious, the demonstration method is used, with the deduction of theorems from the axioms and postulates. In this perspective, the method of deduction guarantees that the theorems must be true if the axioms and postulates are true. Thus, even if the content of the theorems is fixed in the axioms and postulates, this content is far from obvious.

In contrast to the deductive approach, in induction, the conclusion is to the premises, as the whole is to the parts. From particular truths, general truths can be discovered. The inductive argument is based on the generalization of properties common to a certain number of observed cases to all occurrences of similar facts that occur in

the future. The degree of confirmation of the induced utterances depends on the evidence that occurs.

The framework, in the deductive approach, is developed based on examples of systems applied in various disciplines, seeking to abstract interpretations, categorize them and integrate them into a whole. The connection between theory and practice appears, therefore, as the main advantage of the inductive approach.

Induction and deduction are processes that complement each other. Thus, induction is reinforced by deductive arguments extracted from other disciplines that are correlated or similar. In practice, both instruments are used to demonstrate the truth of the propositions submitted for analysis.

In the meantime, it is necessary to add that systemic methodologies must be understood as a coherent set of methods that provide tools for dealing with the various systemic problems derived from the model employed.

The systemic methodology is classified as *hard* and *soft*, since the *hard methodologies* present the continuity of influence on the systems theory of the exact sciences, such as physics and mathematics, demanding great rigor and quantification. *Soft* methodologies consider the system as a perceived part, a unit, which is able to maintain its identity, despite the changes that have occurred. *Soft* systems are those that adopt different states according to the environment, preserving their original identity even after the aforementioned influences have occurred.

FINAL CONSIDERATIONS

The teaching and research model demonstrated seeks to provoke debate and instigate creativity for the construction of a research model that encompasses a systemic understanding of organizations and production systems. From another point of view, an effort is needed in the epistemic and operational mapping of Systems Thinking, thus enabling the expansion of ideas and theories from one area of knowledge to others, from a broader perspective.

On the other hand, there is great pressure to define methods that can deal with the increasing complexity of the problems to be solved. The systems approach offers simplification by understanding and mitigating complexity, ensuring that subsystems work together and generally contribute to the goals of the system as a whole. However, there are difficulties in achieving this, requiring that the decision units are integrated to deal with the common problem regardless of their formal organization, which means the optimization of the system as a whole, without taking into account the decentralization of its subsystems.
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In turn, organizational learning cannot be separated from its performance. The signs that an organization is learning are much more subtle and difficult to measure than performance indicators. There is an increasing need to increase teaching methodologies in a new era of knowledge, with new technologies emerging at every moment.

In short, learning thus acquires a much broader meaning than just internalization and information. It is a true change of mentality, which can enable organizations to create their own future, based on the implementation of Systems Thinking.

REFERENCES

ANDRADE, Aurélio L.; *et al*. **Pensamento sistêmico**: caderno de campo: o desafio da mudança sustentada nas organizações e na sociedade. Porto Alegre: Bookman, 2006.

GATTI, Daniel Couto. **Sociedade informacional e analfabetismo digital**: relações entre comunicação, computação e Internet. Bauru: Edusc. Uberlândia: Edufu, 2005.

LIBÂNEO, José Carlos; OLIVEIRA, João Ferreira de; TOSCHI, Mirza Seabra. **Educação Escolar**: políticas, estrutura e organização. São Paulo: Cortez, 2003.

LIMA, Lauro de Oliveira. **A construção do homem segundo Piaget**: uma teoria da educação. São Paulo: Summus, 1984.

MARTINELLI, Dante Pinheiro; VENTURA, Carla Aparecida Arena. **Visão sistêmica e administração**: conceitos, metodologias e aplicações. São Paulo: Saraiva, 2006.

MELO, Osvaldo Ferreira de. **Teoria e prática do planejamento educacional**. Porto Alegre: Globo, 1979.

MORAN, José Manuel. **A integração das tecnologias na educação.** Disponível em: <http://www.eca.usp.br/prof/moran/integracao.htm>. Acesso em: 02 de abril de 2011.

MUNIZ, Adir Jaime de Oliveira Muniz; FARIA, Hermínio Augusto. **Teoria geral da administração**: noções básicas. 4 ed. São Paulo: Atlas, 2001.

SENGE, Peter M. **A quinta disciplina**: arte e prática da organização de aprendizagem. 5.ed. São Paulo: Best Seller, 1999.

VASCONCELOS, Maria José Esteves de. **Pensamento sistêmico**: o novo paradigma da ciência. 4 ed. Campinas: Papirus, 2002.