

ENACTIVE APPROACH, AUTOPOIESIS AND PEDAGOGY:

The contribution of H. MATURANA and F. VARELA to action in school as Learning/Teaching System

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Abstract:

This paper is an attempt to examine the benefits of an enactive approach in the field of cognition and pedagogy. This approach, initiated by MATURANA et F. VARELA, in the autopoiesis theory, seems to be pregnant in the field of education because it proposes a change of point of view by reconsidering the place of the teacher and the learner. Autopoiesis involves considering the cognition as a biological phenomenon. This approach leads us to consider the cognition as an historical and dynamic process in which the knowledge is enacted that is to say it emerges from social interactions in the school classes. Autopoiesis, allows us to think the connexion between the classes that are a social systems and children who are both living systems and components of these social systems. We examine the educational situation, in the way of systems science, considering the school class as a system we call Teaching/Learning system.

Key words:

autopoiesis, cognition, éaction, organization, structure, living and social system, education

In this paper, we look at the consequences of an autopoietic and enactive approach on the school situation. Autopoiesis theory, developed H. MATURANA and F. VARELA, provides us some relevant concepts to analyse the teaching situation. These authors, neurobiologists, claim the cognition is a biological phenomenon and therefore it can only be understood as such, in connection with the organism that realise this phenomena. The concept of éaction proposes a dynamic and circular vision of the construction of the knowledge that built a subject in interaction with and in his environment.

In the first, we are going to introduce the enactive approach connected with the theory of the autopoiesis. In a second one, we are going to define the organization of school classes as an autopoietic teaching/learning system. Then, we close this paper with few thoughts brought by the enactive approach in the field of pedagogy where we consider the consequences of the autopoiesis.

1. Autopoiesis and enaction

1.1 Basic notions of the theory of autopoiesis

H. MATURANA [H. MATURANA, (1978), (1988a), (1988b), (1995)] and F. VARELA [F. VARELA, (1981), (1983) (1989),)1993]], claim that “living systems are autonomous entities, even though they

depend on a medium for their concrete existence and material interchange; all the phenomena related to them depend on the way their autonomy is realized.” These systems operate keeping their organization that is their identity. In H. MATURANA’s words, this organization in terms of self-production can be characterized as follows.

“There is a class of dynamic systems that are realized, as unities, as networks of productions (and disintegrations] of components that:

- (a) recursively participate through their interactions in the realization of the network of productions (and disintegrations) of components that produce them;
- (b) by realizing its boundaries, constitute this network of productions (and disintegrations) of components as a unity in the space they specify and in which they exist. These authors called such systems *autopoietic systems*, and *autopoietic organization* their organization. An autopoietic system that exists in physical space is a living system (or, more correctly, the physical space is the space that the components of living systems specify and in which they exist).”

In this characterization of the organization of living systems, nothing is said about their structure, and about the medium in which an autopoietic system may exist, or about its interactions or material interchanges with the medium, which can be any that satisfy the constraints imposed by the actual structure through which the autopoiesis is realized. The word autopoiesis is composed of the Greek words for “self” and “to produce”. In fact, an autopoietic system is defined, as a unity by its autopoiesis, and the only constitutive constraint that it must satisfy is that all its state trajectories lead to autopoiesis; otherwise it disintegrates. Therefore, in an autopoietic system all phenomena are subordinated to its autopoiesis and all its states are states in autopoiesis. In other words, while the system operates, its only purpose is to keep its organization, that is an autopoietic organization.

These authors define organization and structure as follows. The organization of a composite unity is constituted by the relation between its components that make it a composite unity of a particular kind specifying its class identity as a simple unity in a metadomain. In other words, the organisation of a composite unity is the configuration of static or dynamic relations between its components that specifies its class identity as a composite unity that can be distinguished as simple unity of a particular kind in a metadomain. The structure of a particular composite unity is the manner in which it is actually made by actual static or dynamic components and relations in a particular space, and a particular composite unity conserves its class identity only as long as its structure realizes its organization that defines its class identity. So, it follows that the structure of a composite unity can change without it losing its class identity if the configuration of relations that constitutes its organization is conserved through such structural changes. If its class of identity changes, the system loses its organization

Moreover, autopoietic systems are Structure-Determine Systems (S.D.S.) that is to say the structural change that a composite unity undergoes as a result of an interaction is also determined by the structure of the composite unity, and this is so because such structural changes take place in the interplay of the properties of the components of the composite unity as they are involved in its composition. An external agent that interacts with the system only triggers in it structural change that it does not determine. To H. MATURANA and F. VARELA, it is a constitutive condition for composite unity that nothing external to them can specify what happens within them. Instructive interaction for this kind of unity doesn’t exist. The structure of the composite unity determines which structural configuration of the medium with which it may interact. It is the structure, at every instant, which determines the type of structural change that may occur at any instant. An event that appends in the medium could trigger, but not determine, a change in the structure of the unity; it is why we call this event perturbation and not input. The course followed by the structural change of a SDS is contingent with the sequence of its interactions with the medium. The relation of dynamic structural correspondence between the medium and the unity, (in which the unity conserves its class of identity), brought forth by an observer is called structural coupling or adaptation by H. MATURANA.

1.2. Definition of enaction

In agreement with the theory of autopoiesis, H. MATURANA et F. VARELA define cognition as an embodied action that is, for one thing, the cognition depends on different types of experiences which are supported by the fact that one own body which allows particular sensory and motor abilities; for another thing these abilities are ground in a biological, psychological and cultural context. In other words (1) the cognition is an action guided by the perception, (2) cognitive structures emerge from recurrent sensorimotor schema that allow the action to be guided by the perception. In this way the perception is not only compelled or constrained by the world that surrounds the subject, but the perception contributes to the realization, the emerging of the world. So the subject enacts the reality.

Enaction is the alternative between realism, that is the pre-existing world as seen by the observer and idealism, that is the world creates by his own perceptions.

2.The Learning/Teaching system

We define the organization of school classes, as a system I call Learning / Teaching system. The purpose of this system is to educate the children and to lead them to learn. We find the term “système d’Enseignement / Apprentissage” (Learning / Teaching System) in the works of M. ALTET [M. ALTET, (1994), (1999)] and M. BRU [M. BRU, (1987), (1991)]. This system is characterized by a set of processes (including relationship processes) and structures developed with this goal. The components of this system, that is the teacher and his pupils, are related by a social contract established and define by the society that is the medium of that system. We notice the contract is negotiated from outside of the system but negotiated again, in an implicit or explicit way, inside each class by the teacher with his pupils that are the parties involved in the school life.

This wide definition, that everybody agrees upon, leads us to specify the main purpose and the main flow of the system. In agreement with a firmly constructivist definition of child development we specify the school as a machine to transform children. As J. MELEZE [J. MELEZE, (1972)] noted, systemic science deals with transformation as a central issue. The aim of a system is to processes the flows that pass through it. In agreement with J. PIAGET, we think that all education is a product of a change in equilibrium; one learns to pass from a dynamic equilibrium to another dynamic equilibrium of the brain structures. This definition of learning allows us to think that school transforms brain structures, both mental and social functions, of the child and induces a change in his internal organisation. If the school brings about new behaviour in children and changes their structures, pedagogic action is both generic and modifying. We just mention that pupils should acquire new knowledge and new behaviours that would further educate them by the end of their schooling. So, the way I specify the Teaching/Learning system is to force us to consider the children as the main flow of the system that processes and transforms them. The difficult point, in this case, is to understand that the main flow of the system is also one of the components, and may be the main component, of it. School, as a social system, is made of actors (pupils and a teacher), relations between theses actors and relations between them and their medium. Moreover, we can say that the children justify the school’s existence that it is a way to provide them with education and culture which they can’t live without. Human beings are social beings who cannot live without culture, and school is a medium that our society designed in order to acquire it. The school seems answer to this vital need of humanity that is to become cultivated. Some authors like E. MORIN [E. MORIN, (1977), (1980), (1986)] consider this need as a deficiency, and an incompleteness of humanity. E MORIN point out the positive effect of this incompleteness in the mechanism of the evolution of species, to compensate for this lack the Homo sapiens operate the emerging of culture and education by which the school is one means of access.

Accordingly, we consider the school classes as a Learning/Teaching System (LTS) that is the system of processes, of interactions, of functional connections that are developed between teaching and learning as

actions. This term is used to avoid the common mix up, by both theoreticians and practitioners of education, between teaching and learning. In my point of view, it is important to mention that teaching and learning don't overlap. Learning is not an automatic consequence of teaching. Unfortunately, teaching is not necessary and sufficient to cause learning. Learning is an individual process due to every child, nobody can learn for another person. As we presented in other articles [R. ORTALI, (1993), (1996), (1998), 1999a), (1999b), (1999c), (2000)], school classes could be formalized as a system. This system is made up of three subsystems, Control, Information and Apprenticeship subsystems. I have shown in which conditions this system function as an autopoietic system. Accordingly to autopoiesis, we maintain that learning and teaching don't take place at the same level of operation in the Learning/Teaching system. Learning operates at the level of the subject cognitive structures, in the brain and the nervous system of person. Learning is a biological phenomenon, which is realized through biochemical mechanisms. Teaching takes place in a metadomain, that is a social system, which human being are components. Teaching is realized through social actions. Thus the domains of existence of these two systems are different. These two domains of existence don't intersect, so it is nonsensical to say that teaching produce learning. Teaching can only trigger learning. The cognitive structures of the pupils, as composite unity, determine which events, produced in the school, could be a perturbation they can interact with.

3. Some consequences of autopoiesis and énaction in the field of education

Since we define living systems as autopoietic system, in agreement with H. Maturana and F. Varela, we consider human beings are Structured-determined systems, that is a system in which the operation depends on their structure. Accordingly, we think that the processes of cognition, as learning, are physiological functions. These assertions involve the following implications.

- a) Cognition depends on the biological organization of its subject. Thus, we can see, hear, act and feel because biologically and physiologically we are built as we are. This point is important because it obliges the teacher to consider the biological features of his pupils as attention periods and biorhythms by example, to make his courses efficient.
- b) The organization of the human being is embodied in a particular and unique structure, which constitutes the human person. Each subject realizes a different and individual structure of the organization that is a human being. By example, sometimes our feeling or concerns or problems stop us to understand or learn something.
- c) It is the subject structure that allows the medium configuration, which with it can interact at any given instant. In other words, it is the individual cognitive structures of a subject that translate each various perceptions, and the informations related to him at every moment. The subject doesn't take orders or instructions from the medium, thus learning can't be programmed from outside. Accordingly, we understand that children are not computers and we understand that school classes are not information processing machines too. This point lead us to be sceptical about programmed education.
- d) Education is only the result of the structural coupling between the human being and his environment. The medium involves perturbations – like perception or information, etc. – that trigger changes determined by each various subject structure accordingly. Learning, that is structural changes of a subject, is the result of his interaction with the medium. In telling that, we are proposing another formulation of the, so-called, *conflit cognitif* conceptualised by J. Piaget.
- e) Education is only possible in the congruence between structural change of the subject and changes of the medium. The medium triggers changes in the subject structure while this change entails, in its turn,

a change in the medium configuration which with the new structure of the subject can interact. In that way, we can say that the subject products his environment which recurrently products himself. Learning is the result of a structural drift that writes, in a same movement, both the subject and the world history.

What is written previously doesn't mean that education is impossible but invites us to consider in another way teaching/learning action. These Implications, grounded on the theory of autopoiesis, include cognition and learning in an enactive approach that is an emerging way. If we agree with autopoiesis theory, we cannot think a sequence of teaching as a scenario, a priori written, that a teacher has to lead until the end. On the side of the teacher, these implications involve an attitude that takes account of the learning situation as a dynamic process. Indeed learning is an historical process, which unfolds as it goes along. This process evolves and changes in the midst of teaching; the situation emerges as the actors generate it in action. We can think that the knowledge doesn't pre-exist but each subject in a particular situation enacts it. Accordingly, the didactic of teaching subjects is not the only way, the one best way for every pupil, unreal and fantasized subject. The didactic has to be understood as the perfect command of the field to teach, of a corpus of notions, which allows the teacher to realize possible learning patterns. So, he can lead his course according to the sequence of class events. In saying that, we are close to the definition of the teaching expert that V. TOCHON [TOCHON (1993)] expresses. For this author, the expert teacher is like a chess player who realizes sets of game configurations as the game goes on. One must understand that we acquire knowledge in each social and changing situation that everyone comprehends in a particular and individual way.

In the éaction theory, the school class allows each pupil to acquire knowledge they can learn at the present moment. This acquisition entails changes in the mental structure of the pupils who can then acquire new learning. The knowledge that is possible to acquire changes at the same time the personal structure of the child changes. Accordingly, we understand that some pupils achieve learning and others don't. Accordingly, we can understand that a subject is unable to learn particular things when he cannot establish connections with knowledge or interact with informations or grasp the meaning of a task. To process information, to realize a task, and acquire a learning presuppose that one is aware of the status and the relevance of it, and it supposes that one can identify or recognize it too. Moreover what has a meaning at a moment for a person could have no sense for another person because of his degree of maturation or because of his own biological organization (neuronal network) or his own history. The concept of emotionning, that is to say quickly, the emotional state of the teacher as well as the pupils is not without consequence or effect on the teaching/learning process.

In conclusion, we maintain, in one hand, that a serious and relevant approach to the teaching/learning process can't ignore the uniqueness of each child living a particular history and, on the other hand, that the learning teaching situation is a social and historiated process in continuous change. The theory of the autopoiesis postulates that existence, that is action in an environment, entails cognition. It postulates that it is the inner structure of a subject at every given time that allows him to acquire knowledge by interacting with his medium that is formed by peoples, objects or ideas and concepts. Thus, the enactive approach suggests a middle way between the theory of J. PIAGET and L. VIGOTSKY plead in favour of an individualized pedagogy based on interaction with the environment both physical and social. The dynamic of learning takes place between an individual and a social point that allows each subject to compare and modify or revise his outlook of the world.

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