

Learning difficulties and (experience) from the concept of Autopoiesis: Reflections on the teaching methods

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Abstract: In this paper, we will discuss some aspects related to the learning difficulties presented by students in the context of (experience) in the education of both sciences and biology. The perspective of the Biology of Cognition of Maturana and Varela, and the double birth of Savater, allow us to elaborate an explanation of our human nature that is both biological and cultural. As human beings, we respond to various environmental stimuli by keeping our autopoiesis according to the functioning of our nervous system, allowing in this way, we learn to learn. Parents and teachers often easily identify some sensory dysfunctions, however, other malfunctions generate learning difficulties and other difficulties of various natures in the school context, and thus the guiding question that drives this text is how, from the knowledge and understanding of our biological and cultural nature can we drive the teaching of Sciences and biology?

Keywords: Biology of Knowledge, Teaching and Learning, Sensory Systems, Learning disabilities, Autopoiesis.

Introduction

In this work of a theoretical nature, we will address the learning difficulties presented by students from the processing of sensory information related to the concept of operational enclosure of the nervous system and with the maintenance of autopoiesis from the Biology of Knowledge of Humberto Maturana and Francisco Varela. Likewise, from the authors cited we propose the concept of (experience) in parentheses so that contact and understanding with this perspective promote reflections and actions that generate transformations in the social relations that occur in the classroom, as well as in the ideas we have about the process of teaching and learning of science and biology. Furthermore, we hope that this knowledge will also promote a truly inclusive education for children and young people with non-obvious special needs.

Learning difficulties and inclusive education

Inclusive education was defined almost twenty years ago by UNESCO from the Salamanca declaration in 2004 (Torres, 2013) As the response to the various needs of students, increasing their participation in the various learning, cultures and communities, thus reducing exclusion within and from formal education. For UNESCO it is the responsibility of each country's educational system to educate all children, and this requires changes in the content, approaches and strategies used for teaching. In our perspective, adding to the elements considered by UNESCO, it is also urgent to expand the understanding of the teaching-learning process as a biological phenomenon by teachers and trainers and all professionals working in education.

The concept of inclusive education has spread throughout Latin America and Brazil, but with gaps in the training for teachers who work directly with children and young people and can closely observe their conduct. A lack of understanding of the deepest sense of the need to offer learning and coexistence opportunities for all students who go to school. This situation has generated a paradox: the proposal for inclusion has produced new and complex forms of exclusion; one of them is due to the lack of training of education professionals, who by not identifying the real difficulties of various natures of students and not knowing how to deal with them, end up generating other forms of exclusion.

According to Yadarola (2012) there is today a partial inclusive school, since the training of teachers in this area is incomplete and unsatisfactory, on the other hand, some teachers have become accustomed to making diagnoses of their students, using classificatory approaches. Finally, for the author, there is the problem of "double schooling" to which many of the students with some difficulty in learning or socialization are submitted: school reinforcement, extra-school classes and several other types of professional care that aims at the normalization of children. What can happen in these situations is that the child is separated from his class and does not perform the activities with his colleagues; that the activities are repetitive or very simple and do not really offer challenges to the student's cognitive skills and possibilities. The consequences can result in lack of motivation, disinterest and school failure. In this situation, the child or young person who needed to be

welcomed and integrated into the school education system ends up being excluded for not responding to the expectations of this same system.

Human existence in the maintenance of the autopoiesis in operational cloister

For Maturana and Varela (1973) the organization that defines the living being is the autopoietic organization, that is, the molecular self-production of the components of a living being. This means that any change in the structure of the living being that subsequently interferes with its autopoiesis, disintegrates it (MATURANA; 1978). The consequence of maintaining its autopoietic organization is that the living being moves in its becoming of living being in continuous structural change, specified at each moment by its own structure. However, follows a course continuously determined by the conservation of its organization in the scope that is made possible to it by the interactions in the environment in which its life is lived. (MATURANA & VARELA; 1973). In this sense, the authors indicate that the ontogeny of the living being, that is its history, occurs in a structural drift where adaptation and organization are preserved.

For the authors, the nervous system is a closed network of cellular elements in which every change in the activity relations of any of its components always causes a change in activity in other components of the same network. This means from the Biology of Knowing that stimuli only disturb the organism and do not determine the changes that are produced in it. Changes depend only on the internal dynamics of the organism, on the possibilities of its structure at the time of being disturbed (influenced) by the environment. The nervous system works in an operational cloister, closed in its physiological dynamics and Maturana (1995) describes this perspective in detail:

In these circumstances, as well as the operation of the living being as an autopoietic unit consists of an internal dance of molecular productions closed in a continuous autopoiesis, the operation of the nervous system consists of an internal dance of continuous generation of changes in activity relationships between its components, closed on itself because the nervous system is as a unit, a network of components that only interact with For this reason, as well as different autopoietic systems differ in how their structure determines the particular way each of them performs its autopoiesis, different nervous systems differ in how their structure determines, in each of them, the particular course followed by the changes in activity relations between their components that constitute their operation as a closed network of interactions between components. The nervous system does not generate behaviors, but its operation as a closed network component of an organism in an environment (to which they are structurally coupled) results in what an observer sees as the behaviors of the organism in its environment. (MATURANA, 1995, p.43)

The observation that the nervous system does not generate conduct is of great relevance to the aspects that we will discuss below. Conducts are the result of the operation of the living being and described by an observer.

Human existence in language

According to Maturana (1995), we can consider ourselves human in the evolutionary history of hominids, from the emergence of language and, as every living being is a dynamic system in continuous structural change. The way of living that defines a species "occurs as a dynamic configuration of relations between the living being and the environment that extends in its ontogeny from its conception to its death" (MATURANA, 1995, p. 96). To this dynamic of relations configuration between the living being and the environment (way of living) Maturana and Mpodozis (2000) call the ontogenic phenotype. In this perspective of the authors, in order to be able to understand what happens in the history of evolutionary change of any class of organisms, it is necessary to find their ontogenic phenotype, this is what is preserved and around which are the changes produced. Thus, to be able to understand the evolutionary history that originates the human being, it is necessary to look at the way of life that made language emerge, and then look closely at the new way of life that emerged with language (MATURANA, 1995).

The origin of language, as a domain of consensual conduct coordination has, required a history of recurring encounters in mutual acceptance (MATURANA, 1978; 1992; 1995) and the collaborative way of life allowed by language, the conversation as a crossover of language and emotion. Language is a neologism used by Maturana to describe the act of being in language without associating such an act with speaking. For Maturana and Varela (1984) when the human way of life arises, talking as an action belongs to the emotional scope, and this is evident in at least three observations raised by Maturana (1995). a) In the tactile images we use when speaking; b) In the physiological and hormonal changes that speaking triggers and us and others and c) In the pleasure that exists in talking and in understanding and belonging in a language.

In this sense, human existence in language configures various ways and ways of being and being in the world, in the words of the author, many domains of reality. These different domains are domains of explanatory

coherences and doings that, as human beings, we generate in coexistence with the other, and that as networks of conversations, constitute all the scopes of the human doing (MATURANA, 1995). School education is one of these areas and it is in this area of reality that we establish rules and ways of evaluating the understanding of a reality, which for school education is proposed as unique. On the contrary, from the perspective of the Biology of Knowledge of Maturana and Varela, reality in any domain is an explanatory proposition of human experience, a singular experience is unique that relates directly to the perception of the world. This occurs through an operationally cloistered nervous system and that in networks of conversations promotes structural coupling, which corresponds to all dimensions of the interactions of the subject (in this case the student) as a condition of existence for the acceptance or denial of the other. In this way, there are realities and not just a single reality described from a single perception. Therefore, different cultures are just different ways of living, that is, to preserve autopoiesis, and in the case of the human being this occurs in language and in thriving, which justifies, defines and constitutes the human relations (MATURANA, 1992). In this sense, the conservation of the organization (autopoiesis) is the primary condition and the conservation of adaptation is always relational, because it defines the context in which autopoiesis occurs (MATURANA, 1995), this is extremely important for the understanding of human relations in class and the teaching-learning process.

Learning and Sensory Systems

Learning in human beings depends on the ability of the individual's nervous system to capture or receive the sensory information that comes from the external environment and/or the internal environment of the organism, process it and integrate it into the Central Nervous System (CNS). The subject to plan and organize behavior, so that an adequate response to the needs of development is produced (MOMO et al. 2011a), uses this information. We consist of seven sensory systems: Vestibular, proprioceptive, tactile, auditory, gustatory, visual and olfactory system. The first three sensory systems are at the basis of development and have a fundamental importance in conduct (LENT, 2012).

The proprioceptive system consisting of muscles, tendons and joints, informs body posture and records traction and muscle movement, allows the consciousness of our body in space as well as the muscle strength necessary to perform the movements. The vestibular system located inside the inner ear informs the CNS of the body movements of gravitation, acceleration and rotation. It establishes a connection between the two cerebral hemispheres and is associated with bilateral coordination alert registration and control of emotions, since it is associated with the limbic system (LENT, 2012). All seven sensory systems have their own functional, morphological and molecular specificity, and the proper response of the sensory systems also indicates an adequate development of the child that will produce responses adapted to the demands of the environment (external or internal), and the process of capturing all information from these systems is called Sensory Integration.

When there is a problem in the maturation of sensory systems, that is, when a child has problems in the neuronal integration of his sensory systems, especially in the proprioceptive, vestibular and tactile systems, the dysfunctions can be both hyper-registration, hypo-registration and fluctuation of the sensory response. Any change will affect the emotional and social development of the child, limiting his ability to learn, self-regulate and alert (MOMO et al. 2011a). As these systems are less known, we ignore their incidence on human development and demand from children only an adequate way to respond, according to our posture of external observers who do not understand the closed functioning of the nervous system. Many students have learning difficulties linked to sensory processing, in this case, the group, including adults or inadequately medicated, by not understanding their biology, can discriminate against them. In this context, it is important to remember here that the observer in his experience does not distinguish between illusion and perception, but produces explanations that are reformulations of the experience itself, and that the way he interacts is a reflection of his cognitive and neurological structure which allows him a diversity of dynamics (MATURANA & VARELA, 1984). In other words, the aphorism of the authors "Everything that is said is said by someone" reveals this uniqueness of the human being in his own biology. Faced with this situation, the school requires all students to perform the same tasks, at the same time and in the same way, generating the denial of the other and suffering.

To understand the conduct of a child we have to know and understand, in addition to his emotional disposition, family and social context and his cognition, his biology, because this is relevant so that together the observed behaviors can be explained.

Objectivity and experience in Biology of Knowledge

In the book "El Sentido de lo Humano" from 1992 Maturana indicates that different cultures are different ways of living, in this sense we can say that there is a school culture that in general, requires all students to respond in the same way and thus standardizes answers and perceptions of the world. This standardization produces suffering since it denies the particularities and uniqueness of the other. Maturana (1992) states that

from a biological point of view there are no children with difficulties or dysfunctions only different children. The expectation of the other's response occurs only in the context of relationships and from the perspective of one observer, in this way:

The disease or limitation does not belong to biology, but to the relationship from which the human being considers that an organism, a system or another human being does not meet a certain set of expectations. This that I say about biology is fundamental because only to the extent that we accept the legitimacy of the biology of the other we can realize the space in which we ask the other to be different from what he is, and we will realize the possible space of encounter with the other in his legitimacy and not in his denial. (MATURANA, 1992, p.263).

As we have already stated, the human beings are human in language and in relation to the observer and his ability to know, there are two explanatory paths in reflection and consequently two possible paths for human relations. Maturana and Varela (1984) indicate that the explanatory path called objectivity without parenthesis is one where we make explanations as if there were only one reality and this was independent of the observer. In objectivity without parenthesis, a transcendent reality is accepted that validates knowing and explaining it, in this way, when we are in objectivity without parenthesis we operate as if there were only valid and universal knowledge oblivious to the biology of the human. On the other hand, when in our way of living we realize that it is not possible to distinguish between illusion and perception, we can understand that there are no absolute or relative truths, but many truths in many explanatory domains and these domains are explanations of experience. Maturana elaborates the idea of objectivity in parentheses to show from biology the inability of the human being to refer to a reality independent of him. The notion of reality on this path corresponds to an explanatory proposition.

In this same domain, we can say that there are two explanatory paths for the structural coupling of the human being, we speak here of the relationships he establishes with his environment and fundamentally with other human beings through experience. For Maroni (2007), experience is something that as human beings crosses us and touches us deeply, it is what takes us out of place and mobilizes reflection. In the teaching of science and biology, it is frequent to carry out experiments that must be carried out and/or witnessed by students. This conception of experience can be called experience without parentheses, in which a truth independent of the subject of knowledge is validated, however in the face of the theoretical framework adopted in this text, knowing is a biological phenomenon, and it is not possible to elaborate an epistemology outside this subject you know. Thus, we affirm that in this perspective, we can consider the (experience) between parentheses, where for each individual and each student at school the experience is the result of the operational coherences of the functioning of their nervous system, that is, the perception of the world through its sensory systems. Thus, and explanation of (experience) by students can be used by the teacher as a path of encounter with the other and as a form of consensual dialogue in the cultural path of knowledge production that is science, in particular when we talk and teach biology.

Learning as a biological phenomenon: Consequences for science teaching

We say that the individual has learned biology or sciences, when he manifests a learned conduct that is consensual with the linguistic conduct of human beings who make and know the language of the sciences and/or biology. Surprisingly, when dealing with students, their biology is not considered and it is required that he manifest a conduct in the experience without parenthesis from an objectivity also without parenthesis, where the diversity of human beings is not considered and where he who presents inadequate conduct (from the perspective of the observer) is denied even if these conducts are appropriate from the point of view of the acceptance of the other as legitimate, which is one of the main consequences of the Biology of Knowing for education. In this case for the teaching of biology/sciences, is not a feeling but a way of acting in the operational coherence of our biology, in this way "if I ask a being who lives in a domain to establish consensus with me in another domain, it will not be possible If I call the other "idiot" or "limited", I just reveal my own blindness" (MATURANA, 1992, p. 265).

Fernando Savater (2006) points to two births of the human being: the first is the biological one, from the maternal uterus, which provides us with the biological matrix for the perception and understanding of the world, remembering that from the theoretical framework of the Biology of Knowing, the organism operates in operational cloister holding the autopoiesis of the individual. There is no dysfunction in this sense, only different ways of operating and perceiving the world. The second birth, on the other hand, occurs from the social uterus (SAVATER, 2006) and this is more important than the first, because it is what develops in us the possibilities of humanity. As our humanity arises in language, it is in networks of conversations that we can accept or deny the other. The second birth often occurs in a different social group than the family, which welcomes unconditionally. This birth usually occurs at school, and if it requires only one type of skill and does

not consider the diversity of abilities and possibilities of students, this birth can be an (experience) of deep suffering for those born and blindness for the observer.

The concern with the teaching of science has proved to be a fundamental and worldwide issue.

Fourez (2003) another decade ago clearly indicated the problem by pointing out that it is in crisis and at the center of this crisis is the issue of lack of meaning, since, as pointed out by Cachapuz (1989), science teaching is marked by the use of technical terms and an impersonal style, whose main objective. For students, what would have made sense is a science/biology teaching that helps them understand, first, themselves and the world in which they live. In this way, the scientific models presented to them should lead to the understanding of the history and the world where these students live (FOUREZ, 2003; LEMKE, 2006; BYBEE & FUCHS, 2006) and especially to the understanding of themselves as doubly rooted human beings, in biology and culture.

Final Thoughts

We discuss in this text the UNESCO proposal for an inclusive education that considers the diversity of children; some fundamental concepts of the Biology of Knowing, necessary to understand this theoretical approach; learning linked to the perception of the world through the seven sensory systems; a proposal for the concept of (experience) between parenthesis and the consequences for the teaching of sciences.

The culture we live in is the environment in which we perform as human beings (MATURANA, 1995), and in scientific culture it seems to us of fundamental importance to know and understand the approach to the biology of knowing, especially in the school environment. Because practices that do not recognize the biological foundation of learning and social, do not promote the genuine reflective exercise of students or teachers. It continues to promote only mechanical learning devoid of meaning and meaning for those who learn, and for those who teach. Therefore, the profound changes that the Brazilian educational system needs are not generated.

Actions with meaning favor the emergence of consciousness (MOMO et al. 2011b) in the experience of the perception of our body and in relationships and dialogue with others. In this way a science teaching not only contextualized historically or socially, but biologically that favors working with different objects or materials, allowing the student to explain and establish relationships with his own words will generate internal and external dynamics that will favor new forms of communication and learning. Thus, the school will not need to be inclusive but respectful, promoting in the human beings who live in it, respect for others and for themselves. In this way, from the teacher and for each of the students can arise the conviction that each one learns differently, but that we can collaborate by generating human social phenomena (MATURANA & VARELA, 1984); re-enchant students with science by understanding biology itself and promote that the second birth (SAVATER, 2006) is really a give birth and not a social abortion gestated from biology and science classes at school.

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