http://doi.org/10.17163/soph.n26.2019.05

Biological mechanisms of learning: neural control in sensitive periods of child development

Mecanismos biológicos del aprendizaje: el control neural en los periodos sensibles de desarrollo infantil

Vinicio Alexander Chávez Vaca[*]
International University of Ecuador / Quito-Ecuador
vchavez@uide.edu.ec
Orcid Code: http://orcid.org/0000-0003-3623-4178

Abstract

The present study aimed to describe the biological mechanisms of learning, fundamentally those that affect the sensitive periods of child development. In order to achieve this objective, the documentary bibliography was used as the main research method, through which the existing information on the topic under analysis was consulted, allowing a compilation of the doctrine both nationally and internationally in this regard. They reviewed books, journals, essays and research papers, which made it possible to identify the main concepts and thoughts that have been built around learning from philosophy and practice. The methodological approach of the research turned out to be qualitative, from which it is concluded that the learning process starts from a genetic and biological condition that manages to transform itself from the social interaction that the boy or girl achieves with his fellow and with the adults who they participate, guide and guide the teaching process. The construction of knowledge is, therefore, an eminently active process not only because it responds to neuronal exchange but also because it varies according to the social historical context that stimulates children's development, allows it to develop in an integral manner and contributes to the experience, the exchange with other people and the environment that surrounds them positively affects their thinking, attention and education in general.

Keywords

Learning, development, biological, mechanisms, children, periods.

Suggested form of citing: Chávez Vaca, Vinicio Alexander (2019). Biological mechanisms of learning: neural control in sensitive periods of child development *Sophia, Colección de la Educación, 26*(1), pp. 167-189.

[*] Doctorate in Education. Master in Ntics with a Mention in School Management. Bachelor of Education Sciences. Master in University Teaching and Educational Administration. Expert in educational planning. Full Time Professor of the Faculty of Basic Sciences, International University of Ecuador.

Resumen

El presente estudio se propuso describir los mecanismos biológicos del aprendizaje, fundamentalmente los que inciden en los periodos sensibles de desarrollo infantil. Para el logro de este objetivo se utilizó como principal método de investigación el bibliográfico documental, mediante el cual se consultó la información existente sobre el tema objeto de análisis, permitiendo realizar una recopilación de la doctrina tanto a nivel nacional como internacional al respecto, igualmente se revisaron libros, revistas, ensayos y trabajos de investigación, lo que posibilitó la identificación de los principales conceptos y pensamientos que se han construido en torno al aprendizaje desde la filosofía y la práctica. El enfoque metodológico de la investigación resultó ser cualitativo, de lo cual se concluye que el proceso de aprendizaje parte de una condición genética y biológica que logra transformarse a partir de la interacción social que consigue el niño o niña con su semejante y con los adultos que participan, guían y orientan el proceso de enseñanza. La construcción del conocimiento es, por tanto, un proceso eminentemente activo no solo porque responde al intercambio neuronal sino porque varía de acuerdo al contexto histórico social que estimula el desarrollo infantil, permite que este se desenvuelva de manera integral y coadyuva a que mediante las experiencias, el intercambio con otras personas y el medio que le rodea incida positivamente en su pensamiento, atención y en su educación en general.

Palabras claves

Aprendizaje, desarrollo, biológico, mecanismos, infantil, períodos.

Introduction

The main objective of the research study to be carried out is to describe the biological mechanisms of learning from neural control, delving into the sensitive periods that appear in child development. The work is structured in three fundamental parts aimed at examining the anatomical and neurophysiological basis of learning, the philosophical sustenance around learning and Education in the construction of knowledge.

All types of development, citing Enesco (2013) "includes behaviors that arise because they are programmed (inherited) and behaviors that are learned" (p.2). In this sense, the development of the learning process, at present, not only depends on the incidence of the environment, the teacher, the use of didactic methods, but is built on the active attitudes assumed by the student. This new perspective of learning is the result of the discussion that has arisen between various theories to define the premises of child development, including psychoanalytic theories, in which the figures of Freud (1856-1939) and Erikson were highlighted (1902 -1994), who defended the incidence of five psychosexual stages, and eight psychosocial stages, respectively, before reaching significant learning.

Piaget (2000) and Vygotsky (1995) are referents of cognitive theories, which assumed the development of the cognitive process as the result of the interaction of individuals with others and as a stage in which the historical and sociocultural context influences. For its part, the theory

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 167-189.

of learning, represented in Pavlov (1849-1936) and Skinner (1904-1990), assumes that, in addition to these factors mentioned above, children build knowledge from what they live and learn from their own experiences.

The information that is generated in all levels of the human mind creates changes in the nervous system that can remain with time and create what is called experience. And in this conformation of what is called experience, there are many elements of the human mind that participate, from more essential processes such as perception, attention, memory or learning, to those of greater complexity such as thought, imagination, language, symbolic activity, memory, reasoning; and it is in childhood that these processes designed to achieve child development are more frequently activated.

For centuries, the subjects of the study of education saw in the teacher the most interesting figure, and also placed him as the main actor of the pedagogical process, therefore, many of the questions that were formulated, found in this figure its main purpose of study, and the answers and solutions revolved only around this actor, who had to find in himself the important biological mechanisms to achieve his own learning and that of his students, from the implementation of didactic strategies.

It is necessary to emphasize that it is from the 20th century when some looks are turned towards the student, to also involve him with his own learning and development process. The application of science has allowed us to verify many of the philosophical theories that defend the active attitude of children and young people when it comes to building their experiences and knowledge, as expressed by Carretero and Castorina (2012) "both the teacher and the student are biological organisms that elaborate knowledge in their different forms and, in addition, the educational activity has in the transmission of knowledge one of its most essential purposes" (p. 89).

The above criteria imply that both the teacher and the student must be in constant exchange, which will allow the enrichment and development of knowledge, playing a key role in the learning process. Despite this, these postulates remain in the memory of few minds and in the practice of few teachers, who continue to see themselves as the main intervenor of the educational process for two important reasons: poor access to studies and little interest in performing an updated bibliographic review about the processes that mediate learning. This prevents drawing comprehensive strategies in the field of education to effectively achieve the objectives of the learning process, in this regard Blakemore and Frith (2013) consider that:

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 167-189.

> Understanding the brain mechanisms that underlie learning and memory, as well as the effects of genetics, environment, emotion and age on learning, could transform educational strategies and allow us to devise programs that optimize the learning of people of all ages and with the most diverse needs (p.19).

Studies on human development are the gateway to the application of more effective activities and methods when it comes to the teaching-learning process, hence the interest of this study to integrate the biological and psychosocial reasons that motivate human development, from the application of the documentary bibliographic method and a qualitative approach to research, so that the professionals of pedagogy acquire a more globalized level of the phenomenon, favorable to a more democratic practice of education.

Anatomical and neurophysiological basis of learning.

Learning is, in principle, a biological process and is one of the most important processes in the life of a human, given that it allows the development and its integration into the life of society. The learning process is complex and as it has been analyzed, different factors are involved, such as biology, psychology and social factors.

This learning process is biologically observable, since many structures of the nervous system responsible for the reception, sending and processing of all the information of the human body that are not instantaneously incorporated are involved, but is generated from the evolution of the species, its anatomy and physiology, to which the human nervous system responds.

The central nervous system constitutes the most complex and important scaffolding of the human organism, considering that it regulates voluntary and reflexive behaviors that allow the development of human life. The brain activity is what motivates all behavior of human beings, because consciously or unconsciously, according to Gordillo (2015), "being in the world, being with others and performing in the world -constituting oneself- at our point of insertion in the world" (p. 358). The dynamics of the brain and those of the human organism cannot be separated, but these integrated bodies communicate from chemical and neural interactions, and in this complex relationship that the development of the mind can be understood. The first step to understand the human mind involves knowing how neurons get organized and communicate, about which Glejzer, Cicarrelli, Maldonado and Chomnalez (2012), ana-

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 167-189.

lyze that to fulfill the three essential functions of brain activity: the sensitive, the integrator and the motor functions, sensory function is based on sensation, which is defined by Velásquez (2001) as a process through which the sense organs respond to stimuli coming from the environment, this means that the external world affects the human organism and this in turn responds to it. It is through this function that information about everything that is part of the life that surrounds us is received, reasons why it can be said that sensations are the basis of knowledge. The sensitive activity is understood as the stimuli coming from the internal and external environment in which the human organism develops.

It is important to emphasize that learning begins through a sensory experience. This must be considered by the teacher taking into account that his actions and other acts can lead to learning, because they are sensory experiences and the brain processes said experience, therefore, the relationship between teaching and learning must be maintained. It is fundamental stimulate the brain of the students, to practice because from the biological field the neurons that are discharged for a longer time, form more connections and in turn narrow the new ones.

For its part, the integrating function is made up of all the events that occur in the brain from the reception of the sensory impulses and subsequent emission or sending of motor impulses. This function includes awareness, emotions, language, memory and psychomotricity. They can interpret the sensitive information that arrives. On the other hand, the motor function allows movement playing a primordial role in human survival and constitutes the reflex of the contractions at the level of the muscles and awakens movements and secretions.

From an eminently biological approach, it must be said that it is the brain structure and the mind that are the foremost repositories of human knowledge. Following Cruz and Galeana (2013), the human nervous system comprises two important divisions: the central nervous system (CNS), which includes and links the data offered by the perceived sensations and which conceives the thoughts and emotions to form and store in the memory; and the peripheral nervous system (PNS), formed by the cranial nerves, linked to the brain, the spinal nerves and the spinal cord, which allows impulses to be brought and carried to and from the CNS.

Within the cerebral cortex there are millions of neurons, which can be of three types: motor which send signals to the muscles, glands or organs, the sensory and sensitive ones that send all kinds of sensory and sensitive information from the sensorial organs towards the central nervous system, and those of association that connect the motor neurons with the sensory ones.

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 167-189.

It must be said that the cerebral cortex is organized into several segments of activity including the frontal area where the frontal lobe is located, where the representation of all the muscles of the human body is located. Likewise, accumulated motor activity programs are accumulated as a result of past experiences and as an important function is the formation of words, the creation of personality, the regulation of feelings, initiative, among others.

On the other hand, there is the parietal area, located on the lateral surface of the brain and among its functions is the reception and integration of various sensory forms, which allows the recognition of objects without visual support. The occipital area is in the posterior part of the brain and its function is to establish the visual information that is received from the primary visual area with past visual experiences, which allows identifying and assessing what is being seen.

Other areas that deserve to be mentioned are the temporal ones that are located on the sides of the brain, here the auditory areas related to the reception and identification of sounds are concentrated, as well as the sensitive area of the language which facilitates and allows the understanding of both of spoken language as of writing. Among other important areas is the area of taste and the vestibular area responsible for balancing and coordination. All of them affect learning because they articulately facilitate development.

To achieve learning, the stimuli must arrive at the relevant areas of the human brain, which allow an analysis of the subtracted information, and integrate the answers to the already known data and store the new meanings. For Cruz and Galeana (2013) "to learn is to change the brain", that is to say, that the construction of knowledge depends to a large extent on the genetics that is possessed, since the elaboration of the information that reaches the brain does not depend on the number of neurons but of capacity. As we have seen, there is a close relationship between brain and learning, in this respect Zull (2011) expressed:

> The human brain is the organ of learning. What it does is learning. The main task of the teacher is to help the student to find connections. Once the student finds (in our teaching) things that connect with his life, his emotions, his experiences or his understanding, he will learn. Your brain will change (p 43).

Learning means obtaining and processing new information and, in turn, there are changes in behavior that benefit adaptation to the environment. There are two types of learning, they are non-associative and

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 167-189.

associative. The first is born from the exposure of a single stimulus and on the other hand the associative arises from the relationship of two or more stimuli, or between a stimulus and a response, or a stimulus and its effect. All this type of change and acquisition of knowledge is born of biological mechanisms.

Therefore, following Monserrat (2015) the mind has meant the first survival weapon of human life, being able to invest physical, biological-neurological and psychic resources with which it must acquire the information it needs from the world to be able to adapt to the different environments that have put existence to the test. The mind is not a static process, new information arrives from reality to generate changes in properties and states of the brain, which are translated into various beliefs, feelings, emotions, intentions, decisions, character, personality, abilities, skills, and competencies.

In the frame of the previous observations, Vilatuña, Guajala, Pulamarín and Ortiz (2012) affirm that "As the human being acquires knowledge of new stimuli the process of cerebral reorganization changes and integrates them in a different way" (p.22); Therefore, we cannot speak of a passive process, but of a sophisticated process of active knowledge construction, in which brain activity and experience participate. In this sense, Sanmartín (2011) states that anatomical and functional flexibility allows all human beings the possibility of learning, but some individuals have greater abilities to achieve knowledge than others, therefore, have better conditions to adapt to the variety of environments and establish more useful behaviors for their life and development. On the other hand, Campos (2014) states:

> Development is made up of the permanent interaction between sources of vulnerability and sources of resilience, so that the same environment can have different effects on children, since the internal qualities that each one possesses for interaction will help to respond to adverse situations in the context individually (p.10).

Following the idea of Cruz and Galeana (2013), when an organism is genetically trained with brain structure, the physiology and behavior towards learning, can adapt early and more efficiently in a given context, it is said to be biologically adapted. Contiguity, repetition, contingency are the simplest mechanisms of learning because the functions of these processes are limited to establishing links between stimuli and responses to achieve an eminently behavioral knowledge. However, the develop-

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 167-189.

ment of the human mind depends on more complex learning strategies such as attention, representation and memory.

Childhood is the most propitious stage to generate this type of development, since children usually remain in an active state in their development process; in this sense, teachers must take into account that this development modulates and is modulated by different dimensions: the mind, the brain, the body, the environment, hence the importance of the relationship between early experiences and the brain in sensitive periods of child development.

It was Montessori, cited in Mutuberria (2015), who first dealt with the definition of the term sensory periods of child development, to understand them as those moments that are conducive to promote human development, hence the importance of the activities practiced by the child in the early ages of life to stimulate personal development, interpersonal communication, and the incorporation of social behavior habits.

The nature of a child's learning depends not only on the biological and social inheritance of their parents, but also on the stimuli they receive from their environment and allow them to access knowledge. Properly stimulating the child will allow the him or her to adopt a certain behavior and perform certain actions. According to Mutuberria (2015), the education system could participate in child development from actions that pay tribute to early stimulation, all development beyond sensory, affective and motor perception that awakens from the environment; early stimulation, awakening in the child stimuli according to their rhythm of development; early attention, respond to the transitory and permanent needs of the infants; early intervention, increase opportunities for child development, in conjunction with the family, based on experiences that may be common in the school context.

Philosophical basis around learning

To study the philosophical basis related to learning, it should be taken into account that on the topic Glejzer, Cicarrelli, Maldonado and Chomnalez (2012) state that human intelligence is the only one competent enough to take on the new information from the world and use it in a process of continuous adaptation, because the brain of individuals have a more developed condition of the so-called plasticity, ability to modify the neural connections with each experience. It is this cerebral plasticity that allows learning.

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 167-189.

Following what Aristotle thought, cited in Bárcena (2013), about being, and establishing a relationship with Education, Aubenque (1974) establishes the fundamental questions of philosophy about the nature of knowledge: "How to become what I am not? How to learn what is not known?" (p. 426). The Greek philosophers would be the first to answer that problem from the form of wonder that the human being adopts when the lived experience is concretized in growth, specifically, in spiritual growth, the *mathesis*.

On this assessment, and in a much more contemporary analysis of what learning is, Bárcena (2013) does not hesitate to affirm that every being learns while studying, while writing and reading, since those actions imply an internal modification of thoughts, something transforms and changes, but not in a clear manner. The being that learns is unable to see in its totality everything that it has absorbed, and from there, the perception that the formulas of learning are always unfinished.

The plasticity of the brain is the ability of the nervous system to transform its structure and functioning throughout its life, is a response to the diversity of the environment, this feature is what allows neurons to regenerate from the anatomical-functional order and form new synaptic connections that allow the formation of cognitive and behavioral skills in sensitive periods of child development, Mackey, Raizada and Bunge (2013) analyze that, it is seen as the moments in which that condition of the brain is more affected due to environmental factors, in this sense, the context in which the human being is inserted constitutes one of the main influences for its development.

In the same order of ideas, Pozuelos (2015) states that "The beginning and end of these sensitive periods are defined by the type of process and cognitive ability and are related to the maturation of the structures of the brain responsible for them" (p. 1).

Following this idea, the individual and collective construction of knowledge, for Sanguineti (2015), constitutes a personal act, since the only responsible is the individual; it is a link with reality, rewarded with the stimuli that man needs and from which he generates adaptation and development; it is a psychic and physical act, a space of inner growth and is generally intentional, however, so that knowledge is associated with child development, the necessary conditions have to be created as those proposed by Cortes, Martínez (1991) and Siegel (2007) "truth condition: if s know that p, then p is true; belief condition: if s know that p, then s believe that p; justification condition: if s knows that p, then s has reason to believe that p" (p.11).

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 167-189.

Learning, then, depends on the rigor and level of importance with which the subject assumes the process of modifying language, constructing meanings and resolving the incongruities that reality emits, based on their intelligence and emotional competences. But this state of the subject who learns requires the will to ask questions about the problems of reality, and the nature of knowledge will start from exercising a critique, based on ethics, that offers a solution to phenomena that are not understood.

According to Piaget (2000) knowledge is explained from the individual to the social, hence one of the processes that mediate learning, the perceptual process, is responsible first of receiving, selecting, organizing and interpreting the stimuli; that will lead the subject to conform to a meaning of the subjective and objective world. According to Monserrat (2015) "this perceived world is constituted by structural entities (objects and contexts) which are integrated in a hierarchical way into increasingly larger structures submerged one into another that conclude in the structure of the universe as a whole" (p. 273). And this internal construction of things is what will favor relations with the environment that surrounds the individual.

Other key processes that intercede in learning is memory, which is essential because it is like a storehouse where memories, experiences and knowledge are retained and stored, specifically in the learning process according to Ballesteros (1994) allows to remember the contents and experiences learned. It is elementary to comment that, although biologically there are resources to develop and use maximum memory, the role of the teacher is essential in its exercise, since it must constantly motivate the student to make efficient use of it. When applying techniques for this, one must consider the true interests of the students, ideas, know even their moods to be able to carry out the cognitive process.

This keeps great significance in the sensitive period of child development, not only by the relationship it has with the information that the human body is able to perceive but by the activities that induce these thoughts, and that is, according to Vigotsky (2014), "The very essence of human memory is that man remembers actively with the help of signs" (p.98). The stimuli constitute a means that justifies human behavior, hence the information perceived is the only one capable of regulating the processes of their own behavior and that of others and is generated as a result of the degree of use and useful use made by the infant of signs of a varied nature.

Following this idea, Vilatuña, Guajala, Pulamarín and Ortiz (2012), affirm that the impression caused by external stimuli affects what the child fixes and remembers. Subsequently, more complex processes are

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 167-189.

activated, such as language and thought, and with this arises the opportunity for the individual himself to master their behaviors, which is evident in the volitional development, the way of remembering, of perceiving, so that what is felt is more determined by the objectives and characteristics of the activities than by the shape of the objects that these stimuli pose.

The nature of knowledge and how it is constructed transits for three periods according to Piaget (2000): sensory-motor intelligence that manifests between 0 to two years in which the child gradually understands the world, articulates the experience based on the sensations with physical activity and build their own schemes, repeat behaviors and experience new actions, with growth imitate actions until one finds mental solutions. At this stage an advance occurs from the innate reflexes, this allows the child to become aware of their role within a group and in the individual order, as well as awareness of their potential.

There is a stage called pre-operational that begins between 2 and 7 years in which according to Piaget (2000) every operation that takes place in the mind requires logical thinking, however children of this age still do not have the ability to think in a logical way; but they develop the understanding and management of the world through the use of symbols or representations, the game occupies a fundamental role in this age to achieve their development, since they use objects to represent others, the thought at this time is individual, manifests in an egocentric way, because they are not capable of thinking about the other, they give life to inanimate objects. The language also manifests in an egocentric way, the child does not care about who speaks or who listens to him, repeats words, there is a monologue since he speaks for himself.

In the analyzed stage the child expresses what he thinks, although he interacts with other children, he only says expressions out laud without pretending to communicate with these or with other people. The schemes are symbolized in the words, the language is acquiring a marked development. The child begins to say sentences and use verbs. The psychomotor system is also being developed.

Other period related to the construction of knowledge is the one that corresponds to the preparation and organization of concrete operations, which is elementary begins between 7 and eleven years old and the children begins to make some comparisons in a logical way, not they only receive influence by the appearance of things, they do not handle abstractions, they begin to identify spatial relationships, being able to determine what is near or far, they order objects from least to greatest. As far as language is concerned, there is great progress, they communicate what they

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 167-189.

think, they talk, they ask a lot of questions and they also answer them. In this stage the children discover people, events and feelings, they begin to perceive the world from their own perspective.

Finally, it is necessary to analyze the period of logical-formal thought that develops from the age of 11, at this moment a thought qualitatively superior to the aforementioned stages is presented. Piaget (2000) considers it the final stage of knowledge development, reasoning is advanced, information is processed both quantitatively and qualitatively, children perform analysis from all points of view and language is used to expose their reasoning.

The stages described above, leads us to think about the process of internalization of which this author spoke and that for Vilatuña, Guajala, Pulamarín and Ortiz (2012), is understood as the progressive step from the sensor-motor intelligence to its preoperative form and from this to the so-called concrete and formal operations.

The rest of the stages of internalization of knowledge is manifested spontaneously, according to the maturity reached by neural networks, hence teaching must diagnose the child's evolutionary rhythm and establish strategies that favor the child's intellectual, emotional and social development. Therefore, the teacher assumes the functions of facilitator of the learning process, since, from the knowledge of the psychological characteristics of the individual in each period of the development, it must create the optimal conditions so that a constructive interaction takes place between the student and the object of knowledge.

Education in knowledge construction

It should be borne in mind that according to Bárcena (2013), "education enunciates a knowledge and, at the same time, the experience of an activity aimed at the transformation of the individual and society through the generations" (p.709). So that without experience all the knowledge that can include in his memory cannot be fused in the human being, it is worthless to understand the meaning of things, if it is unable to interact and transform.

The activities and interactions that the boy or girl reproduces in their existence is what gives them a historical social experience that benefits their development, that in the sensitive periods of growth is fundamentally manifested in the biological development, nevertheless, this is conditioned by social exchange, so that the progressive development of the infant will no longer depend exclusively on the biological maturity,

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 167-189.

but on the social environment in which he develops. This is for Barba, Cuenca and Gómez (2014) "the true source of development in which all the material and spiritual values that the child must make his own in the process of forming his personality are contained" (p.7).

The role of education is fundamental considering that human beings at birth have no pattern of behavior whatsoever and as with all other animals, therefore that interaction enriches and develops. Education is essential because through its exchanges are made and the influence of other people is received, which allows behaving and acting as human beings, all thanks to the plasticity of the human organism that facilitates these processes. The social influence is strengthened through education which will allow the person to acquire forms of behavior and to perceive reality from the community.

Education is, then, an object of knowledge and is only articulated from experience (Bárcena, 2013). This idea is based on the assertion of Delval (2012) when expressing that social knowledge is only possible thanks to socialization which is achieved in an effective way linking the child with his group, through family exchanges. The role of the teacher in socialization is vital as a facilitator of interaction between people, to help the integration and development of students, and this is the process by which the subject assumes the basic behaviors and knowledge of society in which they live.

Cortés, Jordi, & Martínez, Anthoni (1991), distinguish between primary socialization and secondary socialization, the first has its beginnings in the family and subsequently materializes in educational institutions in which the person establishes relationships and interacts with other people outside the family nucleus. This primary socialization is subject to personal characteristics, the social context and the culture in which the person develops. The social agents that characterize this period are: the family, the school and the media, through them the person is integrated into society.

For its part, the stage of secondary socialization is manifested when the individual, is already socialized, begins to carry out everything learned in the family home and educational framework, incorporating to several sectors of society, learning new things that until then were an unknown, such as interaction with government institutions, policies, etc., there is already a personal independence, a greater power of action and the experiences and knowledge acquired are applied.

Education implies a relationship between people, the presence of human influence, communication and activity, establishing a close rela-

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 167-189.

tionship between teacher and student, which facilitates the entire learning process. Some contemporary philosophers have called education, a process and, at the same time, a result, the event in which it becomes visible the discovery and the transmission of the culture between beings of different in age, social origin, filiation, religion, scenes of coexistence. According to Pardo (2004) the central point of the event is the experience of learning: "the passage from before to after, from the power to the act, from the implicit to the explicit" (p. 134).

With this, it can be affirmed that in the elaboration and criticism of the meanings, signs and symbols that the human beings construct according to their environment, is established after a process of consent or rejection of certain events. Experience makes man think, and after that thought man will never be the same as before. The event that provokes a new experience delimits the continuity of being that learns as a biological and psychosocial individual.

Therefore, there are environments in which the individual is as similar as the rest of the subjects, because the process of socialization often imposes a common behavior in the scenarios in which the organism develops, however, depending on the appropriation of the culture, essential factor in child development, the small one will be different in character and personality; In this regard, Delval (2012) notes that "these behaviors, such as the acquisition of language, forms of greeting, patterns of child rearing, have a biological basis, but need a society to develop, and without it they do not occur in a normal way" (p. 193).

So it is the action of others that determines the development process of the subjects, about it Vygotsky (1995) analyzes that from there the influence of the educational process by constituting the school as one of the entities in which the child achieves a greater interaction with their peers and other adults other than parents, as well as mental functions of a superior nature, and acquire their development through social interaction, then it becomes a fundamental pillar for the child to develop.

In this sense, one of the processes that most affects the child's development and to which less interest is given is communication, a resource that the teacher can use to regulate the nature of the interactions that the child builds in everyday life, not seen as an external phenomenon but evaluating how this activity occurs and the repercussions it causes. Through communication, the teacher can assess the particularities of each student and through it transmit not only their content, but values and experiences that contribute to the overall development of the child.

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 167-189.

On the other hand, Peralta (2005) studies that the active behavior that the child develops during sensitive periods of life makes each activity significant for the infant, hence the need for the negotiation of intentions in the pedagogical process, for the sake of the interactive dynamics of the school being effective. This places the teacher as the mediating figure in the child development process, as the person who has the ability to generate each of the interactions that lead the child to an analysis of their environment and an understanding about themselves.

It is important to note that the teacher must know the students in their individuality, to work with them, know their expectations and needs from the biological, cognitive and psychological. To get results one must take into account the age and maturity of the children to ensure a correct correspondence between these particularities and the object of knowledge, which will allow the students to arrive at conclusions about the phenomena and objects of their environment.

The problem of achieving the aforementioned, is that often the teacher forms different objectives and motivations than the student, or worse, that are not compatible with the rhythm of biological development of the child, without taking into account that for an active behavior on the part of the child to occur, the needs and interests of these must match those of the teacher, manifested in their teaching strategies to achieve the expected results in the learning process.

To consider the child as an active subject is to analyze each student separately, to work to achieve that each one reaches, according to their possibilities, a greater degree of development. It means taking him or her into account within the group of the class without forgetting their interests, individual preferences and expectations. For the child to be the center of learning, it must be seen as a whole, both from the biological and emotional point of views and a fundamental aspect is the direct exchange of the teacher with the student. In order for the child to be an active subject, it must be assumed that he interacts not only with immovable and lifeless objects, but with other human beings who mediate the appropriation of culture independently and offer a pathway for biological, psychic and social development, according to the law of Vygotsky (1995):

> Any function in the cultural development of the child appears twice, or in two different planes. First, it appears on the social plane and then on the psychological plane. In principle it appears among people as an interpsychological category. This is equally true with respect to voluntary attention, logical memory, the formation of concepts and the development of the will (p.150).

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 167-189.

Thus, education and teaching, by virtue of what was studied by Barba Cuenca and Gómez (2014), must adapt to the child's psychic development; therefore, learning must be gradual, appropriate to the interests of the child, in which they are offered several alternatives and their independence and are consistent with the psychic stage in which the child is. Similarly, education and teaching must respond to the surrounding environment, but those conclusions were not reached from the start. Three trends marked the way the educational process was built and therefore the way in which the school intervened in child development: behaviorism, cognitivism and constructivism.

The first tendency is based on the observation of the behavior of the subjects, with the that is the imitation of patterns of behavior what makes up ideas and thoughts in the brains of the apprentices. The mind, according to Cruz and Galeana (2013), is seen as a "black box" and the response of the stimuli are quantified instead of delving into the causes of internal changes that are generated from reproducing modes of behavior.

Behaviorism analyzed the behavior of people as a result of reactions, stimuli and responses; does not consider structures of internal order or brain processes in this behavior. The learning process seen from this tendency, is based on the relationship between the response and the stimulus that motivates it, it studies the behavior through observation to predict and control it and based on it achieve a certain attitude.

The trend of behaviorism is related to the quantification of learning, segmenting the activity by performing and studying tasks that are measurable and it is considered that learning is successful when obtaining positive results, through examinations that allow the measurement of the objectives.

Cognitivism, on the other hand, does consider the processes that provoke changes in behavior, understanding that learning depends on the elaboration of associations that are established through interaction with the other. Cognitivists accept the processes of imitation and reinforcement as valid but observe the exchange of apprentices as the opportunity to correct the patterns of behavior they have assumed through imitation of the other. That is why it is said that what is worrying here are not the external behaviors but the mental processes that give rise to the action of the psychosocial being.

The trend under analysis, considers man an organism that develops its activities based on the processing of information and how people are able to assess, organize, filter, code and give a certain category to the information and how these resources and mental schemes are used to

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 167-189.

access and interpret the environment, reality, which is different from one individual to another and can be progressively transformed. The word to "learn" is the fundamental element of cognitivism, a tendency that differs and is more advanced than behaviorism.

Likewise, Cognitivism recognizes the value of reinforcement as an aspect that contributes to feedback to correct answers, in addition to playing a motivating role, and considers the learning process as a way of acquiring and organizing cognitive structures through which people can process and store information.

For its part, the trend that would revolutionize the phenomenon of education for the sake of learning and child development has been constructivism, according to which only the subject is capable and deserves to build knowledge about the world by itself and through its own experiences and developed mental schemes. So, the learning subject constructs his own vision of the world from the perception that is stimulated according to previous experiences, mental structures and beliefs that he uses to rework the concepts and meanings in tune with each object and events of reality.

Piaget (2000) considers the origin of knowledge as "constructivist", since as a relationship between the subject and the object is established, a "construction" takes place, taking into account that knowledge is not reproducing or copying reality, but to achieve the domain, the knowledge of the object, which will allow transforming it based on the schemes of the organism; through knowledge information is interpreted and organized, this construction occurs throughout the development process until it reaches knowledge.

Constructivism is based on preparing the student to solve problems in undetermined conditions, seeking to build their own reality or to perform an interpretation in accordance with the perception they have about a certain thing, born of their own experience, so that knowledge that he owns turns around previous experiences. Deval (2012) describes constructivism as a form of interaction in which knowledge is the effect of the subject's action on reality and is determined both by the properties of the subject and of reality.

It is important to note that according to Casañas (2014) constructivism is characterized by the notion that the subject and the object come together in the process of knowledge construction, it is conditioned by innate and acquired patterns and capacities, in addition to those needs to achieve an organization of its own and develop the subjective system itself. In this tendency it is the subject who constructs the sense of the

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 167-189.

stimulus that generates the instrument based on his personal history, introducing the problem of subjectivity both on an epistemological and methodological level, reality is an indivisible part of the knowledge process and the subject possesses a character eminently active.

This tendency is representative of a new way of seeing the human being as someone capable of developing activities subject to the processing of information and it is recognized that the learning that is acquired by the person is related to social interaction. It is considered that the students use their own experiences to enrich their learning. On the other hand, it is interpreted that each person has in dependence on their individual schemes, their reality and their relationship with the environment, the possibility of transforming and continuously improving.

After reviewing the three trends it is important to highlight the fundamental differences between them. It should be said that both behaviorism and cognitivism have a nature based on objectivity, both in practice, have their basis in the analysis of tasks and their division into small parts with defined objectives and performance is determined with their achievement, while constructivism fosters more dynamic and open learning experiences. In this trend, the learning results are not easy to measure and could be different depending on the particularities of each student.

In his analysis and exploration of the critical assumptions of education, Bárcena (2013) understanding Foucault (2015) elaborates three main conceptions that are related to the learning of the meaning of the phenomena of the world:

> a) It is that which, not being true, pretends to be true; b) refers to what is possible to be certain or true, but has not yet been demonstrated; and c) assumes the idea, judgment or theory that is supposed to be true, even if it has not been demonstrated or confirmed, and from which a consequence or conclusion is drawn, or hypotheses are derived (p.52).

Optimal learning would be that which results from an education based on the ethics of reproducing certain concepts, through which students acquire certain skills, knowledge, and studies that allow them to assume certain behaviors, values, developing reasoning, experience and observation.

Learning occurs through behavioral changes that produce experiences. Therefore, the best mechanism to educate are based on the individual experience of children, who are themselves able to understand the evidence of knowledge to create value judgments before perfectly demonstrable facts in their daily lives.

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 167-189.

According to Bárcena (2013), the "supposed critics of education refer -in their double ethical and epistemological component- to the set of principles, conditions and notions that, historically, have been added to education" (p. 711), the opportunity that educators have today to rectify didactic methods and strategies is based on an in-depth analysis of those assumptions that mediate children's learning and development.

Foucault (2015) states that the discovery of the truth is where Education must lead. This thinking justifies why learning is seen as an active process, about which Cruz and Galeana (2013) assert that "in which meaning is developed on the basis of experience" (p. 21); therefore, the pedagogical practice must provide the child with multiple representations of reality and propose the solution of real problems according to the early ages in which the plasticity of capacity of the human brain is developed, to awaken a negotiation state, in which the subjects are able to integrate new knowledge to those already apprehended, which allows them to build an updated vision of reality.

For the above, is that the apprentice must also participate in the construction of their knowledge. Following this matter, Heidegger (2014) said that it was not possible to access the meaning of things, to interweave thoughts, without being aware of what it is to think for oneself, that is, according to the experiences that have made it favorable to perceive better way the world that is lived.

That is why it is positive when teaching actions, according to Dewey (2014) "give students something to do, not something to learn; and if doing is of such a nature that it demands thinking or awareness of the connections; learning is a natural result" (p. 54). These conditions are favorable especially when individuals are in the sensitive periods and the innate curiosity in them makes them ask questions about the whole environment. Therefore, the teaching must start from what the student knows and thinks, so that the new content that is proposed from a different logic, which is the logic of the teacher, can connect with the motivations and needs of beings with less emotional, spiritual, and intellectual development.

The idea of Dewey (2014) is intertwined with that of Lipman (2013) by saying that:

> One goal of education is to free students from mental habits that are not critical, that do not question anything, so that they can better develop the ability to think for themselves, discover their own orientation to the world and, when they are ready to do this, develop your own set of beliefs about the world (p.344).

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 167-189.

The true apprehension of knowledge happens because the individual, once exposed to the contents disseminated by the teacher, is able to relate it to their daily life, the student takes the new information and contrasts it, readjusts it with the information they already have, performing the reconstruction of both, this is called meaningful learning, the result of the finding of strategies and didactic methods that respond to the interests and needs of the subject who learns, because this is the only way that leads to the development of skills and abilities that prepare us in thought and action for life.

Meaningful learning is a way to combine previous skills and knowledge and to obtain and internalize new information, it is necessary that the motivation and relevance that is attributed to what is learned is present, so that it has a positive impact on the construction process of knowledge.

Finding the most propitious moment to start the learning process is one of the premises that the teacher could use in their educational practice to be effective, is to correspond to the degree of maturity of the individuals, as well as the characteristics of their cyclic activity functional. But we must bear in mind that for Asensio (1987) whatever the origin of the people, their culture, religion, context, ethnicity, in the case of human beings, it is not the neuronal structure that affects intelligence and learning of the small, the influence is also given by the endogenous and exogenous stimuli received by the developing organism.

For this reason Bárcena (2013) understands education as the process that establishes the definitive link between experience and meaning, and already Vygotsky (1995) had pointed out that education and teaching which guide the process of child development, but of each child, according to their biological and psychosocial characteristics, learn differently in their interaction with the teacher, due to the internal logic of the process of development of the psychic in the child, which must also be valued by the teacher, especially in the sensitive periods of human development, at which time the conditions are created to stimulate the construction of knowledge and achieve true learning.

Every action that man executes motivates within himself the concrete change in the application of knowledge and the transformation of his thought. Each activity of the other on oneself supposes an effect, an impact on the human brain that can occur in a resignation external to the activity, or it can be conceived in another way. Bárcena (2013) points out that: "It may be that this effect is nothing other than our own presence in our doing, in our activity" (p.713). Hence the complexity of the learn-

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 167-189.

ing process and the phenomenon of Education, which according to the authors allows to move from non-being to be.

Conclusions

The mind is the most precious asset of the human organism, which bases its development on the continuous movement of billions of neurons that interrelate in biological systems spontaneously and actively seeking the construction of knowledge. From multiple ways in which the world is presented and perceived, the individual can establish an essential interaction between genes, brain and environment that lead to development.

In the most fertile stage of human life that is childhood, the learning process becomes very complex, as it depends not only on the biological conditions of the subject or on how neurons are organized and communicated, but also on environmental factors that stimulate the curiosity for the context in which one lives, the same one that offers the sources of knowledge thanks to the plastic capacity of the brain that allows it to continuously incorporate new information and integrate it to the one already learned, and in the interaction with the other one and achieve a significant learning.

To assume learning as an active and inexhaustible process, laying the foundations for an effective education, based on strategies that consider the rhythm of biological development of each infant and their ability to think, solve problems and execute decisions according to the tests that the determined environment in which one grows and develops. The student, however young, has the conditions to build knowledge from the experiences of his life and not based on the impure transmission of information by the teacher.

The genetic and biological condition, supported by a process of communication and direct interaction in a social-historical context, allows the human being to elaborate his own experiences on the world, and in the remembrance of these he will modify his behavior based on the knowledge already built. But these processes require a selection and guidance of external actions in terms of guiding cognitive processes. Hence the importance of the teacher mastering the biological mechanisms to which learning responds in sensitive periods of human development, to draw more effective didactic strategies that make the child an independent being when building their knowledge.

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 167-189.

Bibliography

ASENSIO, José Manuel
1987 Maduración biológica y aptitudes cognitivas. *Educar,* N°. 12. Universidad Autónoma de Barcelona, pp. 109-124.
BARBA, María Nela, CUENCA, Maritza, & GÓMEZ, Alba Rosa
2014 *Piaget y L. S. Vigotsky en el análisis de la relación entre educación y desarrollo.* Centro de Estudio de Didáctica de Las Tunas.
BÁRCENA, Fernando
2013 Filosofía de la Educación: un aprendizaje. *Educación y Realidad, 38*(3).
BALLESTEROS, Soledad
1994 *Psicología general: Un enfoque cognitivo.* Madrid: Universitas.
BLAKEMORE, Sara Jane & FRITH, Uta
2013 *Cómo aprende el cerebro. Las claves para la educación.* Barcelona: Ariel.
CAMPOS, Anna Lucía
2014 *Los aportes de la neurociencia a la atención y educación de la primera infancia.* Lima: Cerebrum Ediciones.
CARRETERO, Mario, & CASTORINA, José
2012 *Desarrollo cognitivo y educación I: los inicios del conocimiento.* Buenos Aires: Paidós.
Cortés, Jordi, & Martínez, Anthoni
1991 *Diccionario de filosofía en CD-ROM: autores, conceptos, textos.* Barcelona: Herder.
CRUZ, Gabriel, & GALEANA, Lourdes
2013 *Los fundamentos biológicos del aprendizaje para el diseño y aplicación de objetos de aprendizaje.* Centro Universitario de Producción de Medios Didácticos. Universidad de Colima.
CASAÑAS, Mirtha
2014 *Bases epistémicas de la educación.* México D.F: UNAM.
DELVAL, Juan
2012 Notas sobre la construcción del conocimiento social. En *Sociedad, Cultura y Educación* (pp. 193-194). Madrid: Centro de Investigación y Documentación Educativa y Universidad Complutense.
DEWEY, John
2014 *Democracia y educación: una introducción a la filosofía de la educación.* Madrid: Ediciones Morata S.L.
ENESCO, Ileana
2013 *Psicología del Desarrollo.* Madrid: Universidad Complutense de Madrid.
FOUCAULT, Michel
2015 La escena de la Filosofía. En *Obras Esenciales* (Vol. 2). Barcelona: Paidós.
GLEJZER, Claudio, CICARRELLI, Alejandro, MALDONADO, Adriana, & CHOMNALEZ, Manuela
2012 *Las bases biológicas del aprendizaje.* Editorial de la Facultad de Filosofía y Letras.
GORDILLO, Lourdes
2015 El cuerpo humano y su proceso de objetivación. *Revista Internacional de Folosofía*, 357-367.
HEIDEGGER, Martin
2014 *¿Qué significa pensar?* (2 ed.). Madrid: Trotta.

Sophia 26: 2019.

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 167-189.

LIPMAN, Matthew
2013 El papel de las narraciones en la educación moral. En F. García, *Crecimiento moral y filosofía para niños* (pp. 115-125). Desclée de Brouwer.
MACKEY, Allyson, RAIZADA, Rajeev & BUNGE, Silvia
2013 Environmental influences on prefrontal development. En T. Stuss, & R. T. Knight, *Principles of Frontal Lobe Function* (pp. 145-163). New York: Oxford University Press.
MONSERRAT, Javier
2015 *Engramas neuronales y teoría de la mente.* Madrid: Universidad Autónoma de Madrid.
MUTUBERRIA, Ainhoa
2015 La educación temprana, periodos sensitivos. *Revista Arista Digital*, 1-9.
PARDO, José Luis
2004 *La regla del juego. Sobre las dificultades de aprender filosofía.* Barcelona: Galaxia Gutenberg-Círculo de Lectores.
PERALTA, María Victoria
2005 *El saber pedagógico de la educación parvularia en sus paradigmas fundantes.* Santiago de Chile: Ponencia de Encuentro Nacional de Especialistas en Currículo.
PIAGET, Jean
2000 *La equilibración de las estructuras cognitivas. Problema central del desarrollo.* México: Siglo XXI Editores S.A.
POZUELOS, Juan Pablo
2015 *¿Qué son los períodos sensibles del desarrollo?* Recuperado de https://goo.gl/oJvgKH
SANGUINETI, Juan José
2015 *El conocimiento humano. Una perspectiva filosófica* (2 ed.). Madrid: Ediciones Palabra.
SANMARTÍN, Rómulo
2011 La cognición incorporada: el contenido y la justificación del enfoque percepto-operacional del conocimiento. *Sophia* (11), 127-166.
SIEGEL, Daniel
2007 *La mente en desarrollo. Cómo interactúan las relaciones y el cerebro para modelar nuestro ser.* Bilbao: Desclée de Brouwer.
VIGOTSKY, Lev
1995 *Obras escogidas* (Vol. I). Madrid: Editorial Visor.
2014 *Pensamiento y lenguaje.* La Habana: Ed. Pueblo y Educación.
VILATUÑA, Fausto, GUAJALA, Diego, PULAMARÍN, Juan José, & ORTIZ, Walter
2012 Sensación y percepción en la construcción del conocimiento. *Sophia*, 123-149.
ZULL, John
2011 *The Art of Changing the Brain. Sterling: Stylus.* Nueva York: Publishing LLC.

Date of receipt of document: April 2, 2018
Date of document review: June 15, 2018
Date of document approval: August 20, 2018
Date of publication of the document: January 15, 2019

Sophia 26: 2019.

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 167-189.