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How are the human mind and brain trained and modified?

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Abstract: This article proposes a new conception of learning based on the functioning of the human brain: the brain-configurating learning theory, which in turn constitutes the basis for a new pedagogical model, emerging and relevant for the third millennium, the configurational pedagogy model. The main postulates expressed contribute to understanding how students learn and how teachers should teach. The structural didactic elements that allow researching, designing, developing and evaluating teaching and learning processes based on the functioning of the human brain are provided. The above constitutes the basis of configurational psychology and configurational pedagogy, supported by the brain-configurating learning theory which is proposed, assumed and sustained based on the conceptualization of brain-configurating learning. Finally he reflects on how he trained and the mind and the human brain are modified.

Keywords: learning; human brain; brain-configurating learning theory; pedagogical model; configurational pedagogy; teaching and learning processes

1 Introduction

Learning is basic and essential for the behavior of the human being, which is a process and a quality inherent in the subject. It is an activity intrinsic to one's life. Learning has been defined in many ways and these vary according to the approach or theory from which the definition comes. For conditioning theories, learning is an association between two events, or the result of an association between a stimulus and an answer, which follows the rules of conditioning. For cognitive theories, it is a mental process by which knowledge is acquired or restructured; It is the result of a reorganization process that we make about our knowledge in order to achieve the understanding of a phenomenon. For contextual-cultural theories, learning is a process of internal transformation, mediated by the socio-cultural context. It is the process of appropriating or assimilating culture through the activity and influence of the natural and cultural environment of the individual.

From these theories, various definitions have been given to facilitate the understanding of the concept of learning. For Hurlock (1966) learning is "the development that is produced by exercise and effort by the individual. Through learning the individual makes changes in their physical structure and in their behavior and acquires competence in the use of their hereditary resources", for example, if the student learns an incorrect body posture, it can cause muscle shortening or some specific problems such as scoliosis. Likewise, if a paralytic student learns to stand by putting more weight on his/her unqualified leg and tries to march from this position (dragging his/her hemiplegic side), he/she will learn to walk with claudication (lameness), which will be very difficult to correct later. Unless you have opportunities to learn, many of your

hereditary potentials will never achieve their optimal development. For example, students can have a great aptitude for music due to their upper neuromuscular organization, but if they are deprived of opportunities to systematically practice and form, they will not reach their hereditary potential.

Papalia and Wendkos (1995) define learning as "a relatively permanent change in the behavior that results from experience. This experience can take the form of study, instruction, exploration, experimentation or practice", for example, students in the engine sensory period learn from what they see, hear, savor, touch, smell and explore. In this way, they learn what a bird is like, the softness of their feathers, the sound they emit, the number of legs it possesses, how it walks, how it flies. The experience also comes from the interaction between a student and an educator or trainer (teacher, pedagogical assistant, instructor, classmate, friend of the neighborhood, family, or the author of a specific text).

Klein (1994) defines learning as "a relatively permanent change of behavior, due to experience, which cannot be explained by a transitory state of the organism, by maturation or by innate response trends" (p.37). This learning definition has three important components: First, learning reflects a change in the potential of behavior, which does not equals it; Second, changes in behavior produced by learning are not always permanent. For example, as a consequence of a new experience, a previously learned behavior may not occur; And third, changes in behavior can be due to processes other than learning, such as motivation or maturation and development, although we know that learning stimulates development and vice versa.

Tomilson (1984) defines learning as "a process by which the capacities (cognitive learning) or tendencies (motivational learning) change, as a result of an action or an experience" (p.32). Cognitive learning includes knowledge (concepts), learning that 4 x 5 = 20, and processes (skills, techniques), learning how to make kites. Motivational learning refers to the tendency to acquire preferences, values, actions, reactions, thoughts, and judgments; For example, it is learning to run away from thieves. Learning can also be defined as a change in attitude. To achieve this, the three components of attitude must be involved in this process: cognition (knowing), emotion (being), and behavior (knowing how to do it).

If only one component of learning is considered, problems will arise. Therefore, if only cognitive components are considered and the other two components are ignored, it will result in people who know a lot but have never practiced their own knowledge, and do not understand the impact that the latter may have on others. For example, they learn the reasons why the earth should not be polluted, but since knowledge is theoretical, it does not lead them to feel responsible for the planet, or take coherent action in this regard. On the other hand, if only the affective component is worked on, people are emotional, intuitive, with a lot of feeling but lack a theoretical support that justifies the actions they perform. For example, paternalistic people who give fish because they feel compassion, but do not teach how to fish. Finally, if only the behavioral component is worked on, the result is people who do many things but do not reflect on them and do not realize their impact on others. For example, people who learn group dynamics, when doing a job with the community, dedicate themselves to doing as many dynamics as they have heard about that work, those they have read, those they have experienced, but they are not clear about why they chose them, what they think they will gain from them, when they should not apply them, or what their impact is on the community.

Good and Brophy (1995) understand learning as "a relatively permanent change in execution capacity, which occurs through experience", which may imply open interaction with the external environment or can imply cognitive processes such as internal reflection on previous experiences or the manipulation of abstract concepts. Now, for a change to be qualified as learning, it must be "the product of the individual's experience or interaction" (Woolfolk, 1996). The changes that are more due to maturation, such as the change of voice in adolescents, or changes caused by illness, accidents or

physiological situations, are not considered learning, although the way in which one responds to these situations does indeed influence learning.

Brenson (1994) defines learning as "a co-creative reality in which each of those involved (educators-students) brings something. The resulting knowledge is new and distinct from the knowledge possessed and provided by those involved". Based on this, it can be said that learning is a completely personal act, which is why educators promote, induce, and facilitate it; But the one who learns is the one who produces it and therefore builds it. Learning is "a process that develops in the individual; Educators cannot force it, or impose it, or do it for students, but they can facilitate and enhance it through adequate conditions" (Tausch, 1981, p.43). Learning can also be defined as a process of interaction between the subject and objects (the latter can be concrete or virtual, people or things), which modifies or transforms the subject's behavior guidelines and in some way, to the objects themselves.

In a daring attempt to integrate all these definitions, Sarmiento (1999) states that learning is:

A process of change that occurs in the individual, in their cognitive abilities, in the understanding of a phenomenon (cognitive component), in its motivation, in its emotions (affective component) and/or in their behavior (behavioral component), as a result of the individual's action or experience, the appropriation of the sociocultural context, the reorganizations that are made about knowledge, and/or the association before a stimulus and an answer (p.45).

Now, taking into account the advances of neuroscience in these last 10 years, I defend the idea that learning should be neural configurator.

According to Llinás (2003), learning:

It is a means to facilitate that the function of the nervous system adapts to the requirements of nature, of the world in which we live. Although at first glance, the details of the external world seem to belong to the ontogenetic domain, and it is probably the phylogenetically predetermined characteristics of the organism that allow us to give meaning to the detail, to the scope of what is happening now (p.228).

That is, the student can learn perfectly the word that denotes, indicates, expresses or manifests the red color, but the perception of said color is not learned through an ontogenetic process but is learned and remembered in a phylogenetic way. According to Llinás (2003), this perception "has a physical substrate and, except for some SNC injury, and it is a capacity that we cannot learn nor forget - this is beyond our biological capacities" (p.207).

Multiple theories about the neuronal character of learning have proliferated for more than 10 decades. At the beginning of the 20th century, Ramón and Cajal, one of the true intellectual and experimental pioneers of neuroscience, introduced the so-called neuronal doctrine, according to which all brains are the result of wiring between individual cells, neurons. Cajal (1911) proposed that long-term learning occurs due to the reinforcement of synaptic connections and the generation of new connections between neurons (cited by Llinás, 2003, p.218).

According to our neuroscientific approach (neuro-bio-social-psychogical), neuroconfigurator learning is considered as a neuropsychosocial, configuration, creation and/or modification of networks and neural circuits that allow the relatively permanent transformation of the students' mode of action, who model and remodel their experience based on their adaptation to the environment associated with them, whether in the educational organization, in the family or in the community; Modification is produced as a result of its activity and communication, and that cannot be attributed only to its growth and maturation process.

In my opinion, considering these brain processes, it is a great idea to study the design, development, and evaluation of the courses. Finally, we can have a teaching process - less modeling, more science, less spontaneity, and more in line with human brain function! If we can use these features to construct this process, it would be a great teaching feat that has never

seen in the history of education.

2 Development

New research on the brain and the great discoveries that have been made in the last 30 years (Malaguzzi, 1991; Gardner, 1988, 1994, 1995, 2001, 2007; Damasio, 1992, 1994, 2007, 2010; Marina, 1993, 1996, 2000, 2004; González, 1995, 1999; Bermeosolo, 1997; Begley, 1998, 2008; Grinder & Blander, 2001; Carter, 2002; García, 2002; Cruz, 2003; Llinás, 2003; Jensen, 2004; Enciso, 2004; Antunes, 2005; De Zubiría, 2004, 2006, 2007, 2009; Ander-Egg, 2008; Alper, 2008; Ortiz, 2009, 2011, 2012, 2013, Ramachandran, 2011; Martínez, 2012), have an extraordinary implication in learning, and above all in the capacity of all students to learn. Today we know that our brain has an immense potential for learning, that our previous knowledge, our emotions and our ideals significantly affect our learning and that the activities that we do with our students, in one way or another, can contribute to creating and configuring new networks and circuits of neuronal communication.

Santiago Ramón y Cajal [14], in 1913, said that "in adult centers, sometimes nerve ducts are unalterable, determined and immutable".

This assertion was implemented as a dogma in the scientific community for almost a century in neuroscience, so that the invariability of the networks and circuits of the human brain, the static character of its structure and organization, its immutability, the predetermination of its form and functions were accepted, which meant that adult human beings should resign themselves to accepting their brain with its limitations and possibilities, and we had no configuring action on it.

This conception has changed in the last two decades, and today it is accepted that "the brain adapts or expands in response to repeated patterns of activity, so that, in a real sense, the brain that we develop reflects the life we lead" (Dalai Lama; cited by Begley, 2008, p. X), in fact, "the brain contains the materialization of personality and knowledge, character and emotions, of memories and beliefs" (Begley, 2008, p.6).

In 1998, in his book *The Art of Happiness*, the Dalai Lama suggested "the configuration of our brains is not static nor fixed in an irrevocable way" (cited by Begley, 2008, p.28), but the human brain is highly adaptable, so that the habits of study, work, production and research generate changes in the brain and are a reflection of these changes.

The remarkable American psychologist William James, in 1890 postulated that "organic matter, especially nerve tissue, seems to be equipped with an extraordinary degree of plasticity [15]" (cited by Begley, 2008, p.4). However, this statement of James had no significance because he was just a psychologist and a century ago, at the time when he made such an assertion, neuroscientists did not yet exist. On the other hand, today it is accepted that the brain has a docility, extraordinary elasticity and plasticity, "including the power to repair damaged regions, to develop new neurons, to relocate regions that fulfill a function and make it in charge of another, to transform circuits, to form neural networks that allow us to remember, feel, suffer, think, imagine and dream" (Begley, 2008, p.7).

The above has significant implications for the effects of the development of daily learning actions, especially in the positive potential of the discipline of reading, of the systematic practice of problem solving and mental effort in the exercise of divergent, reflective, critical, creative and configurational thinking. The human brain is not a fixed, static, or rigid entity. It constantly changes, adapts, and can be modified, which is not as easy as people say or write, because "without attention and mental effort, neural plasticity is impossible. In order to be able to change, we must want to change (regardless of any factor). But the potential can be immense if there is a will to do so." (Begley, 2008, p.28)

If we propose it, we can positively influence and modify the several billions of neurons that exist in the circuits of our brain. Charles Stevens, makes an informal estimate about the neuronal networks and circuits of the human brain. According to this Salk Institute neurobiologist, "the number of synapses formed between these neurons is more than ten

billion, and the length of the cables of the axons that form the neuronal circuits is several hundred thousand kilometers" (cited by Damasio, 2007, p.295), however, despite the complexity of our brain, we can modify these structures through mental training, so that our emotions, feelings, attitudes, values and thoughts can contribute to the configuration of our brain.

The two psychopedagogical and didactic tools for configuring the human brain are meta-affectivity and metacognition, accompanied by a high intellectual effort through problematic questions. Brain configuration implies the development of specialization, metamorphosis and reorganization processes of neurons, remodeling of brain areas, zones and sites, and creation and/or modification of neural networks and circuits. In other words, the brain is redesigned based on its malleability. And this brain reconfiguration is so novel, original and creative that the brain is even "capable of recruiting healthy neurons and that they are generally close, so that they fulfill the functions of the deteriorated. It is now evident that neuroplasticity causes the brain to vary the functions originally assigned to neurons" (Begley, 2008, p.153).

In 2004 the Institute for the Mind and Life organized a meeting between neuroscientists and Buddhists to discuss the issue of the relationship between the brain and the mind. In this meeting, the Dalai Lama wrote: "The concept of neuroplasticity suggests that the brain is highly malleable and is subject to continuous change as a result of experience, so that new neuronal connections can be formed and even generate new neurons." (cited by Begley, 2008, p.27)

The evidence that the brain is dynamic and flexible, and that it is remodeled, redesigned and delineates itself continuously in response to the experience and influence of the social environment, had been accumulated by the achievements of neuroscience since the middle of the past century. It is evident that "the more connected a brain is, the better it works, allowing the mind to relate recent facts to the most remote, extract memories, and even establish relationships between apparently unconnected facts, which is the basis of creativity" (Begley, 2008, p.86), and other important cognitive processes to interpret, understand, value and transform the world that surrounds us and ourselves, using mental process engendered by our brain.

Now, education received in childhood can mark our adult life:

The way they treat us during childhood really mold at least some aspects of our temperament. As basic features as fear, curiosity, openness to new experiences and neurosis, are not immutable to our DNA, despite the continuous discoveries over genes. Nor are they irrevocably engraved on our brain circuits (Begley, 2008, p.228).

According to Begley (2008):

The specialization of the brain is not an anatomical function nor is it dictated by the genes, but is a result of the experience. What we are and how we work is something that comes from our perceptions and experiences. It is the outside world that determines the functional properties of brain neurons (p.134).

However, Llinás (2003) states that in the state of sleep, the human brain can also feel, perceive and process cognitive functions, based on the recreated images when we are asleep, without the need for contact with the outside world, which is understandable if we take into account that during the day the brain is in constant relationship with the world around it, activating its neurons, configuring nets, structuring new circuits that are mobilized at the slightest memory, thus modifying the brain throughout our lives in response to the stimuli received, the accumulated experience and the context in which it lives.

Begley (2008), affirms that "the brain is the organ of behavior and the deposit of learning and memory, which changes in a real and physical way when we acquire new knowledge, and we dominate a new skill and forget the things that have happened" (p.5). That is, in the teaching-learning process, the university professor can make their students modify their mental structures, at the cognitive, instrumental and affective level, thus causing structural physical changes in their brain,

in the various networks and neuronal circuits that make up their areas, zones and sites, hence "when neurons are activated simultaneously, their synaptic connections become stronger, increasing the possibility that the activation of one stimulates the activation of the other" (Begley, 2008, p.36).

This indicates that the physiological expression of learning and memory is precisely the formation of new synapses, which is nothing other than the various connection points between neurons, as well as the strengthening of existing ones, a process through which "some additional dendrites emerge so that neurons can communicate more with their neighbors, like a home that had an additional telephone line" (Begley, 2008, p.5). Even in the same process of human brain development, new neurons may appear, because the human brain:

It is not limited to the neurons with which it is born, and not even the neurons that populate it after the great development that occurs in early childhood; These are born even after the age of 80, and they are directed to various structures and are incorporated into the brain circuits, and perhaps form the basis of other new circuits (gage; cited by Begley, 2008, p.81).

That is to say, the human brain not only works with its existing neurons to organize them into new networks, groups, and circuits, but can also add new, young, healthy, and powerful neurons to its circuits and networks, with enough energy to generate intelligence, emotions, and skills, and establish synapses by establishing new pathways and larger pathways. This suggests that "neuroplasticity can provide a means to alter the brain circuits of those who have previously led them towards selfishness, prejudice, defensive attitudes, and other human evils" (Shaver, cited by Begley, 2008, p.230).

The above is possible by training the mind, although neurosciences have always affirmed that our mental processes are the result of brain processes, since they constitute their effect, and they are born from brain activity, that is to say, the human brain creates, structures and configures the mind. However, according to Goleman, the latest investigations in this field demonstrate that there is "a double causality route, in which systematic mental activity produces changes in the very structure of the brain" (cited by Begley, 2008, p. XIV), in neuronal communication networks and circuits that make it up, thus demonstrating brain flexibility and its plasticity, that is, the brain can undergo structural changes due to our thoughts, without the need for interacting with the environment that surrounds us.

According to Davidson, "everything that the mind is, does and feels, can be traced and reduced to the brain" (cited by Begley, 2008, p.277). Tell me what you feel and I will tell you how you have structured your areas and brain areas, and tell me what you do and I will tell you how the nets and neuronal circuits of your brain are configured. This indicates that thoughts can modify emotions and feelings, and the mind can modify human behavior, that is, regardless of the fact that the mind (emotions, thoughts, feelings and other cognitive processes) is a creative product of the human brain, and that feelings, emotions, thoughts and behaviors are expressions of brain activity. There is a bilateral, two-way causality, since the mind can also influence the brain and cause physical changes in this, not only in its areas, zones and sites, not only in their neuronal networks and circuits, but also in the synapse, in its structure and functions.

As a consequence of the above, we can ensure that "mental activity affects, and even stimulates neuroplasticity. That is, this occurs only when the mind is in a particular state, characterized by attention and concentration" (Begley, 2008, p.163). In this sense, we can make a simile, marking the distance between comparisons, and presume that the human brain is hardware and the mind is the software that makes that hardware work. Indeed, the human mind can achieve certain results and attitudes of the brain, regardless of the fact that mental processes were created precisely by the brain. In fact, software does not work without hardware, and vice versa, hardware does not fulfill functions without software. It is something similar to the classic problem of the egg and the chicken. Who emerged first, the egg or the chicken? The egg, and where did the egg come from? From the chicken, and where did the chicken come from? From the egg.

The brain creates thoughts and they change the brain. Both are modified by each other, establishing a dialectical relationship between them, because "everything that the mind does apparently has a counterpart in the brain, a physical correlation that first generates mental activity" (Begley, 2008, p.279), mutually impacting both the mind and brain areas, the intangible and the tangible, thoughts and neurons.

In 1992, Davidson and his collaborators reported that the activity in the prefrontal cortex detected by an electroencephalogram reflects the emotional state of the person. Davidson defined the asymmetric activation of emotional styles in this area of the brain as, in this sense, he said.

When the activity in the left prefrontal cortex is notorious and chronically greater than that of the right, people say they feel alert, full of energy, enthusiastic and cheerful, who enjoy more of life and tend to be happier. When there is greater activity in the right prefrontal cortex, people say they feel negative emotions that include concern, anxiety and sadness. They express discomfort with life and rarely experience emotion or joy. If the asymmetry is extreme, such that the activity in the right prefrontal cortex is much greater than that in the left, the person runs a high risk of suffering from clinical depression (Davidson, cited by Begley, 2008, p.281).

The above is very important for psychology, for pedagogy and didactics, since interaction activities with human beings must be aimed precisely to create positive emotions in these subjects.

Meditation or other forms of mental training can produce changes by resorting to the neuroplasticity of the brain, especially in neuronal activation patterns, and perhaps even in the structure of the neuronal circuits, in relation to the connections and the strength of these, and that these changes are responsible for happiness and other positive emotions. If so, then when exploring the potential of the brain to change its functioning, therapists and even individuals may be able to restore that organ and, therefore, the mind and emotional health. (Davidson, cited by Begley, 2008, p.276)

Davidson said that happiness is something that we can deliberately cultivate through mental training that affects the brain. Therefore, like some people "they are aware of the value of exercising their body frequently throughout life, and the same happens with emotional skills" (Begley, 2008, p.287). A person can achieve, intentionally, impact on the brain areas that control the affections, emotions and feelings, which causes physical transformations there, and creates and/or modifies networks and emotional communication circuits between neurons, through synapse of happiness.

Indeed, happiness is educated, hence the student can learn to be happy, that is, he/she can train in happiness, with attention, concentration, effort, practice, persistence, will, which can constrain his/her brain so that it, in turn, manufactures, generates and produces feelings of happiness, hence "happiness can be conceptualized not only as a state or trait, but as the skill product that can be learned and improved through mental training" (Davidson, cited by Begley, 2008, p.286).

In his investigations, Davidson has been tying up loose ends, according to him:

Although we do not know exactly why meditation on compassion may arouse positive emotions, the discovery that cognitive activity modifies activity in one of the brain regions responsible for emotion supports the hope that mental training can modify the nodal point of happiness. If so, then that point is not the only one that can be modified (cited by Begley, 2008, p. 287).

But also the circuits that drive or control fear, for example.

According to Davidson, "the signal in the tonsil (which generates fear) can be modified with mental training" (cited by Begley, 2008, p.290), and in that sense, a person can learn not to be afraid of any situation in any adverse situation, or at least, control it, regulate it and reduce it to almost imperceptible expressions. And the same could be achieved with any emotion or feeling, with any affective configuration, or with any cognitive configuration.

The investigations developed by Davidson with the Buddhists and their intense mental activity of meditation, confirm

that "generating a feeling of love, kindness and compassion has neural equivalents in the brains of all the people who meditate, and they are experts or beginners," which indicates that "mental training aimed at concentration and thought, and can alter connections between the thinking brain and emotional brain" (Begley, 2008, p.295). That is, as the emotion regulates the cognition, the opposite can be achieved with a deep, broad and intense activity of intellectual exercise, and it can be achieved that the cognition generates the emotion, that is, we can redesign ourselves as we really want, and we can be what we want if we propose it consciously and intentionally, and if we conceive, structure, execute and evaluate a rigorous mental and emotional training plan. Now, to fully understand the behavior, mind and brains of the human, "the brain that manufactures the human mind and human behavior, it is necessary to take into account its social and cultural context" (Damasio, 2007, p.297).

We can be better human beings, better teachers or students. We can change, and we can shape, modify and configure ourselves as we wish, since "behavior produces changes in the brain, as well as it produces modifications to behavior", which was demonstrated in the year 2005 by Álvaro Pascual-Leone and his colleagues (cited by Begley, 2008, p.304).

3 Conclusion

Through neuroconfigurative strategies we can activate neurons, make them grow and connect with other neurons through synapses, through the signals they receive from other neurons through dendrites and axons, which are responsible for sending the message. Likewise, we can achieve the formation and configuration of new networks and neuronal circuits to take and communicate information from the body and the world, pass the information in patterns, recognize the patterns and decide what to do with them.

On the other hand, we can activate the neurotransmitters so that some cells send them to stimulate chemicals to others through the synapse, so that each cell receives a sufficient amount of packets of chemical substances at the same time, and it is stimulated and thus sends an electrical signal to the axon, who will transmit the message through a synapse to other neurons or an effector, which will fulfill the order of the neuron. Indeed, we can grow new connections between neurons, thus contributing to the growth of dendrites. And it is precisely to these connections between the neurons that we refer when we talk about neuroconfigurational learning. Understanding and applying this wonderful process can help to enhance and accelerate human learning, which is the object of the study of neurodidactics.

To achieve significant physical changes in brain activity, it is necessary for the students to show a high development of their volitional processes. Neuroplasticity and the brain's ability to change as a result of mental training call into question the role of genes in behavior. Genes influence but do not determine human behavior. This is the result of a physical and real force, very powerful, which can considerably modify the brain: the will, which is born, grows and develops from as inexplicable qualities as the mental state, the intensity, quality and stability of attention and the students' concentration, that is, their configurational thinking.

Conflicts of interest

The author declares no conflicts of interest regarding the publication of this paper.

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