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NEUROSCIENCES AND ITS APPLICATIONIN IN MULTIPLE INTELLIGENCES

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Abstract

Curiosity and emotions play a relevant role in the acquisition of new knowledge, stimulating the development of cognitive abilities and leaving behind old paradigms about the existence of a unique intelligence. Scientifically it has been proven that they stimulate the activity of neural networks, reinforcing synaptic connections, showing that new knowledge is better consolidated when factors of emotion and curiosity are involved. Faced with this reality, it is proposed to analyze the incidence of neuroscientific sciences in the development of the different intellectual capacities proposed by Howard Gardner, the identification of neurocognitive and educational processes of knowledge that allow understanding and applying the eight intelligences or aptitudes treated in this work.

To answer these questions, a synthetic analytical methodology was used based on the bibliographic review of information obtained through reliable databases of authors who in recent years have studied the neurological phenomenon of education. It was determined that the in vivo study of brain structure through neuroimaging techniques provides information about the behavior of the brain and how it acts according to the cognitive capacity that a person has more development and evolution.

Keywords: neurosciences, neuroeducation, brain, learning, multiple intelligences.

Introduction

In education, individual differences become a crucial element to obtain the best of everyone, in those cases learning must be an adapted process. Neuroscientific studies and

research in individual cases show that the information obtained from each person turns out to be a preponderant factor on behavior and learning patterns (UNESCO, 2019).

The detailed learning provided by neurosciences can be taken to the field of Multiple Intelligences (MI) to expand it and detail its incidence, if it is desired to guarantee an environment in which each person makes the most of their intellectual potential. So, learning tailored to your cognitive abilities is extremely promising.

(Sánchez, 2016) points out that in recent decades more has been learned about the brain than in the entire previous history of humanity, the decade 1990-2000 having been declared by the United States government as the "Decade of the brain". The European continent is currently experiencing the boom of its decade of the brain, its first world countries have allocated 500 million euros to the "Human Brain" project with the aim of creating a virtual brain that allows internalization through it, generating relevant information about neurosciences.

One of the countries in Europe that has given the greatest importance to the neuroscientific study is Spain, an example of that was the declaration of 2012 as the Year of Neuroscience by the Spanish Parliament. Likewise, great writers and exhibitors of works oriented should also be mentioned to the Neuro field that have motivated other countries to follow this research route.

In Latin America, neurosciences are in the process of expansion and consolidation thanks to the great heterogeneity in scientific development in different countries (Cárdenas, Fontenela, & León, 2013). In South America, countries such as Argentina and Colombia have spent years studying and understanding the functional structures of the brain through neuroimaging techniques.

Ecuador tries to wake up from a lethargy in the neuroscientific world. Until 2012, the Ecuadorian Journal of Neurology was in one of the most important databases of the scientific context Science Citation Index of the Web of Science (Ramos, 2017). In recent years, there has been a favorable interest in carrying out studies on neurosciences, neuroeducation, neuropedagogy in the educational context, which is evidenced in articles and academic works published in journals of high scientific impact.

There are several prestigious universities in the country, which currently have neuroscience research centers. In syllabi or syllabi, some careers include modules based on neurocognitive learning that arouse the interest and curiosity of students eager to understand how thoughts, emotions and general knowledge of the human being are processed.

Undoubtedly, there are many factors that have contributed to the rebound of the neuro study, we can count those that derive from the effects of globalization in terms of technology, training of highly trained professionals in various areas of knowledge and the creation of learning communities they see a door in neuroscience study both brain and cognitive abilities.

It is impossible not to associate the culture of neurosciences with the evolutionary development of the brain and the study of human intelligence. The word intelligence was introduced by the Latin speaker and philosopher Cicero and corresponds to the concept of human intellectual capacity, the result of a long path of biological and cultural evolution (Eraso, 2018).

Historically, the existence of a unique intelligence has been conceived as an expression of human cognition, which was susceptible to quantification when evaluated with instruments that measure the IQ, determining that an individual was intelligent or not, dependent only on certain areas of knowledge. (Amarís, 2002) argues that the findings of cognitive psychology with authors like Gardner show that in reality there are at least eight different intelligences.

At the end of the 20th century, the Theory of Multiple Intelligences emerged, elaborated by Howard Gardner, which modified the way of understanding and meaning what intelligence is (Peña, 2018). Gardner proposes to reject the idea of a unitary intelligence of genetic origin and to consider the existence of several types of intelligence, recognizing the contribution of biological predispositions, but valuing in the right measure the decisive participation of the influences of the social environment for its development (Mesa, 2018).

IMs have the particularity of being different and independent, but they interact and enhance each other. Gardner defines intelligence as "The ability to solve or create products that are valuable in one or more cultural settings" (Mesa, 2018). Under this definition, it can be thought that intelligence tends to be a creativity skill that develops under a need.

Research carried out from the various branches of neurosciences has generated important contributions from the intellect. Recently, the effort to link the contributions from these sciences with the multiple intelligences postulated by Gardner has been evidenced. This link allows taking these findings to achieve the understanding of learning processes from a brain that looks at intelligence not as a whole, but as the sum of several of them.

(Jiménez, López, & Herrera, 2019) agree that an important factor for intellectual evolutionary development lies in the understanding of the brain structure and how it affects the capabilities of an individual. Neurosciences make their contributions by analyzing the neurobiological bases of learning, the conditions under which it can be most effective.

Science advances by discovering how areas of the brain have specialized in various functions and that there is a link between them. The in vivo study of the brain using neuroimaging techniques, structural and functional magnetic resonance imaging, allows us to discover the location of behavioral patterns and activities that take place inside this fascinating organ. This situation has allowed the development of educational programs that favor learning adapted to cognitive abilities.

For the teaching-learning process to be effective, it is necessary to complement the cognitive components, the emotional aspects as proposed by neuroeducation, for example, the interest regarding what they are learning (Araya & Espinoza, 2020). In the case of neuroscience, emotions and observation are focused on the individual organism. Although they all come together in the study of the brain to analyze how emotion is produced, there are some differences in the brain location and in the relationship with the body itself (García, 2019).

According to the previous paragraph, the question arises: How does neuroscience and its application affect multiple intelligences? The answer lies in the new advances in science, specifically neurosciences, which offer the keys to improve the knowledge of educators on the profiles of their students, having the ability to apply specific strategies adapted to

individual needs and appropriately managing both the curriculum of each subject and the hidden one, mainly motivation (Cobos, 2018).

(Maceira, 2005) points out that the hidden curriculum consists of learning such as values, attitudes, knowledge, skills, meanings, abilities, non-explicit and unintentional assumptions that occur in the school context, not only in the classroom or in the teaching process itself but are reproduced or expressed both in elements linked exclusively to this process.

Analyzing the incidence of neurosciences and its application in multiple intelligences is presented as the primary objective of this academic article, for this, Gardner's approach and the scientific and evolutionary development of neurosciences will provide answers to questions posed in this work. Identifying the neurocognitive and educational processes of knowledge and proposing the correct application of multiple intelligences in teaching-learning are objectives.

Materials and methods

The proposed methodology is based on the bibliographic review applied to the subject under investigation, to determine its relevance and importance and ensure the originality of this academic article. The information collected was obtained through databases, repositories, indexed pages, world-wide organizations, and other sources that provide preponderant information on the subject. Of course, being selective in terms of the information chosen, given that currently there is a lot of scientific information available, and its growth is exponential.

The proposed methodology establishes a definition of the problem, search for information and analysis. The literature review of conceptual elements will the reach reader understanding skills required to analyze as neurosciences affect multiple intelligences by Gardner. The modality is developed in theoretical principles such as phenomenology, study of the structure, functions and biological bases very typical of the nervous system, specifically of the brain that in its transversality houses multiple intelligences (Guerrero, 2016).

The resulting product of this article will allow other researchers to consult the bibliographic sources cited, being able to understand and perhaps continue the work carried out. The bibliographic review constitutes a fundamental stage of any research project and must guarantee the obtaining of the most relevant information in the field of study (Gómez, Navas, Aponte, & Betancourt, 2014).

Analysis and discussions

Multiple intelligences are tools that make it possible to give a real meaning to individualized teaching within the inclusive classroom. It is an approach that offers a perspective of intelligence beyond the cognitive. It is non-cognitive skills such as motivation, curiosity, perseverance, self-control, meta-cognition, social relationships, resilience, and the ability to face problems, that is, intrapersonal intelligence, which determines better performance. academic in students with results that a traditional intelligence test would not detect.

Neurosciences are providing knowledge that has revolutionized education by discovering essential and functional aspects of the mind that cannot be ignored and that change the way of learning and educating.

Neurological systems, deficits and various potential capacities, brain plasticity, synaptic connections, emotional intelligence and executive functions of the brain allow us to understand the relationship between neuroscience and education, mainly to understand how cognitive neuroscience and multiple intelligences are a important contribution in the development of individual and collective capacities of a person.

An Evolving Brain

The human brain is the most complex, holistic, systemic, and dialectical physical structure in the universe (Ortiz, 2015). One of the questions that has been raised throughout the history of the species is precisely how the brain works and its relationship with learning.

The 90s were considered the decade of the brain, bookstores were packed with works dedicated to understanding its complex functioning. Various fundamental theories and tools were patented to develop the potentiality of the mind, such as emotional intelligence, neurolinguistic programming, the brain naming instrument, mind mapping, information mapping, multiple intelligences, among others (Ortiz, 2015).

The brain is considered the organ of the body that regulates the entire organism, it is the one that has been gestating, controlling, regulating the actions and reactions of the body that are activated by the stimuli of the physical world that surrounds them (Burgos, Molina, & Carvajal, 2020). In fact, it works without resting before any action it performs, be it cognitive or physical, due to the direct relationship between the physiological and cognitive processes that take place inside it.

In the first years of life, the brain evolves in an amazing way and it is when learning is most effective, the greater plasticity at these ages is justified by early stimulation to favor the neural circuits that regenerate and those that atrophy (Tarrés, 2015). Hence the need for early diagnosis and intervention of possible imbalances in the development process of children.

Brain plasticity is the adaptive capacity of the nervous system to minimize the effects of injuries by modifying its own structural and functional organization (Sierra & León, 2019). Experiences and activities are key to brain development, but the brain is not static.

There are periods in which certain learnings are more favorable than others, for example, the first seven years of life are a fundamental stage for linguistic learning, in the same way, it is the stage in which more is learned through the senses and forms, colors, movement and depth are built. Maturing is nothing more than creating new neural networks and for that the brain needs new experiences, especially during childhood.

The process described above allows this body to be a creative and renovating system, capable of elaborating and re-elaborating new things based on the experiences of the subjects since their early childhood years, fostered by a physical-social and cultural environment. They are intellectual, emotional and social experiences, which enable the enrichment of the brain in its dimensionality, through pertinent pedagogical interventions; Furthermore, he is endowed with the skills to think, perceive, act, learn, know, love and basically solve problems (Velásquez, Remolina, & Calle, 2009).

The knowledge of how the brain learns has an impact on education, understanding the brain mechanisms that remain hidden in learning, memory, genetic disorders, the environment in which it operates, emotion, age, could transform strategies educational programs and devise programs that improve learning for all people, including those with special needs (Chunga, 2019).

Research shows that the brain can learn by combining techniques, procedures, and through behavior change, development, emotions, and any brain injury that occurs. In reference to the latter is the case of Phineas Gage, presented by Dr. Harlow in 1848, who demonstrated how a brain injury in the frontal lobes caused a change in personality, social behavior and decision-making capacity. of this patient.

Neurosciences are disciplines in charge of studying the functionality of the brain, which gives rise to behavior and learning. They constitute a valuable tool in the educational field, they teach about the plasticity of the nervous system, the bases of motivation, attention, emotions and memory, as essential constituents of the teaching-learning process, among other things (Tarrés, 2015).

(Mesa, 2018) details that when analyzing the neurological systems involved in multiple intelligences, it is understood which brain areas promote the cognitive abilities of a person as shown in figures 1 and 2.

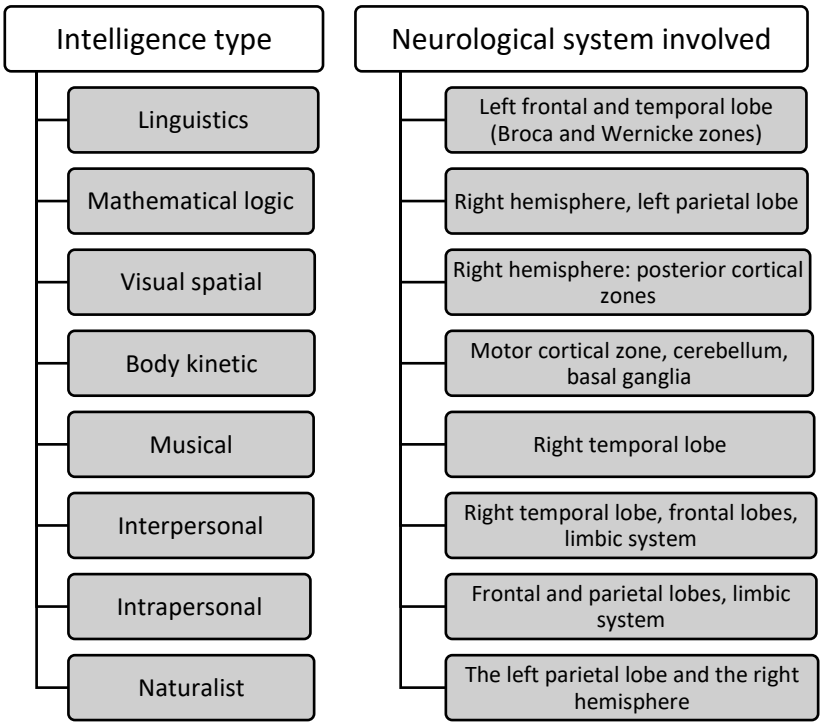

Figure 1. Relationship of multiple intelligences and the neurological system

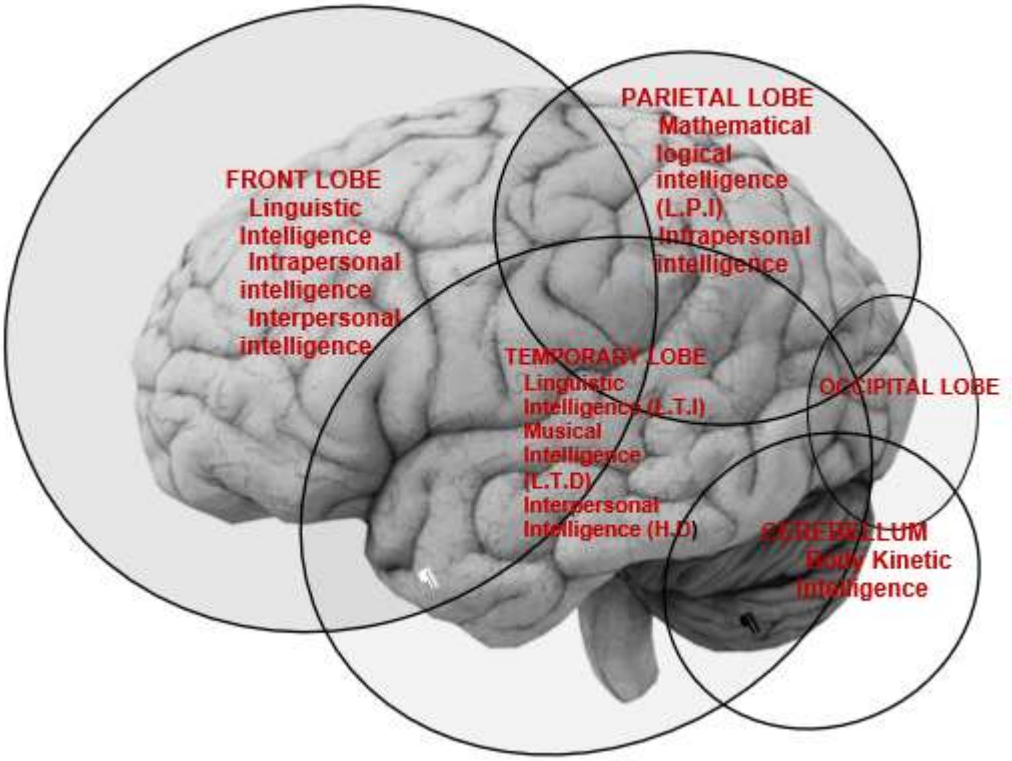

Figure 2. Relationship of multiple intelligences and the neurological system

Neurosciences and Learning

Neurosciences are the group of disciplines whose research objective is the nervous system, emphasizing the activity of the brain and its relationship with our behaviors and aspects neurobiological behavior (Gago & Elgier, 2018).

An important subdiscipline of the neurosciences is cognitive neuroscience that has generated contributions during the last decade, in relation to potential contributions to education. As part of its objectives, it proposes the integrated study of the neural bases of the mental representations involved in different cognitive, emotional, motivational, and psychological processes.

Cognitive Neuroscience emerged as a scientific discipline with its own entity in the 1980s, driven by the development of modern neuroimaging techniques, which have made it possible to visualize the human brain in vivo, both at a structural and functional level (Enríquez & Cales, 2012). This development has made possible the study of brain activity associated with different complex psychological functions in subjects, thus achieving an unprecedented advance in the knowledge of the functional organization of the brain.

This development is due to the growing use of functional neuroimaging, highlighting functional magnetic resonance imaging due to its widespread adoption in the study of neurobiological mechanisms associated with psychological capacities. This mainly to the possibilities it offers, being a non-invasive technique for the study of neuronal activity

and in the context of the performance of some cognitive tasks of interest (Venturelli & Branca, 2016).

One of the main fields of research in neurosciences is memory, for example, working memory deals with activating a representation that was stored in one of the memory systems and keeping it activated if it is necessary, in order to modify or relate it with another representation (Manrique, 2020).

Learning adapted to neuroscience or microlearning, is a discipline that combines psychology, pedagogy, and neurosciences to explain how the brain works in learning processes (Pherez, Vargas, & Jerez, 2018). Today, there are tools to discover how the human brain learns in general.

Neuroeducation

is understood to be the pedagogical strategy that uses the theory of neuroscience as a didactic component to guide teaching and empower students in their way of thinking, learning, understanding concepts and giving them meaning in their daily lives (De Souza, Posada, & Lucio, 2019).

It is essential to understand the function of the brain as part of the human process, where the central nervous system is based, in attention to aspects of development such as physiological, cognitive, and emotional. Thus, the need arises to strengthen the knowledge of neuroscience in educators and that they can benefit from improving their teaching practice (Figueroa & Farnum, 2020).

The interaction between neuroscience and education has begun to join forces to understand the various processes that occur in the brain from before birth to adulthood. That is part of the change and innovation that education and teaching need to meet the demands of today's society.

(Béjar, 2019) mentions that neuroeducation tries to use knowledge based on neuroimaging and aims to launch attempts that address the way the brain interacts with its environment in each teaching-learning process. The line of research in neuroeducation tends towards the scientific resolution of questions about the neural substrate of the human cognitive system.

Neuroeducation teaches a new look at the teaching-learning process from the knowledge of applied neuroscience. It tries to take advantage in education by the current knowledge of the brain, but it still lacks a regulated framework of systematic studies to take it to educational institutions. Sometimes some of the results of neuroeducation seem somewhat obvious and well known to classical pedagogy. However, there are studies that open new lines of neuroscientific research for its application in education (Béjar, 2019).

Multiple Intelligences

The term intelligence composed of "Intus lego", which means to read inside myself, was coined by Cicero to designate the ability to understand, comprehend and invent and has a very broad semantic spectrum, which reflects the classic idea according to which man, due to his intelligence, he is in a certain way all things (Madrigal, 2007).

The intelligence of a person is formed by a set of variables such as attention, observation capacity, memory, learning, social skills, among others, that allow them to face the world daily. It should be considered that many other functions are involved to have adequate

performance, such as, for example, a stable emotional state, good psycho-physical health or a normal level of activation.

(Suárez, Maiz, & Meza, 2010) indicate that the theories of multiple intelligences question the traditional views of intelligence because they focus primarily on cognitive aspects, neglecting the role of personality, emotions, and the cultural environment in which it occurs. developmental processes, that is why they make up an ideal context.

The importance of Gardner's definition is twofold: first, it broadens the field of what intelligence is and recognizes what we all knew intuitively, and that is that academic brilliance is not everything, second and not least, Gardner defines intelligence as a capacity (Jiménez, López, & Herrera, 2019).

From the educational point of view, the author proposes a school centered on the individual, committed to the optimal understanding and development of the cognitive profile of each student. In addition, he points out two hypotheses: first, everyone has the same abilities and interests, not everyone learns in the same way, and second, no one can learn everything there is to learn.

This theory facilitates the application of novel, motivating, integrative and creative strategies so that students in their leading role build broad knowledge schemes allowing them to acquire a vision of reality that exceeds the limits of everyday knowledge, and brings them closer to knowledge and to the creative potential which they possess by developing or activating other intelligences. This would speed up the cognitive ability to solve problems, make decisions, improve forms of behavior, increase esteem, develop skills and abilities, and have a greater interrelation with the people around them and with themselves (Mesa, 2018).

(Suárez, Maiz, & Meza, 2010) refer to certain basic requirements that each intelligence has to meet in order for it to be considered as integral intelligence and not just a talent, aptitude or ability. Criteria are detailed in Figure 3 and include the following factors.

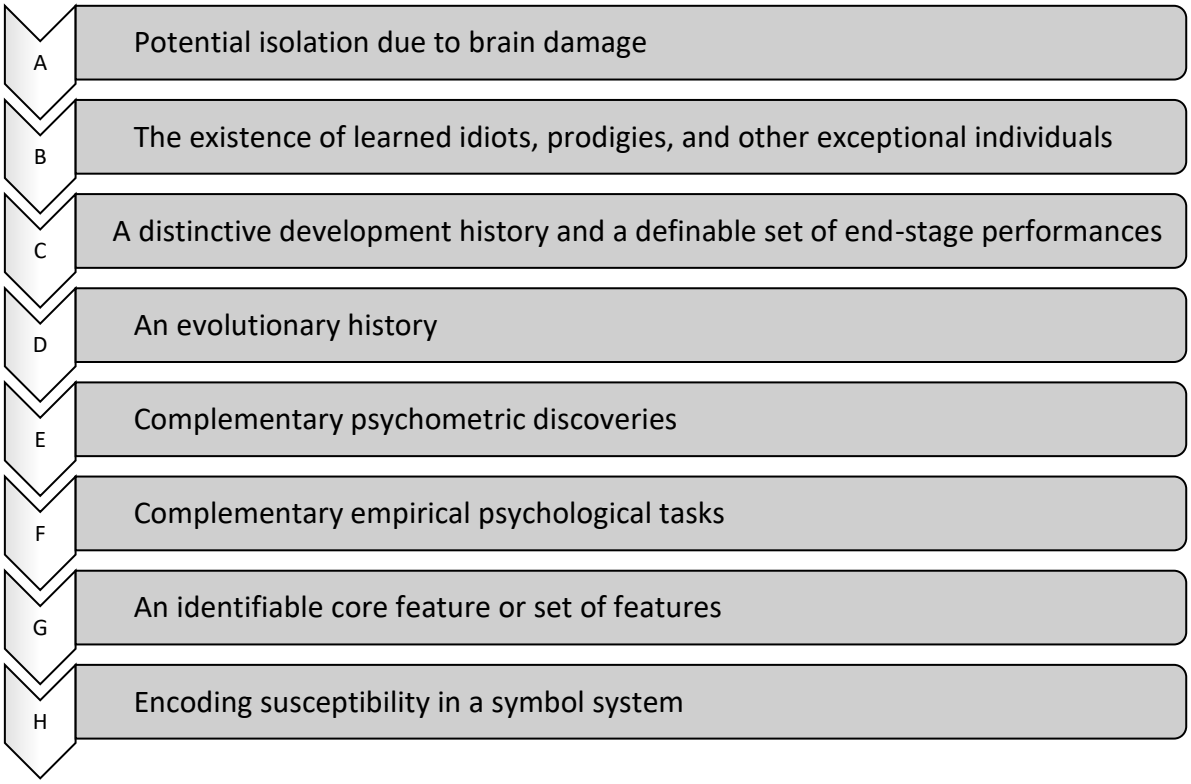

Figure 3. Requirements that an intelligence must meet to be considered as integral.

A. *Potential isolation due to brain damage.* It refers to people who have had accidents or diseases that a priori affected specific areas of the brain. In some cases, brain injuries selectively damage one intelligence, while the others remain intact, that is, it is possible that the same person can sing, do mathematical calculations, say tongue twisters, reflect on emotions and feelings, interact with other people and know themselves.
B. *The existence of learned idiots, prodigies, and other exceptional individuals.* Gardner mentions that it is possible to observe in some individuals that the intelligences operate at high levels. Scholarly idiots are individuals who demonstrate superior abilities in part of one intelligence, while disregarding the others by placing less value on them.
C. *A characteristic development history and a definable set of end-stage performances.* The intelligences are stimulated by participation in some type of culturally valued activity, where the development of the individual follows an evolutionary rhythm. The best way to see the culminating workings of the intelligences is by studying the final states of the intelligences in the lives of truly exceptional people.
D. *An evolutionary history.* Each intelligence fulfills the condition of having origins deeply encased in the evolution of human beings. In other words, certain intelligences seem to have acquired more importance in the past than they do today, following an evolutionary course of social importance.
E. *Complementary psychometric discoveries.* Norm-type measures of human ability constitute the "evidence" used by most intelligence tests to determine the validity of a model. Although the author is not notable for his norm-type tests, he suggests that many of the standard tests can be used to support MI theory.

F. *Complementary empirical psychological tasks.* Gardner proposes to analyze certain psychological studies to observe the intelligences functioning independently, that is, different levels of competence can be demonstrated in the different intelligences in each cognitive field.
G. *An identifiable core operation or set of operations.* Each intelligence has a set of core operations that serve to drive the different natural activities of that intelligence. In musical intelligence, for example, these components might include sensitivity to tone or the ability to differentiate between various rhythmic structures.
H. *Encoding susceptibility in a symbol system.* Each of the intelligences proposed by Gardner has its own notation or symbol system.

It is from these criteria that Gardner proposes the existence of at least eight different and independent intelligences among themselves and affirms that all of them are equally important and necessary for life. The MI are shown in Figure 3.

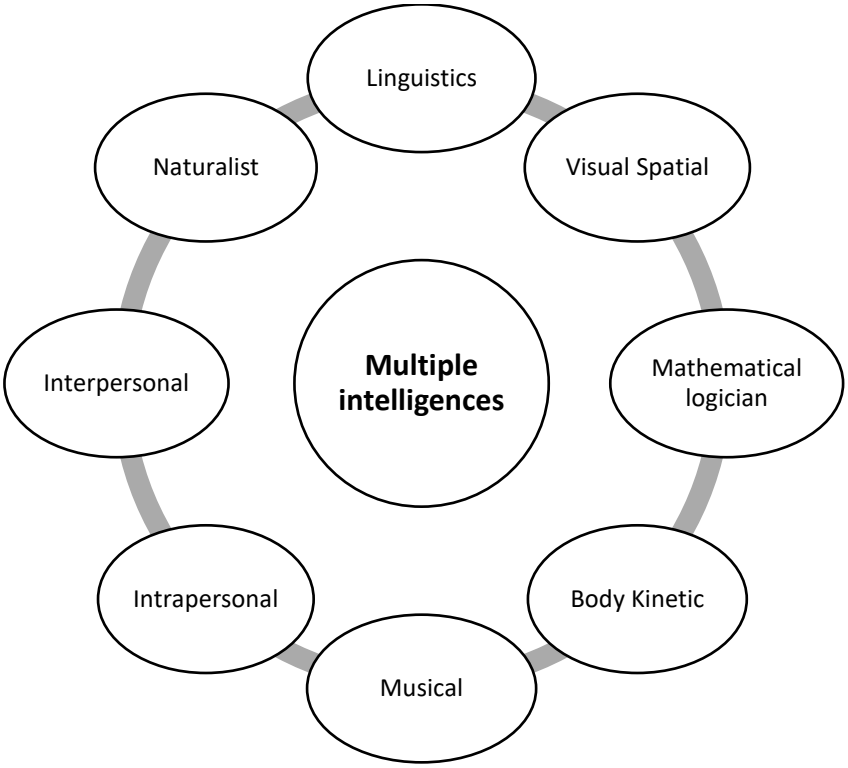

Figure 4. Gardner's Multiple Intelligences

Source: (Nadal, 2015)

The eight intelligences are summarized in this way according to (Nadal, 2015)

1. *Linguistics*, it is the fluency that a person possesses in the use of spoken and written language, both understood and expressed. It is the skill and ability that is manifested in the use of the correct linguistic expression, emphasizing the meaning of words, syntactic order, and sounds.
2. *Visual spatial*, it is the ability to think in images and create mental models in shapes, colors and textures, linked to the imagination. A person with this intelligence can create designs, charts, diagrams, and build things, as expressed in graphic art. From the perception of images and their subsequent recreation,

transformation or modification, the individual is able to mentally represent ideas with astonishing ease.

3. *Mathematical*logic, ability to solve both logical and mathematical problems. It is the most like the intelligence measured by normal intelligence tests. Those who possess it can successfully perform complex mathematical operations, reason correctly, analyze problems logically, and carry out investigations scientifically. For this reason, Gardner describes logical-mathematical intelligence as the set of different types of thinking: mathematical, logical, and scientific.
4. *Body kinetic*, is the ability to control the movements of the whole body and perform physical activities, create products, or solve problems. It is used to carry out activities such as sports, which require coordination and a controlled rhythm. People who excel at this intelligence acquire information through tactile and kinetic processes, and they need to experiment to understand.
5. *Musical,* t is the ability to create sounds, rhythms, and melodies. It is used to express emotions, appreciate, discriminate, develop musical forms and feelings through melodic measures, as well as to be sensitive to rhythm, tone, and timbre.
6. *Intrapersonal*, It implies the ability to understand oneself from self-reflection and the construction of a real self-concept that reflects one's own strengths and weaknesses. It is a capacity that allows us to understand the acts that a person does, valuing their actions.
7. *Interpersonal*, consists of relating and understanding other people. It includes the skills to show facial expressions, control the voice and express gestures on certain occasions. It encompasses abilities to perceive emotions in other people and denotes the ability to understand others in their moods, desires, intentions, motivations and interact effectively with them.
8. *Naturalist is the ability to understand the natural world and handle capacities such as observation, planning and hypothesis testing. It consists of the understanding of the natural environment and the scientific observation of nature such as biology, geology, or astronomy.*

Diversity is evident in the classrooms and the plurality of intellect that Gardner raises leads us to accept and respect individual differences. Thus, it is committed to an education focused on the individual who cares about knowing his students taking into account all the intelligence profiles that exist within the classrooms and offering each one what they need.

To understand how intelligences are associated and grouped in the brain structure, it is important to know the functioning of the lobes of the brain and not make the mistake of imagining that they are separated or differentiated from each other. Each lobe has a series of its own characteristics, but that does not mean that each structure exclusively controls a certain task. Many activities and processes overlap across different brain regions (Cabrales, 2015).

Thus, the functioning of one region could not occur effectively without the presence of another. Hence, sometimes the brain damage caused in a specific area can be compensated with what other regions can carry out with greater or lesser effectiveness.

Moreover, sometimes even the researchers themselves debate among themselves about the precise point at which one lobe begins and another ends. On the other hand, what we can see almost with the naked eye are the two hemispheres: the right and the left. Starting

from here we can know that each of the four lobes that make up the brain crosses both hemispheres. (Cabrales, 2015) details the characteristics of each brain lobe.

Frontal lobe

- The frontal lobe comes from the Latin name lobus frontalis. It is one of the six main lobes of the cerebral hemispheres. The frontal lobe is the most modern phylogenetically and represents the very essence of the result of our evolution. Broca's area is found, located in the front part of the head, and just below the frontal bones of the skull and near the forehead, forming the most refined region of our brain, the one that took the longest to evolve and appear. She oversees linguistic and oral production. The movements of the phono articulatory organs are also given. Thus, among the various tasks that it can carry out, are the following:
- Speech and language production thanks to the Broca area, an exceptional region that allows us to translate thoughts into words.
- It is characterized above all by its cognitive processes, by those sophisticated executive tasks that allow us to plan, fix our attention, memorize long-term data, understand what we see, regulate our emotions.
- Allows you to understand and react to the feelings of others. An example of this is empathy.
- Regulation of motivation and reward seeking: Most of the brain's dopamine-sensitive neurons are found in the frontal lobe.

Parietal lobe

This lobe is, within the cerebral lobes, the one that occupies the area under the parietal bone, that is, in the middle and lateral parts that make up the skull. It is located near the center of the brain behind the frontal lobe, in front of the occipital lobe, and above the temporal lobe. It is multifunctional, but if there is something that defines this brain area, it is its role in sensory perception, spatial reasoning, body movement and our orientation. Its task is:

- Understand written language and solve mathematical problems.
- Captures sensory information related to most sensory organs. It is here that the sensation of pain, physical pressure and temperature are processed and regulated.
- Understand the nature of numbers. Its relationship with mathematical competences is therefore very relevant.

Occipital lobe

The occipital lobe is one of these regions into which the brain is divided anatomically and functionally, although in close relationship and communication with the other areas of the brain. It is the smallest lobe and occupies a rear position, that is, it is the brain region closest to the neck, it is almost like that path through which most of our mental processes pass, organize and connect. It limits the lower part with the cerebellum, the upper part with the parietal and the medial part with the temporal. It is attributed:

- Participate in the processes of perception and visual recognition.

- Be of key importance in everything related to the sense of vision. In fact, its cortex integrates various visual areas such as the one that detects patterns to process information and send it to other areas of the brain.
- Helps to differentiate colors.

Temporal Lobe

The temporal lobe is one of the most important structures of the cerebral cortex, since thanks to its functioning the Central Nervous System can be understood, because it allows us to globally integrate a good part of the sensory information that comes to us through the environment. It is almost attached to the temples and on both sides of the brain are those lobes that regulate many processes. They perform essential tasks such as:

- Helps to recognize faces.
- They relate to the articulation of language and the understanding of sounds, voices and music.
- Facilitates balance.
- Participates in the regulation of emotions, such as motivation, anger, anxiety and pleasure.
- Also participates in the elaboration of emotions and thoughts.

The brain lobes make up a fascinating map of processes and connections where it is very difficult to establish functional boundaries. The interest in understanding the brain, its functioning and structural bases is not only current, in the attempt to explain this interest, various theories have arisen in history (Cabrales, 2015). In this sense, the MI theory is perhaps the one that has caused the greatest impact for several decades.

Conclusions

In the educational field, neurosciences are applied from the growing interest in an education based on scientific evidence and the progress that these experience in the cognitive part of the students. These disciplines make it possible to identify some elements that intervene in the functioning of the brain, in the teaching-learning process that teachers can keep in mind when designing their pedagogical practice.

There is no single intelligence, on the contrary, there are various intelligences and are potentiated according to stimuli, where motivation and curiosity work as a multiplier of learning in the brain and activation of executive functions in it.

The architectural, structural and connectivity analysis of the brain in vivo can help to study the processes of human cognition and development, which makes it possible to identify eventual changes in its structure in the event of diseases or cognitive deficiency.

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