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**THREE NEURODIDACTIC STRATEGIES TO HELP
FRESHMEN STUDENTS TO ACQUIRE VERB TENSES IN AN
ENGLIS GRAMMAR CLASS DURING THE THIRD QUARTER
OF 2018**

Thesis Submitted to Obtain the Bachelor in English with Concentration in Teaching

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Dedication

I want to thank God first for given me the strength to accomplish another important goal in my life. *“Have I not commanded you? Be strong and courageous. Do not be afraid; do not be discouraged, for the Lord your God will be with you wherever you go”*. Joshua 1:9

To my mom, a strong and brave woman who taught me that everything is possible if you really want it to happen, and just because she deserves it.

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Abstract

This Project begin due to the necessity of speaking English, since nowadays is mandatory in order to have a good job opportunity; however, often, the most difficult part for people to learn is Grammar. For that reason, the main objective of this investigation was to find new techniques to teach as well as to learn Grammar in an easier and smoother manner.

Neurodidactic brings new teaching methods that are focused on the brain's function, feelings and participation from the students in order to have a better learning process. Therefore, the question set at the beginning of this project was What is the effect of using three Neurodidactic strategies to help freshmen students to enhance Grammar knowledge?.

After performing a deep investigation with a qualitative method, it was found different Neurodidactic strategies; nevertheless, only three were applied to seventeen students at a private institution. The results were very positive because students were learning, while at the same time they were having a good time during the development of the Grammar class, which at the end is one of the main objectives of Neurodidactic.

As a conclusion, according to Neurodidactic it is important to know how the brain works at least in a general way, to know the type of intelligence of the students because teachers will know what are the best strategies that apply during the learning process, and also those people who wants to become a teacher it would be preferable for them to be educated, so they can have knowledge in this matter and also the people skills required to perform that career in a successful manner.

Resumen

Este proyecto surgió debido a la necesidad de hablar inglés. Actualmente es obligatorio hablar dicho idioma si se quiere tener una buena opción de trabajo. Generalmente, la parte más difícil de aprender para las personas es gramática. Por esta razón, el principal objetivo de ésta investigación es encontrar diferentes técnicas tanto para enseñar como para aprender gramática de una manera sencilla y agradable. La Neurodidáctica brinda nuevos métodos de enseñanza que se enfocan en la función del cerebro, los sentimientos y la participación del estudiante con el objetivo de mejorar el proceso de aprendizaje. Por lo tanto, la pregunta planteada al inicio de la investigación fue ¿Cuál es el efecto de usar tres estrategias de Neurodidáctica para ayudar a los estudiantes de primer ingreso a adquirir el conocimiento gramático?

Después de realizar una investigación profunda con el método cualitativo, se encontraron diferentes estrategias; sin embargo, solo tres fueron aplicadas a diecisiete estudiantes de una institución privada. Los resultados fueron realmente positivos porque los estudiantes estaban aprendiendo y al mismo tiempo disfrutaban la clase de gramática, que al final ese es uno de los principales objetivos de la Neurodidáctica.

Como conclusión, de acuerdo a la Neurodidáctica es importante saber al menos en rasgos generales el funcionamiento del cerebro y el tipo de inteligencia de los estudiantes, porque así los profesores pueden saber cuáles son las estrategias que se ajustan mejor durante el proceso de aprendizaje, e incluso debe ser de conocimiento para aquellas personas que les gustaría ser profesores, ya que sería preferible que cuenten con la educación, conocimiento y buen trato para desarrollar la carrera de manera exitosa.

Chapter I

Introductory Framework

This work has as main objective to investigate the different strategies of Neurodidactic have. It is a new technique that comes from another important area which is the Neuroscience. Neurodidactic's objective is to find renewed learning techniques, in order to help professors to teach any subject easily because they learn first how to find the brain's optimal stage to receive new information. Neuroscience focusses first on how our brain works, and then Neurodidactic looks for new strategies that can help professors on their teaching techniques. At the same time, Neurodidactic will help students to learn a second language easily.

1.1 Problem statement

Nowadays, learning a second language has become important due to globalization. According to Cuterela (2012), globalization refers to the emerging of an international network, belonging to an economical and social system. Many transnational companies have chosen Costa Rica as a good option to place their branches; therefore, the main objective to learn a second language is to look for better job opportunities due to the competition that these companies offer.

However, this process can be difficult sometimes for people who speak Spanish as their native language. One of the difficult subjects to learn on English is grammar. For that reason, the main goal of this investigation is to find, at least, three Neurodidactic strategies that can help teachers, in the first place, to understand these techniques, and then students to learn grammar without any difficulties. There is where the following questions arises: What is the effect of using three Neurodidactic strategies to help freshmen students to enhance Grammar knowledge?

1.2 Objectives of the investigation

The following objectives were set according to the main goal on this investigation work, which is to find those Neurodidactic strategies to help professors, as well as students, through the learning process of grammar rules on English as a second language at a private institution.

1.1.1 General objective

To evaluate through three Neurodidactic strategies how to improve the learning process of freshmen students to acquire verb tenses in an English grammar class during the third quarter of 2018

1.1.2 Specific objectives

1.1.2.1 To identify the neurological aspects that affect people's learning

1.1.2.2 To apply three Neurodidactic strategies to help freshmen students in the grammar classes

1.1.2.3 To analyze the effect of neurological aspects when learning a second language

1.3 Justification of the study

The main purpose of this work is to find Neurodidactic strategies that can help freshmen students at a private institution. Since English nowadays is a very important tool to get better job opportunities, sometimes it is difficult to learn mainly for people who speak Spanish as their native language. In Costa Rica, the Ministerio de Educación Pública (MEP) managed public schools and they are always looking for new educational techniques to improve the English language learning.

On the other hand, according to the State of the Nation, (2015) most of the University careers offered by private institutions have not updated their curriculum for more than 10 years,

so this situation may have consequences in the professional level because students from public institutions can have priority to be selected by the companies (p.69). However, this should be a fair competence. Another aspect to take into consideration is that professors have to change the traditional manner to teach, and to be open and creative because every person has a different type of intelligence; therefore, not everybody will remember new information in its some way.

There is where Neuroscience plays an important role, since it studies all functions related to the nervous system, where the brain is the most important organ. Therefore, it is essential to learn first a little bit about brain functions to understand when it is the appropriate moment to receive new information. Moreover, the Neurodidactic objective is to look for new teaching and learning methodologies to guarantee that students can learn easily everything related to a second language.

One of the difficult parts when learning a foreign language is grammar, as it always causes some troubles to understand it. Therefore, the idea is that through these new strategies, students do not have any problem to learn, and professors can get new ideas to perform a successful grammar class.

According to Forés (n.d.) who is an expert in Neurodidactic from a University in Barcelona, the brain's development is totally related with the learning process. Besides, she mentions that the main objective of Neurodidactic is to work with the whole brain's potential. The first step is to discover every person's talents and from there on, the clue is to focus on those talents and develop self-confidence in each student.

One of her main goals in every class that she teaches is to let the students know that every mistake is good. When students make mistakes, they can learn better, for that reason, mistakes

are an important part of the learning process. The idea is not to create the fear of failure, but to reinforce the expectations of success, the reward makes the brain work better.

There is a close relationship between the brain and pleasure or emotions, where the segregation of hormones makes people feel better. Therefore, students are more willing to receive information, resulting in a better learning. If a student solves a difficult problem on his own initiative, that success gives him a feeling of happiness causing the secretion of dopamine that gives him pleasure and desire for more.

Back to English, for example, some people learn the alphabet with the alphabet song, and although it is not the best song in the history; its rhythm helps to remember each letter. Based on this principle, the learning process is better when there is an emotional component added; consequently, the more knowledge people have about how the brain works, the more benefits people can have from the Neurodidactic strategies.

1.4 Antecedents

1.4.1 Historical antecedents

According to Rocha-Miranda (as cited by a study from the University Pontificia Bolivariana, Colombia 2001), the Neuroscience concept is recent, it was created due to the need to integrate the contributions from various scientific research areas and clinical sciences for the understanding of the function of the nervous system. They mention that, according to Kandell, Schwartz & Jessell, (1997), the main purpose of the Neuroscience is to understand how the brain produces every human action in each individual. It contributes to explain the behavior focusing on the brain activities, and how cells act influenced by the environment and other individual behaviors.

According to Panigua (n.d.), the advances of the Neuroscience around 1990, have discovered a new way of seeing the education field, which is based on the analysis of the brain, and its power. These advances are at the level of knowledge of the brain, and they must influence directly in the way of educating students. This new form of education explains how to produce learning through the study of cognitive functions involved in every learning process. However, the knowledge of the brain function just helps to have an idea, because every individual has its own personal characteristics, and each one learns differently, so the same techniques cannot be used in the same manner for everybody.

All these advances help to explain all the brain functions; it is important to take into consideration that there is an approach called neuropsychopedagogical approach in the education process, which pays close attention about the student's academic skills, and at the same time, how the brain develops its functions in every class. This approach also includes academic competences such as art, music, or painting.

According to Panigua (n.d), this approach will guide professors with the new ways of teaching called Neurodidactics, which is based on brain competitions. It will help them to understand why a student does not get a new information, or gets distracted, or presents brief lapses of attention. It will also help to understand the diversity of the brain organization of each student, and the interaction in every brain hemisphere, in which the left side is in charge of some areas, such as language, and the other side of the rest areas where the motor activity is the most important.

During the last 20 years, Neuroscience has reached big importance and it has been more popular over the years; it is directly related to knowledge branches such as robotics, computer science, psychology, and pedagogy. According to Punset (2009), the cerebral cortex is modified

by experience and education, the last one influences the brain organization and it also develops competences in the brain.

Once these competences are established, they will affect almost everything that each individual is going to perform because to educate is to modify the brain. The educational field should be involved with all or at least the majority of the characteristics and brain competences. This is the moment in which Neurodidactics starts its functions because it is a new discipline which is going to change the art of teaching through its new techniques oriented to the educational field.

Neurodidactics is the union of the cognitive science and Neuroscience directly related to education, its main objective is to design new didactic and methodological strategies more efficient, as well as to promote a better brain development. Since Neurodidactics is strictly related to emotions, the professor's role will be to develop a better way of analysis, where students will have the opportunity to solve problems by their own, and at the same time will create self-confidence and self-esteem on every task that they are going to perform.

1.4.2 Internacional antecedents

Neuropedagogy and Neurodidactics are considered a revolution in the educational field, where they have obtained more popularity in the last 20 years. However, everything depends on the way of teaching because professors have to be open to new views on education techniques. Also students' motivation play an important role due to their success related to learning foreign languages will depend on them.

On the international field, according to Moravcová (n.d.) from a Slovak University of Agriculture in Nitra, in her article about "Neurodidactic and its Utilization in the Field of Language Teaching", to learn one or more foreign languages are considered a key for every

young person to find a job. Although, her country, Slovakia, is considered as a developed country, foreign languages are not considered main subjects in schools.

Moravcová (n.d.) mentions that teaching English in the Asian countries is taken for granted on the European side; students start learning a new language since primary school. Depending on every country conditions, some learners have the opportunity to learn a foreign language in the early childhood, where according to diverse scientific studies from three years on it is the best age for people to learn because in this stage the brain is in optimal condition to receive new information.

Moravcová (n.d.) states that Neurodidactic started in the 80's. This concept was used for the first time by Gerhard Preib who was professor of Mathematics at the College of Education in Feinsburg. Since 1988, Neurodidactic combines research of the brain and didactics related to other scientific fields such as, Neuroscience, psychology, among others, and the last research about Neurodidactic shows that there is not a unique form for the brain to teach and learn.

Her investigation also mentions that one of the Neurodidactic basic requirements is the individual talent. Once this talent is discovered, work from there is a maximum potential, in which personality and knowledge can be developed from another perspective. Moravcová (n.d.) mentions that it is important to know how the brain works, at least in a general way, the hemisphere is in charge of analytical and which of holistic thinking, it is known that the left is in charge of analytical thinking and the other is in charge of holistic thinking.

The same author mentions that several senses are used when learning a foreign language. Certain linguistic structures are developed in the brain, these structures help to remember and prevent to forget the new vocabulary, that has been installed in the brain, and which is used in speaking. The learning process involves a lot of neuron and nerve fibers which help to create a

neutral network. This process is called synapses, and it allows the learner to receive new information, but this information is not processed quickly, it takes some time to store it on each individual memory.

Moravcová (n.d.) also states in her investigation that emotions are important in the learning process because a part of the brain is considered the emotions center, and our memory and motivation are related to them. The last findings show that emotions help to stimulate the learning process, for instance, it is interesting that the human being will remember the most positive or negative experiences of life, for sure they are not going to remember situations that have not been significant.

In her study, Moravcová (n.d.) refers to how teachers should have enough expertise, knowledge, and ability to communicate accurately in the foreign language that they are going to teach, she also mentions how the brain works and the hemisphere focused in the language learning process. There are other aspects for learners to take into consideration, for example, their emotions, communication skills, motivation, self-confidence, among others.

Moravcová (n.d.) indicates that Neurodidactic is a new model that has been introduced in order to help teachers to look for brain-adequate learning, and for the development of emotions which play an important role in this learning process, excluding the relation between teacher and student.

Another international work found was from Samafolova U.V. Teacher, National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute” Kyiv, Ukraine entitled “Usage of Neurodidactic Principles as Modern Approaches in English-speaking Communicative Competence Formation among Students of Technical Professions”. According to Samafolova (n.d.), the introduction of modern science as neuropedagogy, which is based on

didactics, psychology, among others, encourage to the development of new techniques and methods in the learning process, and this the point in which Neurodidactic starts.

On this research, Samafolova (n.d.) speaks about the Neurodidactic principles, formulated by the German scientists R. Caine and G. Caine in 1990. The principles helped to create foreign language textbooks for adults and some relate them to their professional approach, when learning a foreign language. Qualitative changes took place in the system taking into account the learner's abilities and capabilities.

Samafolova (n.d.) states that learning environments and experiences should be designed to help individuals to focus on their strengths and work on their weaknesses; one of the Neurodidactic principles indicates that "each brain is unique organized", another principle also indicates that Neurodidactic is related to "brain/mind is social" so human beings are prepared to learn by imitation and modeling.

For that reason, according to Samafolova (n.d.), it is important to take into consideration students social needs, so that the professor may create a positive atmosphere in the classroom, as well as apply technology in language tests, electronic books, audio files, and so forth. It is very important for students to learn and improve the foreign language. Moreover, the usage of new and modern teaching methods will help the professor to create a positive learning environment, also by showing respect, a friendly attitude, and positive motivation, so students can feel comfortable to learn a foreign language.

Samafolova (n.d.) points out that another principle states "The search of meaning occurs by patterning", the brain/mind organizes everything into patters. It works by neural networks, so every new activity is perceived and processed, after that, new structures are created or connected to the existing one it is when the brain classifies this new information as important. Therefore,

the usage of these processes by repeating lexical and grammatical patterns is the main job throughout the educational process. The use of these principles will help learners to achieve a better learning process and promote a successful career growth.

1.5 Scope

In this investigation, the main objective is to find the effect of using three Neurodidactic strategies to help freshmen students to enhance their grammar knowledge at a private institution. The methodology will be carried out detailed observation, at least one or two times in every grammar class, this observation will be performed before using the Neurodidactic strategies and after the professor observed use some of them. The goal is to prove the effect of each strategy on the students by giving a detailed explanation on every action and attitude carried out by the professor as well as by the students.

Another instrument that is going to be used is the questionnaire, which is going to have a qualitative focus. Its main goal is to set around ten questions where the professor and students will express their feelings after experimenting the usage of Neurodidactic strategies, and they will realize by their own, if these strategies actually work and can be part of the methodological study process at the private institution. For that reason, the objectives previously mentioned were set to accomplish this research goal.

Chapter II

Theoretical Framework

The development of this investigation involves different concepts that are important to know. For example, concepts such as the brain functionality in general, and Neuroscience will help to define what Neurodidactic is. In order to obtain a successful teaching method, it is important to apply the corresponding principles and strategies throughout the learning process.

2.1 How does the brain learn?

2.1.2 Nervous system functionality

As Gage (2015) explains, “The modern era of Neuroscience can be traced to the 1890s, when the Spanish pathologist Santiago Ramón y Cajal used a method developed by the Italian physician Camillo Golgi to stain nerve tissues to visualize the morphology and structure of the neurons and their connections. The detailed description of the neurons and their connections by Cajal, his students, and their followers led to the “neuron doctrine,” which proposed that the neuron is the functional unit of the nervous system”.

As stated by the British Neuroscience Association and European Dana Alliance for the Brain (n.d), the brain, spinal cord, and peripheral nerves form the nervous system; it is constituted by the nerve cells called neurons, and the supporting cells called glial. There exist three kinds of neurons. First sensory, the sensory ones, which are the receptors in charge to detect and respond to different attributes of the internal and external environment. These receptors are sensitive to changes, such as light, sound, mechanical, and chemical stimuli; they are also in charge of vision, hearing, touch, smell, and taste.

The second type are the motor neurons, which are in charge of the activity of all the muscles. Finally, the third type are the interneurons, which are between the motor and sensory

neurons. The interneurons are in charge of the most important functions of the brain. In addition, there are the glial cells that support the function of the neurons and are important for the functioning of the nervous system. The process of form neurons is called axons, axons function as transmitters of information from a neuron to another linked by the synapses. In this process is where the dendrites receive information transmitted from the axons to the neurons. Neurons are organized into complex chains and networks through which information is transmitted on to the nervous system.

As the British Neuroscience Association and European Dana Alliance for the Brain (n.d) explain, the brain and the spinal cord are connected to sensory receptors and muscles through long axons that make up peripheral nerves. The human body has two types of reflexes, which are simple and complex, and the spinal cord is in charge of this function, it forms the main road between the body and the brain with the objective of transporting information in both directions, from the brain to the body and vice versa.

According to Francis (2005), the learning process allows the subject to adapt to the cultural environment. Each process requires changes in the nervous system, hence, it is necessary the plasticity of the brain to be able to learn and adapt to new situations. The ability to learn is also performed by the memory that makes learning possible based on experience. Although, scientists wanted to standardize this process comparing the processing of information of computers, new contributions from Neuroscience, Cognitive and Evolutionary Psychology showed that capacity could not be reduced to that metaphor.

Wolfe (as cited by Francis, 2005) explains the memory processes that allow the human being to encode, store, retract, and integrate new information with the one already stored. They seem to operate in three categories interrelated called sensory memory, functional memory, and

long term memory. The role of sensory memory is to bring new information to the brain through the sensory receptors and keep it there for a fraction of seconds until a decision is made about what to do with it.

Functional memory allows integrating the current information perceived with the stored knowledge and consciously manipulating the information, possibly to ensure if it is stored in the long-term memory. Finally, long-term memory has an unknown capacity, but it is considered extremely large, some estimate that it contains more than one million trillion connections that allow the storage of information.

This memory category receives information elaborated and organized by functional memory, and through two types of memory, the declarative one that allows storing and reminding information, and the procedure one that facilitates the storage processes for routine actions. The two of them allow the subject to retrieve information or abilities.

Sprengr (as cited by Francis, 2005), states that long-term memory also includes the episodic memory that is associated with the memory of the context, of the spatial, the location, and the automatic memory, recently identified and frequently referred to the conditioned response memory. The synaptic networks produced by the brain develop these memory processes that complement the learning process.

It has been estimated that seventy percent of the number of neurons are found in the cortex cerebral. García (as mentioned by Francis, 2005) explains, as well, that it must be considered that there is a differentiated organization and a morphological diversity among the neurons that allows the specialization of neuronal actions.

2.1.3 Brain's functional organization

The human brain is a very especial organ, not only due to its functionality, but also because it is in charge of behavior, language, thinking, and feelings. On the prefrontal cortex, the neuronal organization and distribution nodes of information to other cortex areas are fundamental in the elaboration of the mental processes, especially in those that refer to rational thought, decision-making, values, norms, and ethics.

As Grein stated (2017), based on several studies of the brain, there is not just one right way to learn. Learning is set by the population of neurons. Since pregnancy, around five hundred thousand neurons occur per minute, language perception begins in the last three months of this period. Between the second and ninth month of age, babies can hear the sounds or phonemes of any language, during the first three years the synaptic connections between the neurons develop very fast.

As Mora stated (2017), the human brain starts its formation sixteen days after fertilization. During the intrauterine development, there is a very active process of neural reorganization of the cerebral cortex. This development continues in the early postnatal stage and childhood with an overproduction of neural circuits in the brain structure. After birth and until two years of age, there is a progressive enrichment of the dendritic tree and the number of synapse increases. In this stage, the input of sensory information is very important for postnatal development progress of the synaptic organization.

This sensory information role is essential in the development and maturation of synapses to understand the general effects of a large amount of environmental factors in the postnatal progress of the organization of the cerebral cortex. The creation of the synapses through the

development of the brain differs among its regions. Brain's development is produced in an asynchronous way and it has different periods.

The adult human brain is formed essentially for about one hundred thousand millions of neurons and other cells which are interconnected and distributed in small territories of the cerebral cortex; they are the base of neural circuits, which have a code for specific functions as Mora explains (2017). This brain is changeable as a result of the development period; also, the neuron has the same properties due to the work of the genes that are going to determine the characteristics of each person, actually the individual interaction with the environment produces continuous changes in the brain.

According to Mora (2017), the human brain is a heterogeneous organ; the cerebral cortex is divided into many areas and structures. On the one hand, it has areas, where the sensation and perception of the world are created through the information gives by the organs of the senses like vision, hearing, touch, temperature, pain, taste, smell. There are other areas where the motor programs are made, and where the behavior is executed. In addition, it possesses those long prefronto-parieto-temporal territories, the areas of association, in which, for example mental, abstract, and symbolic thoughts and feelings are built.

As stated by the British Neuroscience Association and the European Dana Alliance for the Brain (n.d), the human brain is formed by the brain stem and the cerebral hemispheres, the hind, mid, and diencephalon compose the brain stem. The hind is an extension of the spinal cord; it comprehends networks of neurons in charge of the control of vital functions, such as blood pressure and breathing the cerebellum is located in the roof of the hind. Its main function is to control timing and movements.

As the British Neuroscience Association and European Dana Alliance for the Brain explains (n.d), the mid brain contains groups of neurons used as a type of chemical messenger, they can modulate the activity of neurons in the higher centers of the brain, and are in charge of functions such as sleeping, attention or reward. The diencephalon is divided in two areas called thalamus, its main job is to relay impulses from all sensory systems to the cerebral cortex, and the hypothalamus, on the other hand, controls functions, such as eating and drinking, also it is in charge of regulating the release hormones related to sexual functions.

According to the British Neuroscience Association and the European Dana Alliance for the Brain (n.d), the cerebral hemispheres consist of a core, the basal ganglia, which is involved in small groups of neurons that form the gray matter of the cerebral cortex; this ganglia has an important function of initiation and control of movement. The cortical tissue is the most highly developed area of the brain and it is divided in three different areas visual, auditory, and olfactory. The sensory receptors go to the cortex, and from the cortex to the muscles crossing over from one side to another, so the movements of the left side of the body are controlled by the right side of the cortex, and the right side by the left.

Besides, the cerebral cortex is one of the main research areas in Neuroscience, it is in charge of voluntary actions like language, speech, thinking, and remembering, both sides of the brain perform the majority of these functions, but some activities are lateralised, so they occur in one cerebral hemisphere or the other. This cerebral cortex is divided into two hemispheres, left and right, and they have different and complementary functions. There is a bridge between these two hemispheres called Corpus callosum (a million of nervous fibers) which is in charge of unifying these hemispheres.

The right hemisphere is holistic and global, and performs associations of time and space; it is the generator of rhythm, music, images, drawings; it is the creative one; it works under disperse and unconscious attention. According to Forés, Vázquez and Torre (2014), this hemisphere accepts the evidence even if it is not rational and starts from there for the subsequent inquiries. With its previous overview, it handles situations in another way, that is, its "intuition", which is a capacity that does not only handle the learned data, but also conjugates the sensations and information largely unconscious by; some of them are possibly evolutionarily innate and others are received throughout our life and in many occasions we are not conscious of it.

The left hemisphere is responsible of language, logic, and mathematics; it is the analytical one, and it works on focus and conscious attention. According to Forés, Vázquez and Torre (2014), the left hemisphere performs a rational analysis; it combines the data learned about what is good or bad, real or impossible. The rational data, "learned according to their culture and time" are put in action to analyze situations. Everything that does not fit that framework that is, it is not "reasonable", will be denied or rejected. Both hemispheres always work together for the development of any specific cognitive function.

2.1.3 Why are emotions important during the learning process?

According to Posner and Rothbart (as cited by Barrera and Donolo, 2009), current literature shows that emotions, such as feelings, can encourage the learning process while an intensive and reinforced activity of the neural network exist, known as the synaptic connections. Neurobiology shows evidence that the learning process is better when a content or subject presents certain emotional components. Therefore, it is very important to have a pleasant educational environment; emotion and motivation direct the system of attention, which decides what information is stored in the neuronal circuits, and as a result learned that information.

As Mora stated (2017), it is essential to know the world of emotions to capture the essence of teaching. The elaboration of emotions corresponds to another brain within the brain, it is known as the limbic system or the emotional brain, which is the detector of relevance and emotions. Emotion interacts with the cognitive process; emotion is the energy that moves the world. Its importance is that what is seen, heard, touched, tasted, or smelled after being analyzed without any emotional meaning by the corresponding specific sensory areas of the cerebral cortex, passes through the filter of the emotional system and there is where those sensorial perceptions put the label of good or bad, attractive or rejectable, interesting or bland, and so forth.

Once the emotional meaning is established, it goes to the association areas of the cerebral cortex where the mental processes, reasoning, and thought are built, and complex functions are elaborated. Then, it goes to the hippocampus, where the mnemonic (memory) traces what has been perceived, recorded, and learned. The fundamental neural circuits of a structure of the limbic system, which is connected to almost all areas of the brain. Cognition-emotion means, then, that there is no reason without emotion, in order to understand the essence of what should be taught and learned.

As stated by Grein (2017), some hormones produce some processes in the brain that play an important role, for example, acetylcholine is responsible for the attention span (max. 20 minutes) and the capacity to store information, dopamine is responsible of motivation, curiosity, concentration, compliments, praise, positive emotion, laughing, among others. Finally, noradrenaline is responsible for attention, alertness, flexibility, responsiveness, and stress.

As Grein explains (2017), emotions help to pass information from one neuron to other, with the objective to form synaptic connections. Transfer or memory is fast with negative

emotions such as fear, so anything learned while feeling anxiety causes the same feeling again, when the information is recalled from the brain, for that reason, creative problem solving is excluded as in Math. On the other hand, positive emotions release dopamine, so the person feels happy and motivated as a result, and as a consequence, they are able to release their creativity.

2.1.4 Types of intelligences

As Forés, Vázquez and Torre explain (2014), the senses put the body in touch with the world. The view shows us a whole universe of daily information, as well as our ears, skin, smell, or taste. All the information received travels to the brain where it is "encoded" and it makes sense through our millions of sensory receptors, distributed throughout the body, (nerve endings that receive impulses from the environment), the brain interprets and shows what is called "reality".

The five senses become access roads, in arrival channels of information. However, there are three predominant channels or intelligences like the visual, auditory, and kinesthetic, which is the sensation or perception of movement, and that includes touch, pressure, temperature, humidity, body awareness, movement, taste and smell. Throughout childhood, people are able to develop more of these channels, either due to genetic predispositions or due to family influence and near environment. Depending on which the predominant is, the information will be captured in more or less quantity related to the learning process.

Therefore, if a person is visual, he/she will need images to speed up the ability to retain knowledge, but if the information is given to him/her through sounds, with only verbal explanations, it will be more difficult for him/her because it is not the sensory habitual language.

According to Forés, Vázquez and Torre (2014), there are some characteristics to identify every type of intelligence. Let us start with the visual intelligence about an experience. The

person receives mental images like color, faces, and those images help to access the data stored in the memory. The people with this kind of intelligence, look at the face of the person when a conversation is developed, the attention is focus on visual appearance when there is interaction with people, and finally the hobbies are like photography, painting, sculpture, museums, traveling to beautiful places, among others.

The auditory intelligence has the following characteristics, for example, about memory the first thing to remember will be words, tones of voice or sounds. All information received is through the ears. For instance, regarding conferences, the participation it is just to hear every sound. The hobbies for people with this intelligence are music, oratory, concerts, listen to stories, sounds of nature, among others. Finally, these are some characteristics about the kinesthetic intelligence; the body will be use to express emotions, and capture information. Memories are stored through hand sensations and emotions lived. The learning process is throughout participation, and for people who has this intelligence type their hobbies are dancing, theater, adventure sports, traveling or amusement parks.

There is not just one main intelligence, all of them are important. The objective to people would be to have a balance among the three of them, in that way the information would be received and remembered in an easier manner. It is not usual that people have highly develop just one type of intelligence and the other two types of intelligences were not develop at all. The most common fact is that people have two predominant types of intelligences this means that they learn through them and the type of intelligence left has a deficient level. As Forés, Vázquez and Torre explain (2014), it is important to know, which is the predominant intelligence, because intelligences are like sensorial languages, for example, two people with different intelligences

will have more communicative problems, because they will not understand each other since their sensorial codes do not go in the same way.

2.2 Neuroscience

2.2.1 Definition

According to Mora (2017), few years ago, the interest to change, innovate and improve education and teaching based on knowledge about the brain has been increased Neuroscience begins to clarify the neural ingredients of what is known as emotion, curiosity, attention, conscience, mental processes, learning, memory and its consolidation, sleeping, biological rhythms, and the changes that take place from childhood to adulthood..

Neuroscience explains that these processes are not singular events that take place in the brain, with a unique neuronal substrate, but multiple processes in which many brain circuits participate, at different and localized times in diverse areas of the brain and they worked by stimuli of the environment. Jessel et al. (as cited by Barrera and Donolo, 2009), state that the main task of Neuroscience is to explain how millions of individual nerve cells in the brain produce the behavior, as well as how the environment and the behavior of other individuals influence these cells.

On the word of Vorhauser-Smith (2011), Neuroscience is the study of the nervous system, concerning biological basis, directly related to the cognitive behavior; it is the study of the brain. One of its founders Donald Hebb, showed that neurons continue to activate one another like a network tree. His law and fundamental principle on how the learning process is performed are defined with the following expression: “Neurons that fire together, wire together”.

During this process, the brain develops neural networks that embed and store learning; this neural network involves cells in different areas of the brain; every new information received

and kept on the brain requires the whole network process for each person to recognize an object that is already there. Every learning process will modify the brain, this is why Neuroscience transcends. Its main challenge is to integrate the knowledge derived from the different levels of analysis consistent by the structure and encephalic function, as Blanco explains (2017).

2.2.2 Neuroscience Contribution to education

Gruar et al (as cited by Barrios-Tao, 2016), state that learning as common point of interest, develops in two areas, that is in Neuroscience and Education. While Neuroscience seeks to understand the cerebral bases for education, learning is a point of arrival, which must be permanently improved, that starts in any common language and exchange of questions and data. Strategies, orientations, and models related to pedagogy and learning could be benefit.

According to Grushka et al (as mentioned by Barrios-Tao, 2016), another consideration is that Neuroscience can be used to inform and modify the cognitive models that are adapted in the theories of learning, and thus contribute to the interpretation of behavioral data. Varma et al (as cited by Barrios-Tao, 2016), proposes Neuroscience education as a common discipline, so that both Neurosciences like education join in order to integrate procedures with behavioral methods related to learning.

As stated by the Organization for Economic Co-operation and Development (OCDE) (as cited by Barrios-Tao, 2016), Neuroscience facilitates not only the understanding of "chance", but also the "correlation", and it moves important issues of the intuitive or ideological scope of evidence. Revealing the mechanisms through the effects produced, can help to identify effective interventions and solutions; it goes deep into the base of knowledge of what constitutes learning.

It reveals features so far hidden in the individuals to solve problems or improve yields; it informs about how to design and order better the different educational practices; it supports

continuous learning and its benefits for aging populations; it contributes in relation to the findings on the plasticity property of the brain.

As Blanco said (2017), Neuroscience puts in evidence the relationship between emotion and learning. When attention detects "something pleasant", dopamine makes that stimulus impossible to ignore and the neurons are activated intensely (a mayor quantity of this neurotransmitter is equivalent to more attention). Downloading dopamine in the Accumbens Nucleus, makes motivation remain for longer term by releasing it in small doses.

Blanco explains that, "Neuroscience helps to improve the emotional situation and behavior and coexistence in the classroom. All the cerebral areas in charge of processing emotions are known as emotional brain and constitutes the limbic system. This system is located below the cerebral cortex and includes the thalamus, hypothalamus, hippocampus, and the amygdalas. Likewise, the prefrontal and frontal lobes are important in the assimilation of neocortical emotions, as they are responsible for softening the reactions and impulses".

As stated by Blanco (2017), the emotional process affects teaching and learning in two ways. First, if a person develops all capacities from Neuroscience: control, motivation, perseverance, among others, the learning process can be easier for the students who focuses their attention, motivate, and automotive. In addition, they are essential for the creation of a positive school environment. Second, when a student achieves the correct development of the functions, and; therefore, the control of their teaching and learning process, this student is going to have success. Neuroscience gives keys to develop these capabilities and to achieve the improvement of a school environment.

According to Friedrich and Preiss (as cited by Peralta, 2007), the human being is always in permanent learning because the enabled synapses reinforce or weaken through new stimuli,

experiences, thoughts, and actions; nevertheless, the stage where the neuronal connections are formed in major quantity and when there is greater plasticity to new situations, is in the early childhood. Therefore, children are the ones who learn more and better.

The brain needs continuous interaction with the external world for its development; its interest is based in changes that occur around. The diversity of external stimuli determines the complexity, which neurons are connected and intercommunicated. The creation of neuronal connections requires a process of selection and ordering of the brain before existing stimuli, this job is performed by the attention, which focuses on the new things, the unknown and surprise information excite neural networks, and it causes an easier memory process.

The cerebral cortex carries out the learning process from the outside, especially when it is related to information that already exists. As much accurate data is received, the process to record this new data is better. Learning is a process of self-impulse, as much as the knowledge a person has about something, the progress in that area will be faster. When new information is ordered with an existing connection, that is, when something new is learned, two neurotransmitters are generated such as dopamine and acetylcholine, which incite the desire to learn more.

According to Friedrich and Preiss (as cited by Peralta, 2007), all the learning process is stored at the beginning in the short-term memory. To move to the long term, chemical and electrical changes must take place, this means building enagrams (model of solid connections) that structure long-term memory; this requires at the same time, concentration, repetition, and variation. In addition, while much information is transmitted or as more senses are involved, the long-term learning will be kept longer, since it can be accessed through different channels, making the neurons communicate among themselves.

Ibarra stated (as cited by Peralta, 2007), that when something is learned for the first time, it is performed slowly at a certain rhythm, but when neurons are activated repeatedly, more myelin is produced, and this increases the speed of transmission and learning is simplified. When the learning process does not work, it is important to find another way to perform it. This is easy for the brain to reinforce damage connections by situations that are not understood and memorized. On the other hand, a good learning process increases dopamine which produces a feeling of happiness that provides strength to the person, totally different from the feeling of frustration. The emotional system is the one that decides which stimuli are important and valuable through the limbic system.

The information that the limbic system has imprinted as an emotional stamp is stored deeply and strong by the memory. When the knowledge is forgotten, the emotional base helps to incorporate a new learning linked to that situation into the existing network. Emotions are energies in movement that can be controlled, handled, and expressed, they stimulate large areas of the brain, achieving powerful connections among thoughts. A major emotion exists during the learning process; but greater integration and memory will remain.

According to Katz and Robin (as mentioned by Peralta, 2007), the human brain is prepared in terms of evolution, to seek and address what is unexpected or unusual, as completely new and unpublished information coming from the external world. When the brain deals with new things, cortical activity increases in several areas of the brain. This strengthens synaptic connections, links areas in new patterns and accelerates the production of fine neutrals.

2.2.3 Relationship between Neuroscience and Neudidactics

According to Campos (2010), one of the contribution of Neuroscience in the educational field, is the relationship between learning and the brain. Here is where Neurodidactic born as a

new line of thoughts and actions. Its main objective is to bring educational knowledge related to the brain and learning process. Neurodidactic is also the unification of Pedagogy, Psychology Cognitive and the Neurosciences.

As Campos (2010) explains, the laboratory researches about Neuroscience and education will not only facilitate the creation of better educational programs, but they will also influence the parenting style in the family and the whole community. The Neurodidactic knowledge shows a manner to see challenges as opportunities, so the human brain is adapted to learn the same of different things as many times as necessary, as long as the genetic and environmental conditions allow it.

According to Campos (2010), since Neurodidactic allows the professor to understand the particularities of the nervous system and brain. At the same time, professors can be able to relate this knowledge to the behavior of their students, their learning proposal, their attitude, the environment of the classroom, among other factors; it can be the initial step in educational training that will make a difference in the quality of education.

Nowadays, knowing the brain functions, is a requirement for parents, professors, and the whole community that want to make a difference and promote the development of the human being in this new millennium, and with the new generations to come. As Campos (2010) mentioned, “to improve the education quality, it is important to adopt innovating proposals innovate means to transform, so it is important to implement new educational components in the classrooms, in order to open a new model of pedagogical practice, a model that considers the harmony among the brain, learning, and human development”.

2.3 Neurodidactic

2.3.1 Definition

Mora stated (2017), that Neuroscience offers new knowledge about education.

Neuroscience studies the human brain. Many specialists from various professional disciplines, become aware of this new start which can be the beginning of the change of the direction of learning and teaching in schools, high schools and universities. It is known that or good education produces deep changes in the brain and helps to improve the post learning process, as well as the development of the human being.

Mora expresses (2017), that the study of the brain brings about new knowledge that allows designing new techniques in order to create a better learning process. The objective is to have a plan with better teaching tools which simplify the subjects' learning process and detect the psychological and cerebral failures of normal learning, promoting empathy, and collaboration. Changing the education received by children in schools, based on the knowledge given by scientists of how the human brain develops after birth, and how the brain learns from the surroundings will have a deep impact on education.

This impact should encourage governments to improve new educational policies and increase the economical investment in education from school to the university and as a researcher. In this institution, the formation of critical and analytical thought is developed in students, that is the new teaching technique of creative thinking.

Neurodidactic is also known as Neuroeducation. It consist on the knowledge of the brain and how it interacts with the environment, specifically in the teaching and learning area. It is also an attempt to create new educational plans, based on the data provided by the scientists, beyond opinions or ideologies, that can be taken, not only by teachers, but also by the society including

parents, various educational institutions, media, and of course, leaders at a national level that have to implement educational policies.

However, Neuroeducation is not yet a regulated academic discipline. Indeed, in front of this possibility some specialists consider premature the use of this new teaching method because the available data can be scarce and difficult to apply in the classrooms. Nevertheless, some people think; otherwise, that this knowledge about how the brain learns and memorizes should be required.

As Mora explains (2017), Neurodidactic is a new version of teaching based on brain functionality. It is combined with Psychology, Sociology and Medicine in order to improve the whole learning process, students' memory, and teaching techniques. Neurodidactic is also a new open field from Neuroscience, full of a bunch of possibilities that should provide useful tools for teaching, with the goal to approach a real critical thought. It also means evaluate and improve the training of professors and helps the process of those who are learning.

Neuroeducation can help in the process of improving creativity or the learning process of some subjects, such as mathematics. It explains that the social environment, family, and culture can affect the children's learning process. In addition, to recognize the variability of their abilities during the learning process, it is important to analyze the genetic information of the individuals, and to the changes produce by the environment in the brain since birth.

Neurodidactic has a main goal, which is to detect psychological or brain processes that can restrict the learning process and memory development, and together with Neuroscience, to find new ways to apply in the classroom.

2.3.2 Neurodidactic principles

2.3.2.1 Interaction principle

According to Forés, Vázquez and Torre (2014), this principle reminds that learning requires an active participation of the reader. For that reason, this principle is based on reflection, personal analysis, reading pauses in favor of assimilation, the choice between itineraries options of reading, stimulation of the creative capacity of the brain, an upcoming language, and the implementation of everything that is being developed at a theoretical level.

2.3.2.2 Balance principle

As the same authors explain, balance requires the stimulation of different brain areas, with their corresponding languages, such as, analytical, descriptive, reflective, inductive, deductive, playful, neurobiological, rigorous, pedagogical, interdisciplinary, transdisciplinary, fundamental, and metaphorical. This mixture of records has allowed describing, arguing, and explaining key concepts making the merge of them with symbolic elements that are essential to make possible the combination of contents. Being able to unify medical and pedagogical knowledge is an important step in the learning process.

2.3.2.3 Holistic principle

According to Forés, Vázquez and Torre (2014), this principle considers the person in all life areas, in order to achieve globalism and efficiency in the learning process at any level. This principle expands the vision on what is necessary to learn, for example, to discover the relationship among thinking, feeling and behaving; to understand the knowledge built at the brain level, to show the constant process of learning. The importance of self-esteem, safety and emotional intelligence are considered as pillars of the learning process in deep, and the goal to learn, not only for a specific time, but also for the rest of life.

2.3.3 Contribution of Neurodidactic to the learning process

According to Garrido (2012) from the Institute of Neuroscience, Education and Design, there are some important contributions, for example, the main job of the hemispheres, where the left side works with the rational part and the right side with the emotional one. It is no longer scientifically based on the brain adopting functions in a holistic manner, that is, that it is focused on feelings. Collin (as cited by Garrido, 2012) explains that the brain is both, an artist and a scientist, for that reason, it is important to have a variety of didactic activities in order to develop both hemispheres and strengthen the brain in an integral way.

Scientific activities should enhance the abilities of both wraps of thinking, especially when the brain functions as a synergistic network where certain areas that are activated regularly can affect other brain areas. In addition, improving skills that are more related with entertainment, rather than with the curricular point of view. Improve language and the development of intelligence; and as a result, students will have an easier understanding in other subjects.

Ramón y Cajal (as cited by Demarin, Morovic and Bené, 2014), father of the study of the neuron said, "Man can be, if it is proposed the sculptor of his own brain". These ideas begin to breakdown the conceptions of the static brain, carrying out numerous experiments that validate the brain restructuring and synaptic rewiring. The results show the brain-dynamic idea throughout experience. Neuroplasticity is the ability to generate new molecular routes that will condition the generation of new synapses, that is, it is a process developed throughout life in which learning exists until death.

While there is a biological substrate or genetic determinism to learning, depending on the nervous development, synthesis of neurotransmitters, and other components of this complex

system are not able to demonstrate its functionality, since the experiences and constant stimuli may vary significantly and change the inherited patterns. For that reason, the human potentialities of development can be infinite and can always be improved and learned.

The learning process changes the physical and functional structure of the brain, and allows the subject to a constant adaptation to a natural environment; it is also a critical element in future mental health. According to Davidson (as mentioned by Garrido, 2012) empathy, works with roles or functions that can generate the same brain responses physically.

The importance of these data support speculative thinking of the students, since it allows increasing this neuronal adaptability and efficiently prepares the individuals for improvements to future stimuli. It is necessary to increase the learning process by discovery, solving practical problems that lead to different options of responses, since in that way the frontal lobe will present a major sensory activation, improving future decision-making.

According to Gómez-Pinilla (cited by Garrido, 2012), the cerebral functioning at a big extend depends on what we eat. He said that, "Food is like a kind of pharmaceutical compound that affects the brain". A brain health, based on a diet according to the generation of neurotransmitters involved in well-being (tryptophan-serotonin) can influence in the activation of the reward zones. In addition, it coordinates the synthesis of antibodies, to maintain a general and future stability, because through certain components, the onset of neurodegenerative diseases can be presented.

The brain always defends itself when the necessary substrates are consumed for its correct functioning and balance. Everyone knows that a sick person does not learn because he/she does not have the optimal conditions for this process. According to Sprenger (as cited by Garrido, 2012), the levels of attention will also be influenced by the synthesis of hormones

involved in this process, such as dopamine and noradrenaline. To have a good cerebral functioning it is vital to have a good nutrition, focusing, not only in the growth of the body in general and in the assimilation of nutrients, but also in the cerebral exigencies to acquire knowledge.

A good scientific conscience will help to take care of the body in order to improve its basic functioning. Although, there are social factors that influence upon this, the teacher can also activate these areas of dopamine gratification with non-verbal language, in which the emotional gestures can generate an emotional and trusting environment. This will be very positive for encouraging students' motivation and learning.

The brain is formed by water in a large percentage; therefore, a good hydration allows better synaptic connections and helps in the cancellation of the stressful effect of some hormones secreted by a specific agent, a stressed or threatened brain does not learn the importance of emotions in the educational process. Facing life positively will influence cognitive development through intimate connections between emotional areas such as the hypothalamus and the amygdala and cognitive areas, such as the prefrontal one.

According to recent scientific studies, it may affect cell aging and even the strengthening of the immune system. In relation to brain development, the lack of emotion or threat will diminish learning, affect areas related to memory, and reduce serotonin levels, that may have repercussions in depressive states and aggressive behaviors, among others. This demonstrates the application of Neuroscience to school environment, specifically with new discoveries of mirror neurons, involved in language and empathy, a characteristic that categorizes them as a fact that underlies the emotional management of the brain.

Doing aerobic exercises few times a week, promotes the synthesis of serotonin and endorphins that automatically cause a feeling of happiness, which derives on positive thoughts in any situation of stress. According to Jensen (as cited by Garrido, 2012), movement influences the learning process. In spite of being a reflex action, the oxygen demand necessary to assume the basal energy functions of the organism is not acquired; having an impact on the body's physiology, besides to be a way of physical self-regulation, it also influences in the psychic part, since it affects emotions.

Experiments carried out by Greenough (as mentioned by Garrido, 2012), validates the hypothesis that the environments that provide major quantity and quality of stimuli help to have a greater cerebral development from a structural and functional point of view. As neurotropic factors are synthesized, they nourish the neurons helping their synthesis by maintaining a balance of glucose and oxygen, improving in the electrical activity of nerve cells. For example, a classroom in a static and routine environment reduces the learning process, increases stress, blocks divergent thinking, and the ability to relate the studied subject correctly.

The sleeping time, promotes major neuroplasticity in those areas related to the consolidation of memory and other neuronal circuits involved. That time allows the processing of information received during the day, reinforcing those synapses related to functional behavioral patterns. When there is not enough sleeping time, the individual's brain may suffer from similar implications to the ones related to some drugs; as a result, this avoids a good synaptic functioning and increases the hormones related to stress.

Greenough (as mentioned by Garrido, 2012) explains that, it is important to take into account that the neurotransmitter functionality is better during the morning, because it helps to a major brain activity. According to recent scientific studies, educational practice may influence

biological changes in the long-term life, since didactic strategies can go against normal biological cycles.

2.3.4 Neurodidactic strategies

As it was mentioned previously, there are three types of memories: visual, auditory and kinesthetic. According to Forés, Vázquez and Torre (2014), for that reason, it is important for the professor to work with the three of them in a balanced way. For instance, verbal explanations should be given with changes in the tones and modulations of the voice to avoid monotonous during class. Also, audiovisual contribution, such as diagrams and colors, visual summaries, and so forth, may be very useful for visual students.

Forés, Vázquez and Torre (2014) explain, implication and student participation, in games, metaphorical stories, music, short movie scenes, movement, and laughter. In that way, the teaching technique will reach everyone through one channel or another. Moreover, if the professor develops the three types of memories during a class, he/she will include all of them and will have better results with the students. He/she will communicate better with them, and will teach them to practice what they handle less.

According to Díaz (n.d), another important strategy will be open the sensory areas of the students' brain with attention, the professor has to be excited and transmit as much as possible emotion to the students, because emotion activates the hippocampus, this area is in charge of stored recent memories. In order to open students' senses and focus their attention, the professor can use visual organizers such as conceptual or mental maps.

When the human brain sees something new, it releases noradrenaline, which is in charge of stimulates the brain. Therefore, the professor can use innovating teaching techniques such as tell the students interesting facts, use technology about the new data provided in order to

illustrate it, hang elements related to subject of study around the classroom, use music or sounds that students do not expect, and finally the professor can use real facts about the students life so they will be interested.

Díaz (n.d) explains that, it is necessary to make the students think, and that when this happens the information has passed from the sensory memories to the working memory. This is the moment to manipulate the taught information. It is important to stimulate students by ask questions they have just because in this way they connect the information stored in the long-term memory with the new information learned. Students need time and silence. According to scientific studies, from three to five minutes will be the necessary to give a reflexive response. There are fifteen seconds that teachers can give the students to answer; thus, teacher promotes reflective thinking and this allow the information in the short-term memory go to the long-term memory.

Make summaries with students' own words. It is forbidden to study memorizing with cut and paste. Students will remember better what they have done by themselves, since the summary they make is consistent with their own neural circuits, and as a result, the chances of remembering are higher. Another important strategy will be to provide feedback in order to verify if the students are learning the content. There are two types of evaluation, one is formative evaluation, which is a test without a grade, after each test the professor will provide feedback about the strengths as well as the weakness, this will help the students understand and remember, and the other type of evaluation is the one that has a grade and evaluates knowledge.

According to Díaz (n.d), practice and repetition also play an important role because when applying these strategies the information goes to the long-term memory. The practice is to repeat, but the professor should have careful that students do not notice that they are repeating, and this

activity must be complemented with motivation. Consolidation to long-term memory occurs during sleeping, a person under ten years needs to sleep ten hours, a person older than ten years needs to sleep eight hours.

There are several types of memories; these memories are based on language. For example, emotional, motor and conditioned memory, the last one is related to associative learning based on experience. As Díaz (n.d) mentioned, another necessary strategy in the classroom is reviewing new information, if the professor does not do it the new information could be lost. The professor should not ask if the students have doubts, because they do not know what information they need, he/she can guide the students throughout the new information learned.

As Mora explains (2017), there are more strategies to help teachers create a better class environment, for example, beginning the class with something different calls the students' attention, like a phrase, drawing, a thought, or something shocking, another one can be to introduce a daily problem that leads the awakening of students at the beginning of the class. As Mora stated (2017), it is convenient to create a dialogue atmosphere where the students feel relaxed and comfortable, avoiding the feeling of being questioned about their difficulties, so that they will not feel silly.

The professor should give enough time to a student to develop an argument; as a result, he/she will feel motivated to find a solution to the problem to he explained in front of the others. Regarding a specific topic, a good technique to be applied by the professor, is not exactly to ask about a problem, but encourage the student to explain the problem spontaneously. This action stimulates students' desire, self-esteem, and personal motivation.

As Mora explained (2017), the professor should develop an active student participation and personal research on practical lessons. The professor should also encourage students when they are able to solve certain problems. Moreover, the professor should modulate but not drive directly the student to the answer of a question, and he/she should avoid giving the solution to a specific problem. The teachers' main objective is to create curiosity and develop a way for learning. This curiosity may vary depending on the age, time of the day, and feelings, it can be affected by what happens in the physical, social, and family environment.

Chapter III

Methodological Framework

The purpose of this chapter is to describe the methodological approach, as well as the research instruments that are going to be used, that is, observation, interview, and questionnaire. The reason for applying these instruments is to accomplish the objectives set at the beginning of this investigation. Moreover, the diverse sources have been used with theoretical contents to collect the existing information related to Neurodidactic, to support the development of this research.

3.1 Research approach

This paper is a qualitative research focused on the study of reality to describe and characterize it. It uses data collection without numerical measurement to discover or refine research questions throughout the interpretation process. (Hernández Sampieri et al., 2006, p8)

This approach evaluates according to the natural development of events, that there is no manipulation or stimulation with respect to reality. (Hernández Sampieri et al., 2006, p8)

This approach is considered since according to Hernández Sampieri et al. (2014), it focuses on the understanding of phenomena by exploring them from the perspective of the participants within a natural environment and in relation to their context.

For that reason, in order to accomplish the objectives set at the beginning of this project, that is, to analyze, identify, apply, and evaluate what effect have Neurodidactic strategies in freshmen students during the grammar learning process of English as a second language. In order to test if the strategies are valuable and help the students to understand better all the new information provided by the teacher.

The focus is to use the qualitative method, which according to Denzin and Lincoln (as cited by Ospina (2004), involves an interpretive and naturalistic approach: “This means that qualitative researchers study things in their natural settings, attempting to make sense of, or to interpret phenomena in terms of the meanings people bring to them”.

3.2 Research method

The research method or design is the general approach that will be used in the research process. Qualitative research by itself is a design, since there are no two identical qualitative investigations; there may be some that share certain similarities, but they are not identical as in the case of quantitative research (Hernández Sampieri et al., 2014, p.470).

To provide information the phenomenological action research design will be used, about the same and different experiences, as well as about the appear categories that frequently in the experiences. (Hernández Sampieri et al., 2014, p.471). Phenomenology is in charge of describing, exploring, and understanding what individuals have in common according to their experiences with a specific phenomenon given, those experiences can be feelings, emotions, visions, perceptions, among others, so in this design the researcher will work directly with the statements of the participants, instead of creating a model based on their interpretations. (Hernández Sampieri et al., 2014, p.493).

Hence, it is important for this investigation, since the researcher is trying to evaluate the effect on the application of Neurodidactic strategies to freshmen students and determine if they help them to improve their grammar learning process based on their experience. For this reason, data collection process will be carried out through primary, secondary and tertiary kind of sources. Besides, through the instrument of observation, interview, and questionnaire, the researcher will try to collect important data in order to accomplish the objectives.

3.3 Information source

According to Maranto and González (2015), an information source is everything that gives us data to recreate facts and the bases of knowledge. It is an instrument for knowledge, search, and access to information. There are different kinds of information sources, they are commonly primary, secondary and tertiary, but they will depend on the investigation focus. Reviewing literature throughout the process of the investigation on the topic should be selective and dynamic because new texts are developed continuously on different fields of knowledge.

3.3.1 Primary information source

This kind of sources contain original information, and it is the result of ideas, concepts, theories, and results of investigations. The main sources of the primary information are books, written works, periodical publications, technical reports from public or private institutions, theses, research projects presented at conferences, expert knowledge or experiences, newspaper articles, documentary videos, forums, among others. This primary information has not been interpreted or evaluated by anyone yet (Maranto and González, 2015).

3.3.2 Secondary information source

According to Maranto and González (2015), this type of sources is the one that has already processed the information taken from the primary source. The development of this information can be obtained through interpretation or analysis, of the information from the primary source. This kind of source describes the point of view of other people about the subject. Some examples are books or articles that interpret other works or researches related to the investigation topic.

3.3.2 Tertiary information source

According to Maranto and González (2015), this kind of sources are those that gather sources of information, either primary, or secondary. These tertiary sources are used to search data or to get a general idea about a topic. Some examples are bibliographies, dictionaries, glossaries, among others, in which the reference has been taken from other documents, that contain names, titles of journals, and other publications.

The procedure to choose acceptable information sources to carry out an investigation, and therefore design a relevant methodology are, for instance, reading, understanding, comparing and evaluating the information selected, as well as verifying if it is coherent, relevant, enough, and impartial. Moreover, if there are proposals or aspects which there are different points of view among the authors, verify if the concepts are explained clearly by the authors, if not it would be necessary to look for more information. (Maranto and González, 2015).

Besides, it is important to pay close attention to the conclusions expressed or answers to the information needed, and that was intended to solve. It is essential to remember that those who elaborate secondary or tertiary sources are experts on the areas. Therefore, the effort should be taken into consideration. In order to carry out an accurate choice of the information sources, the researcher requires different characteristics, such as open mind, observation, and analysis that will help in the selection process. (Maranto and González, 2015).

According to Maranto and González (2015), when an investigator chooses a good source of information, it is because the source is reliable, and during the investigation procedure the researcher can establish a connection between the scientific approach and the utility of the content focus on the work development, in order to accomplish the objectives.

3.4 Analysis of categories

The analysis of categories are fragments of the document that are used as a base element for the investigation. They can be classified according to different criteria according to the grammatical content to the meaning. (Balcells I Junyent, J. 1994). These categories are those units of observation that are selected in advance, and recognized by the observers in the field, and during the observation time.

Moreover, these categories are the object of coding or categorization in the records constructed for this purpose. (Gaitán M, J. A Piñuel R, J. L. 1998). A category by itself is defined or understood as each of the levels, in which the units of analysis are characterized. (Hernández Sampieri, Carlos Fernández - Collado, Pilar Baptista Lucio, 2014, p359). These analysis of categories have been taken from each specific objective with their corresponding definitions.

1. Neurological aspects that affect people's learning

According to Brice and Carson 2009, the basis for all thought, communication, and language occurs in the brain. The nervous system is a key component of the brain. The brain, the spinal cord, the cranial nerves attached to the brain, and the spinal nerves make up the nervous system, where receptor or sensory neurons transmit sensory information from the body to the brain and motor neuron carries motor information from the brain to innervate muscles.

2. Neurodidactic strategies

According to Forés, Vázquez and Torre (2014), Neurodidactic not only includes the content to be taught, but also how the people who are going to learn feel, Neurodidactic helps the development of students' personal abilities, attitude, and aptitude throughout the learning process. The different ways in which the contents are taught, choosing specifically those in which assimilation, memory and integration are required.

3. Effect of neurological aspects when learning a second language

According to Rodríguez-Fronells, De Diego Balaguer, and Munte mentioned by Brice and Carson (2009), when learning a second language, the brain has to build on a neutral network that enables the segregation of the new language from the native one. The creation of its corresponding activation and inhibitory links at the lexical, neurological, and syntactic level, help in the development of the ability to select a word and its properties in the target language.

3.5 Data Collection Instruments

3.5.1 Observation

The observation method is an instrument that will help to achieve the objectives set at the beginning of this work. According to Marshall and Rossman (as cited by Barbara B. Kaulich, 2005), observation is defined as “The systematic description of events, behaviors, and artifacts in the social setting chosen for study” (p.79.)

There are different types of observation methods; however, on this research the one that adjusts better to the objectives, the observer as a participant. This role, is described by Gold and Pearsall (as cited by Linda M. Baker, 2006) as the one that includes more observation than participation. In this observation method the researcher gets in contact very slightly with the people observed, but at the same time the observer will apply a short interview to the professor and a questionnaire to students.

Based on the previous definition, the researcher is going to write a diary with the different activities observed, and at the same time, compares the behavior of the teacher in a regular grammar lesson for freshmen students at a private institution. Among those activities, for instance, the researcher will pay closer attention to the professor’s teaching techniques, tone of

voice, attitude, motivation, knowledge about the grammatical content, and Neurodidactic techniques.

At the same time, the participants, who in this case are the freshmen students, will be also observed during the class. The researcher will focus on their behavior, emotions, attitude, motivation, participation, interest about grammar, and level of difficulty for them to learn. The main goal is to observe the learners throughout one or two classes before using Neurodidactic techniques, then one or two more times using the Neurodidactic techniques.

The objective is to compare if there is a difference when using those Neurodidactic techniques and let the professor know about new ways of teaching, and show him/her that there are new options of successful knowledge-learning process for students. Moreover, as it has been mentioned previously, Neurodidactic is focused on the emotions in order to look for the optimal brain condition to learn.

3.5.2 Interview

According to Kvale mentioned by Alshequeeti (2014), an interview is a conversation whose purpose is to gather description on the life world of the interviewee with respecting the interpretation of the meanings of the described phenomena. Similar to Schostak (as mentioned by Alshequeeti, 2014) He adds that an interview is an extendable conversation between partners that aim at having an in-depth information about a certain topic or subject.

As other kinds of research methods, the interview has different types of advantages, for example, it involves reality, the interviewer has full control about the topic and questions, and he/she can be flexible. On the other hand, it also has some disadvantages, such as time consuming, inconsistencies on the answers received, among others. However, an interview can be a helpful instrument to collect valuable information related to the objectives.

For instance, there are some types of interviews, such as structured, where the researcher uses a guide of questions that limits the conversation; then there is also the open type, in which a general guide is used as a base, the interviewee having the freedom to expand on the topics of interest. Finally, the semi-structured type, in which a guide of issues is used that allows the interviewee a greater degree of freedom to speak than in the structured interview. (Hernández Sampieri et al., 2014).

In this case, the researcher is going to use the semi-structured type. This one will be applied to the professor; the purpose of this is to have an idea about the professor's knowledge on the Neurodidactic field, and at the same time to know his/her inputs about using Neurodidactic strategies during a grammar class. The interview will be composed by seven questions, through which the professor can provide his/her opinion and any additional comment related to the topic.

3.5.3 Questionnaire

According to Chasteauneuf (2009), a questionnaire consists in a set of questions regarding one or more variables to measure. It must be congruent with the problem approach and hypothesis (Brace, 2013). In a questionnaire there are two types of questions, closed questions, which are answer options previously selected, that represent the possibilities of answer for the participants with two or more options. The other type is the opened question, without any limit, so the participants can express themselves, and their answer can be variable. (Hernández Sampieri et al., 2014).

Besides, there are different kinds of questionnaires; however, to accomplish the purpose of this investigation the one selected is self-administered, that is that the questionnaire is provided directly to the participants, who are going to answer it. Nevertheless, the form of self-

administration may be individual, in group or by email or webpage. (Hernández Sampieri et al., 2014).

For that reason, in this investigation the closed questions type will be applied. There are nine questions that contain two to four options (depending on the question), and they are applied to the freshmen students in a grammar English lesson. The main goal is to know their opinions, emotions, and feelings regarding grammar as we have seen in previous chapters. All of them play an important role on the Neurodidactic field during the learning process and are also used to identify the students' level of knowledge on the relating topic.

The research instruments described previously were selected because they would help to determine how effective the Neurodidactic strategies were. As there will be a comparison between the two grammar classes based on the data collected. Their results, the final conclusion will help to verify if the question set at the beginning of the investigation will be answered or there will be an open query which will need a deeper investigation.

3.6 Collection data process and data analysis

In order to collect data during this work, the observation, interview, an intelligence test, and a questionnaire will be the main important instruments. The intelligence test is related to the main kinds of learning styles such as visual, auditory and kinesthetic, this test was taken from "What's your learning style created by the University of Dakota (2009) adapted by the researcher with the objective to know the types of intelligences of the students. Due to one of the main Neurodidactic strategies is that the professor can focus on all these three areas in order to have better results throughout the learning process, is when the last instrument which is a questionnaire will be applied. All of them are very important for gathering information in the process of a qualitative investigation.

For instance, observation will help to obtain expressions, interaction, and environment; the interview will achieve an interpersonal communication established between the subject of study and the way of obtaining verbal answers to the questions raised about the problem presented. Finally, the questionnaire will help to gather information from the participants.

The data collection techniques are the different ways of obtaining information. For instance, some of them are direct observation, the survey in its two modalities (interview or questionnaire), the documentary analysis, content analysis, and so forth. (Arias, 1999). Below, it is a description about the instruments selected to collect data. In the first place, observation, in which the professor as well as the students will be observed carefully during a grammar class with and without Neurodidactic techniques.

The observer is going to write notes about every activity as a field journal divided in two days (could be more depending on the details observed). In the first day, the researcher is going to observe the professor's behavior as well as his/her knowledge about the topic teaching in that moment, his/her attitude, tone of voice, motivation, teaching techniques, and if he/she handles the Neurodidactic strategies in order to apply them during the class.

At the same time, the researcher is going to pay close attention on the students behavior, emotions, attitude, and knowledge. Also if they are getting the new information accurately, and having a good time or not throughout the learning process. The objective is to write all the activities, movements, and everything that happens in the process of the grammar lesson before using Neurodidactic strategies.

Before the class finishes, the researcher is going to apply an intelligence test to students in order to know their type of intelligence so that to plan different activities according to their intelligence type in the next class. Neurodidactic strategies will also be included this time. The

process will be the same, that is the observer will write detailed information about the professor and the students using those strategies, and compare if there are differences with the previous class observed.

The next instrument to collect data will be an interview. This instrument is only applied to the professor, and contains around seven questions (could be more or less) depending on the professor answers. The questions are related to Neurodidactic, its strategies and his/her knowledge about them. The professor has the freedom to express his/her opinion and explain if Neurodidactic is useful or not according to his/her personal opinion. The main goal is to collect information about the knowledge on Neurodidactic strategies that a university professor has, how he/she transmits new information to his/her students, and how the students receive that information. Moreover, the objective as well is to have a positive or negative opinion from an experienced professional about Neurodidactic in the learning process.

Finally, the last instrument that is going to be applied will be a questionnaire to the students observed, before and after the application of Neurodidactic strategies during a grammar class. It contains around nine questions mainly in scale where they can choose from one to five or the word that describes better their opinion. Those questions are related to their feelings or emotions during a grammar class, the knowledge they have about Neurodidactic, and also about their own intelligence type, and talent because as we has previously seen this is an important part of the Neurodidactic strategies.

In this questionnaire, the researcher will obtain the students' opinion, as well as the students' emotions, and if they demonstrate that through the usage of these strategies the grammar learning process is easier for them. Once the results are obtained, all the data is going

to be evaluated through graphics with the purpose of having a better and easier tool to analyze and understand the outcome of the research instruments, and hence of the investigation.

Chapter IV

Data Analysis

In the development of this chapter, the selected categories will be analyzed in detail according to the importance of each one, in order to accomplish the objectives proposed at the beginning of the research. The main focus of these categories is based on the observation of teaching techniques in the development of a grammar class in a private institution, the knowledge related to Neurodidactic strategies by the professor and the students observed.

According to Hernández Sampieri, Fernández - Collado, Baptista Lucio (2006), this chapter is important because it is where the analysis of the data collected is performed by the researcher. Qualitative analysis focuses on all data collected, generate concepts, categories, descriptions, among others. The data organization begins with the transcription of the data collected and then, the analysis will demonstrate if the objectives have been achieved or not.

4.1 Analysis and interpretation of the results

All the data collected in the process of applying the instruments will be transcribed, and analyzed with the objective of verifying if the hypothesis established has had a positive result.

4.1.1 Observation

The first observation was carried out on October 11, 2018 at Universidad Internacional de las Américas (UIA), in a grammar class for freshmen students from 6:30pm to 8:00; the total of students were seventeen, fourteen women and three men. Their ages ranged from eighteen to twenty-five years old. The class topic was the simple present tense.

According to Mora (2017), one of the Neurodidactic strategies is to create a good atmosphere and catch students' attention during the development of the class. For example, at the beginning of the class, use a phrase, drawing, image or something shocking. In this first

observation the professor did not use this strategy, he began the class with questions about their homework. These questions were to find out if they had questions or doubts about the topic.

The professor did not know anything about Neurodidactic, and although he did not know about it, he used some of these strategies such as, providing verbal explanations, showing a positive attitude, providing exercises to practice and guide the students to solve the grammar issues. Due to his outgoing personality, the atmosphere during the class was comfortable. Therefore, the students participated actively.

The students did not have any specific question; however, they asked the professor to review the exercises from the homework assigned. Therefore, the professor wrote the sentences on the board. During the class the students spoke in Spanish, as their English level is too basic and some of them have difficulties with pronunciation and vocabulary. For this reason, the professor spoke in English and translated to Spanish at the same time in order to have students understand everything.

The homework was about the analysis of the sentences, students were supposed to look for the subject, verb, and predicate. The teacher asked them to do it by their own with his guidance, but at the same time he helped them with their doubts; some of them took notes, others participated and helped the professor with the answers and others just paid attention. When they were not sure about the answers the professor, guided them with a hint so that they could provide the correct answer. The professor gave them the opportunity to think carefully before saying the answer; after that he reinforced what he had explained about the topic and asked them again if everything was clear for them. When the answer that he received was negative, he provided the explanation in detail or in another way, so that the information could be understood by all of them. If after that, they had not understood the explanation the professor provided the in Spanish.

Every homework assigned by the professor was from the virtual class, which is a university website where students can log and access to the information provided by the professor. These documents can be practices, important information, or homework. After the break they had a quiz related to the sentence analysis that they had been reviewing at the beginning of the class, so he asked for the last time if they had any additional question.

According to Forés, Vázquez and Torre (2014), students' participation in emotional strategies such as games, music, movement, and laughter is fundamental, as when students have a positive attitude, the new information will be kept in their brains for a longer period of time. As the researcher mentioned previously, even though the professor did not know anything about Neurodidactics, he applied an activity which was a game related to questions.

First, the professor provided the explanation of the game throughout a role-play. He said that the idea of the activity was to answer only with questions related to the topic. The game was played in pairs and the best team won extra points, besides the extra points offered, only three pairs participated. The topics were buying a Halloween custom, the first pair on this topic got four correct answers. The second topic was family meeting in this case a girl and a boy participated and they also had four correct answers.

The last pair had the topic of enrolling in school. This pair had twelve correct answers; as a result, they won the extra points. Throughout the progress of the activity, everybody became interested on the game and the topics, and they had a great time. The professor looked for the students' participation all the time, till the whole class was involved in the development of the activity.

The students had an extra motivation because they not only won extra points, but also, throughout the game, they went motivated by the professor to make their best effort wherever

they made mistakes; the professor provided feedback, so the rest of the class would learn how do it correctly. After the activity, the professor went back to the topic and asked them again if they had had any questions.

According to Díaz (n.d.), it is important to make the students think, when this process is happening in the human brain, thinking goes to the sensory and working memories. When the professor asks questions the information learned will be connected to the long term memory, and the learning process will have better results. Fifteen minutes before the break, the researcher had the professor's permission to apply an intelligence test.

The test was created by the University of Dakota (2009) and adapted by the researcher in order to know the intelligence type of each student. The test focused on the three main types of learners such as visual, auditory, and kinesthetic. It had sixteen questions and the students, as well as the professor had to read the statements, and answer the first thing that came to their minds based on the options given a, b, or c.

According to the test if they had more "a" answers, it meant that they were visual. If they had more "b" answers, they were auditory, and finally if they had more "c" answers, they were kinesthetic. The test had a brief explanation about the characteristics of each intelligence. In this opportunity, the professor knew his own type of intelligence, but he did not know the students' intelligence.

According to Forés, Vázquez and Torre (2014), one of the main Neurodidactic strategies is that, the professor show first his/her own type of intelligence, as well as the students intelligence in order to find a balance during the class development and apply the best techniques with the purpose of having a successful learning process. In this class, there were eight visual

people including the professor, eight kinesthetic, and two auditory, so the activities to apply in the next class should be focused on these types of intelligences.

Some days before the second observation, the researcher had a short meeting with the professor in order to guide him with the Neurodidactic strategies that he could use during the class, so he took the advice and applied some of them. This observation was done on October 25, 2018, as well as the first one, it was at the Universidad de las Américas (UIA) in a grammar class for freshmen students from 6:30pm to 8:20pm. This time there were eighteen students, from which fourteen were women and the rest were men.

In that day, the class began with a song, since Halloween was coming, the professor chose a song related to the topic. According to Díaz (n.d) one important strategy is to open the students attention throughout the sensory windows; here emotions plays an important role, as well as professor's feelings. Emotion activates the hippocampus, which is the storage place of new memories.

The professor told the students to take out a piece of paper, and write the words they heard that they did not know or did not understand. The song was played twice. After the first time to listening, the professor asked them their opinions about Halloween and if they thought that in Costa Rica existed a similar celebration. They provided their opinions in Spanish with some words in English because as it was mentioned previously, their English level is basic; however, the professor continued speaking in English.

While the professor was speaking, the students learned new vocabulary that they did not know about Halloween, the professor was guiding them with the objective of having them participate as much as possible. Some of the students partially understood when the professor

spoke, some others understood everything, and others did not understand anything at all, for this reason, the professor had to speak in Spanish too.

Then, the students started speaking about legends from Costa Rica, their opinions were given in Spanish all the time. The professor asked different questions about those legends and how many they knew, the professor spoke English almost all the time. He guided them throughout the conversation, they laughed a lot because some of their classmates said funny things; they had a good time. After that, the professor asked if those legends of horror stories from Costa Rica had any kind of moral, and they provided their opinions about them.

The second time, the professor played the song with the video, so all the students could see it on the white board. This audiovisual media helped the students to understand the song better, they enjoyed it a lot, and the activity created positive feelings in the students who started the learning process that day in a differently. Throughout the use of technology, the professor balanced two types of learners: visual and auditory.

After the first activity, the students' attention was focused on the professor who was going to introduce the new topic of the day, which was the simple past. The professor created a game in Kahoot, which is an online game where the person who answers quicker and faster accumulates points after the total of questions. This time there were thirty questions (sentences, regular and irregular verbs, negative and interrogative sentences) related to simple past. The student who had more points in the game would obtain an extra percentage in his/her grade.

According to Díaz (n.d) practice and repetition are essential, and they should be linked to motivation, during these two processes, the information received will be stored in the long-term memory; however, without motivation, it does not accomplish its main objective. When all the students can access to the application, the game started, it has sentences in the past tense, and

verbs to select the best answer in the past tense as well; at the beginning, it seemed a little bit confusing, and some moments seemed to be disappointed, while others were sure about the answers. Everybody was paying attention silently, the students looked at every sentence or question carefully because they wanted to win. Once the game finished, they laughed a lot and had a great time.

When the game finished, the professor used power point slides to explain the simple past. On the slides, the students could see the verb to be in affirmative, negative, and in question form. Regarding the professor's tone of voice, sometimes it was flat. And according to Forés, Vázquez and Torre (2014) when the professor provides verbal explanations the voice should have different tones and modulations in order to avoid that students lose attention.

During the explanation time, an innovation teaching technique was applied. According to Díaz (n.d), when the human brain is exposed to something new, it releases noradrenaline, which is in charge of the brain stimulation. The professor continued explaining about the regular and irregular verbs, the students paid attention during the whole explanation and they took notes too, the professor used examples to help them understand better. They had a textbook, which contained a list of the common verbs with its simple past form, participle, and meaning.

One student asked about a guidance to learn the verbs and the professor gave his recommendations. The explanation about the topic continued, this time it was about how to form sentences using the simple past, as well as how to do negative sentences and questions using the auxiliary. After this part, new questions came up, the professor explained when the simple past should be used. He finished the explanation with some sentences as practice.

The professor requested the students participation in order to do the exercises; when the students answered correctly, he congratulated them and when the student had some difficulties to

answer the professor guided them to answer correctly by giving them hints. At the end the exercises, there were ten sentences, so ten students participated.

After this final activity, the students had a break, during that time, the researcher performed the interview to the professor. This interview contained seven questions related to Neurodidactics and the objective was to know how much knowledge the professor had on the strategies. After the break, the professor allowed the researcher to apply a questionnaire to the students; this process did not take more than twenty minutes and all the students participated.

4.1.2 Evaluation rubric

The evaluation rubric objective was to prepared all the activities performed during a grammar class for freshmen students during two days of observation. This rubric contains twenty items related to Neurodidactic strategies; the researcher evaluated each of them during an hour and a half in order to determine if the items had been accomplished or not. However, only eight items were considered because the selected items showed the difference between each observation.

Comparing the first observation in which a few Neurodidactic strategies were applied, with the second one it could be seen that there had been a big difference related between the two of them. Once the professor knew the types of learners that he had in the classroom, he could plan different activities to establish a balance among the three main types of learners in order to help all the students to have a better learning processes.

Referring to the classroom atmosphere in the second day of observation was more comfortable than the first one. Students had a better attitude and they were focused on the new information provided; the reception to new information was better. The use of technology, engaged young people to work better, nowadays the whole world turns around it. Finally, when

the professor provided a feedback, it was well received by the students because the professor created a trustable environment, so students felt free to express themselves and the professor was able to correct them avoiding sensibility. Below the results of each observation:

Table 1

4.1.2.1 Results from observation one

	Yes	No	Sometimes
1. Did the professor begin the class with a motivational story, image, or phrase?		X	
2. Did the professor use Neurodidactic Strategies?			x
3. Did the professor use images, colors, visual summaries, or maps?		X	
4. Did the professor use a flat tone of voice?			x
5. Did the professor know about the student's intelligence?		X	
6. Did the professor use different kind of tools such as music, technology, or hands on activities to explain grammar?		X	
7. Did the professor provide feedback?		X	
8. Did the professor create a curiosity feeling in the class?		X	

Table 1 shows the main items used for the first observation for the investigation objective.

Source: Researcher's own creation

On the first day of observation, the professor did not know about Neurodidactic strategies. Besides that, he applied a game and students had a great time during the development of it; however, he did not have the knowledge of the objective of applying games and the rest of the items, which are also part of Neurodidactics were not applied at all.

Table 2

4.1.2.2 Results from observation two

	Yes	No	Sometimes
1. Did the professor begin the class with a motivational story, image, or phrase?	x		
2. Did the professor use Neurodidactic Strategies?	x		
3. Did the professor use images, colors, visual summaries, or maps?	x		
4. Did the professor use a flat tone of voice?		x	
5. Did the professor know about the student's intelligence?	x		
6. Did the professor use different kind of tools such as music, technology, or hands on activities to explain grammar?	x		
7. Did the professor provide feedback?	x		
8. Did the professor create a curiosity feeling in the class?	x		

Table 2 shows the main items used in the second observation for the investigation objective.

Source: Researcher's own creation

As it can be noticed, the answers to the second table were totally different from those in the first one, although the same aspects were taking into consideration in order to compare the results. This time, the professor did his own investigation about the Neurodidactic strategies; he also had the guidance of the researcher, so as result, he applied more strategies during the development of the class.

4.1.3 Interview

The following interview was performed to the professor observed on October 25th, at Universidad Internacional de las Américas (UIA) during break time. This interview contained seven questions related to Neurodidactic, as well as, its strategies. The main objective was to

analyze if the professor had the knowledge about this innovate way of teaching. The questions and answers will be transcribed.

1. What do you know about Neurodidactic?

Answer: **Nothing at all, I just learned some strategies when I started to investigate about them.**

Comment: This question was asked because during the investigation, the researcher found out that Neurodidactic has many strategies that can help students to improve their learning skills; however, some professors do not know anything about it.

2. What are the regular teaching strategies that you use in class?

Answer: **Every time that I have the opportunity I use visual elements, videos, power point presentations, I love to use technology.**

Comment: Since the professor did not know anything about Neurodidactic, the researcher was curious about the kind of teaching methods the professor used, and at the end the researcher found out that the professor used some Neurodidactic strategies without noticing it.

3. Which are the Neurodidactic strategies that you know?

Answer: **I know that multiple intelligences are very important when planning any lesson when you know the intelligence type of your students; you can prepare activities for all of them that will make them feel better in the class. Once, a student told me that he really enjoyed the English class because it took him out from his problems for a period of time, and that he really spent a good time during the lesson and he felt that the new information was easier to get than in other classes.**

Comment: The professor did not know about the Neurodidactic strategies, but after the first observation made he did his own research, and noticed that multiple intelligences were very important because every student learn differently, for that reason the same teaching techniques should not be applied repeatedly. He learned that a game or to start a class with something different is part of the Neurodidactic strategies.

4. Which Neurodidactic strategies have you used?

Answer: Carried out a research about Neurodidactic, and I did noticed that I was using some of the strategies during the grammar class. For example, I like to use predictions; this activity make students think further, I also use a battle ships game, or the profession guessing game, in which the students have to use modal auxiliaries at questions. Another game is taboo which consists in images with clues or hints. In this game, a student is the detective, and he/she should give the students the topic to talk about. Then, they have to ask and answer questions. I always enjoy all of them.

Comment: The professor did not know that he was using the Neurodidactic strategies; he enjoyed the time when he applied the games and the students had a great time during these activities.

5. What were the results obtained from using Neurodidactic strategies?

Answer: The students' level of motivation and interest about the topic were higher. Sometimes when students could not express themselves in English, they tried to do it at first in Spanish or combining both languages.

Comments: When the professor transmited feelings such as friendship, communication, trust, among others, students felt confidence to express themselves, for that reason,

besides they had a language barrier they made their best effort to participate, provide their opinions, or even ask questions if they had doubts about a specific topic.

6. Do you think that Neurodidactic strategies are useful? Why?

Answer: Yes, because the students will have another point of view and they are going to focus better at the end, besides, they enjoy every class because they do activities that are different from the ones they do in regular classes.

Comments: According to the professor's answer and with the theory consulted that is one of the main objectives of the Neurodidactics, that is, students showed have a good time throughout the learning process because in this way, they will focus and pay more attention.

7. Do you recommend Neurodidactic strategies? Why?

Answer: Yes, every type of strategy should be implemented in all classes, so the students will have a better experience during the learning process. Also, it is important to remember that every person has a different way of learning. Therefore, using different types of strategies will guarantee that all learners will get the new information provided, since everybody learns differently.

Comment: This question is really important because after the research carried out by the professor about Neurodidactics, he was able to apply new strategies during the class, and experiment the attention, and motivation of the students. With these strategies, they were more perceptive to receive new information.

According to the professor's experience if the Neurodidactic strategies are practiced on every class, the students' learning experience can be more satisfactory, they

can learn easily, and catch the new information not only for a test, but also for life in one way or another.

4.1.4 Questionnaire

The following questionnaire was applied by the researcher on October 25th, when students finished their recess. The questionnaire contains eleven questions in which they have to select the option that applies better for them, also they have the opportunity to express their opinion about Grammar and Neurodidactics. Every question will be analyzed in a chart.

Figure 1

Question 1

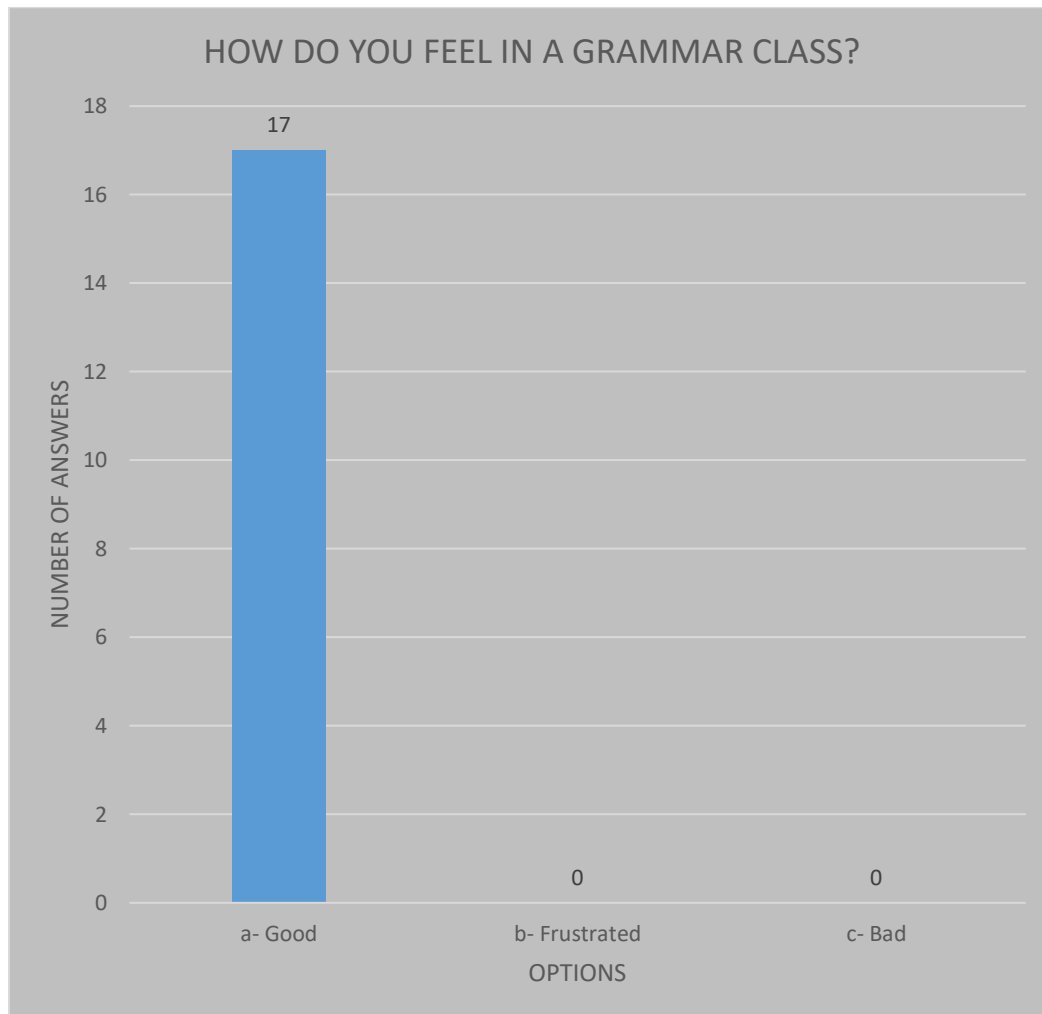


Figure 1 illustrates how students feel during the grammar class.
Source: Researcher's own creation

A 100% of the students (17) agreed that they felt good during the grammar class. This question was one of the main ones because Grammar is considered one of the difficult subjects to learn in any language. The students will feel good about it. If the professor creates a good atmosphere during the development of the class.

Figure 2

Question 2

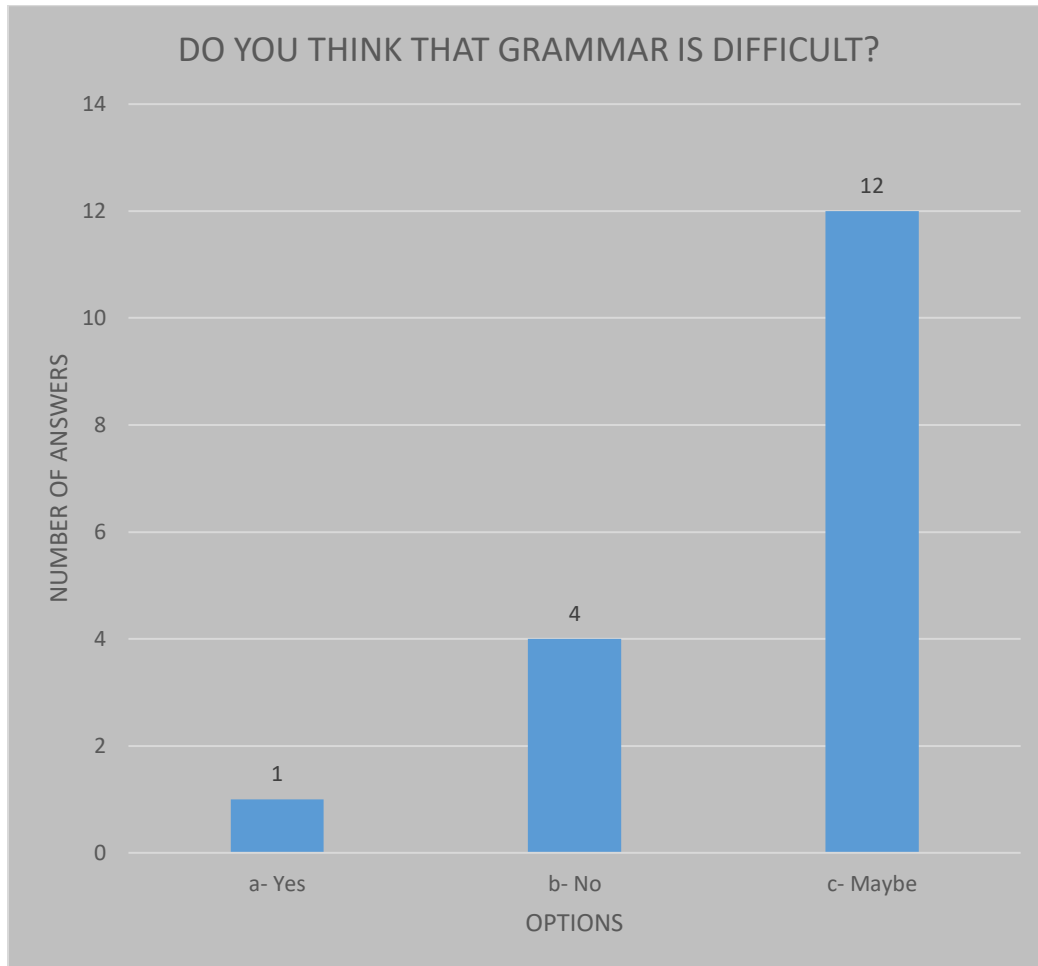


Figure 2 shows if students feel grammar is a difficult subject.
Source: Researcher's own creation

Regarding question two, 12 out of 17 students think that Grammar may be difficult to learn. This means that 70.58% of the students are not sure about the subject. Besides, students answered in the first question that they felt good in the grammar class, but that they were not sure if it was difficult or not. They added that it also depended on how professor explained every topic, as well as, the tools and practices given, so that the students could develop practices on the new information obtained.

Question number three should only be answered by people who answered “yes” or “maybe” in the previous question. This question aimed the students to explain why they thought grammar is difficult. The only person who answered positively said that: “because sometimes there are a lot of topics without any further explanation”.

Among the people who answered “maybe”, five students stated that the rules were the reason of their answers. The majority (12) expressed that there are a lot of rules, that are difficult to remember and apply correctly, They stated that it could be easier if they had the necessary tools, and clear methods of teaching to make easier the understanding of the topics. Other answers were: “because it is something new to learn”, “sometimes is tired”, “sometimes there are a lot of topics that make you feel tired of confused, because it is a class without activities or student’s participation”. Based on their answers, it is important for the professor to find a variety of teaching methods to explain every grammar subject, and according to the Neurodidactic strategies, the professor can apply different activities that may keep all the students understand the grammar lessons.

Figure 3

Question 4

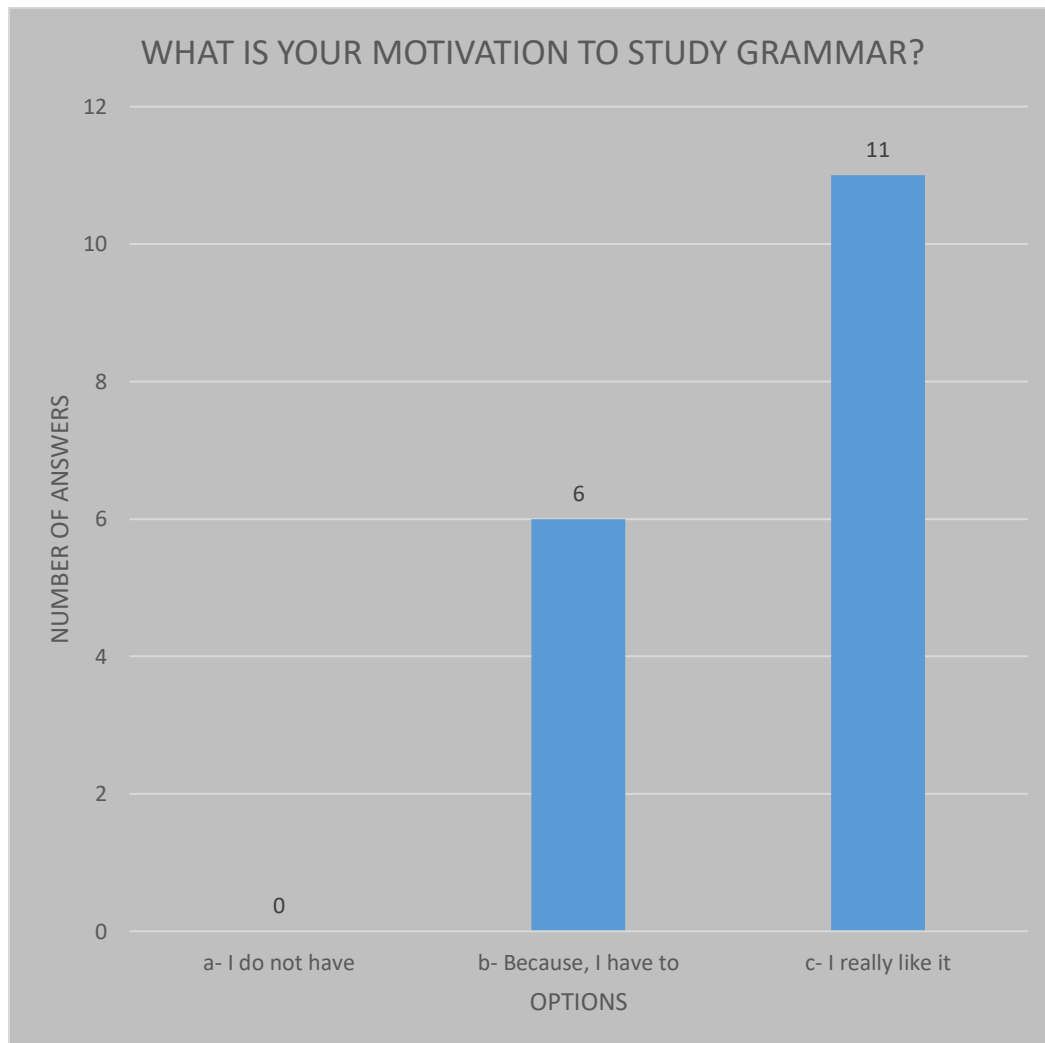


Figure 3 states what the motivation of the students to study grammar is.
Source: Researcher's own creation

The majority of answers (11) on this question, point out the fact that they really like studying grammar. Eleven out of 17 students, or 64.17% responded with the option "c". The rest of them (6), with option "b", so they are learning grammar because it is part of the English major. All of them are motivated because nobody answered that they were not motivated.

The answers to this question reflects that students are motivated when they are studying Grammar. The clue for the professor will be to keep that motivation and increase it, throughout different activities that encourage students participation, so that every time they are receiving new information during the Grammar class they feel it is a good experience instead of a frighten one.

Figure 4

Question 5

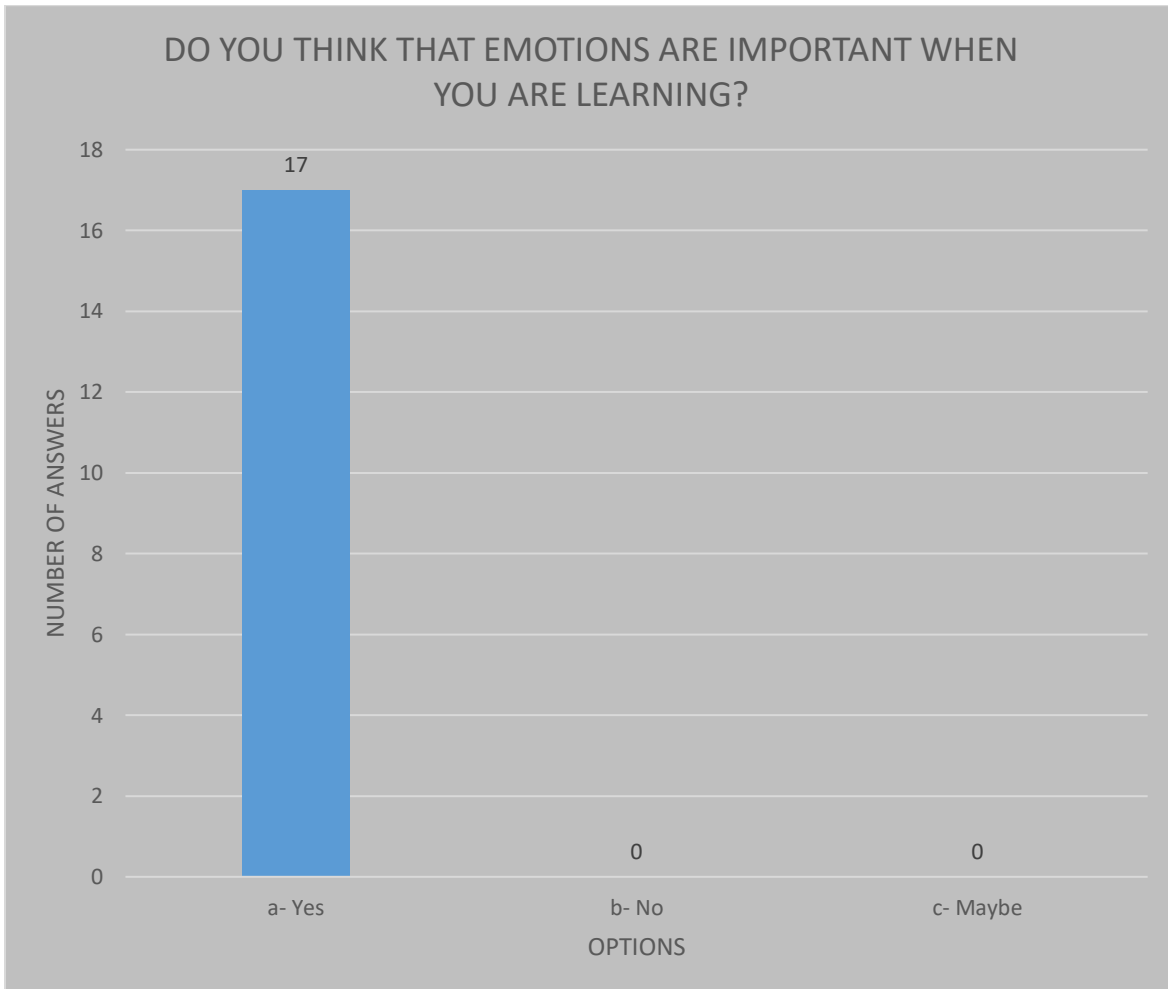


Figure 4 illustrates if students think that emotions are important when learning.
Source: Researcher’s own creation

In this question, 100% of the students (17) agreed that emotions play an important role during the learning process. About emotions, according to Díaz (n.d), an important strategy is to have open sensory windows in the students to develop their attention, emotion, and enthusiasm; aspects that the professor should also have in order to transmit them to the students. These aspects are important because they activated the hippocampus, which is the place in which recent memories are stored.

According to the Neurodidactic strategies, emotions are always important because they are directly connected with attention, and attention is in charge of storing new information in the brain. If the students are learning and they have positive emotions their learning process will be easier, on the other hand, in the case of students who do not have positive emotions or motivation, the new information learned can be lost throughout the brain process.

Figure 5

Question 6

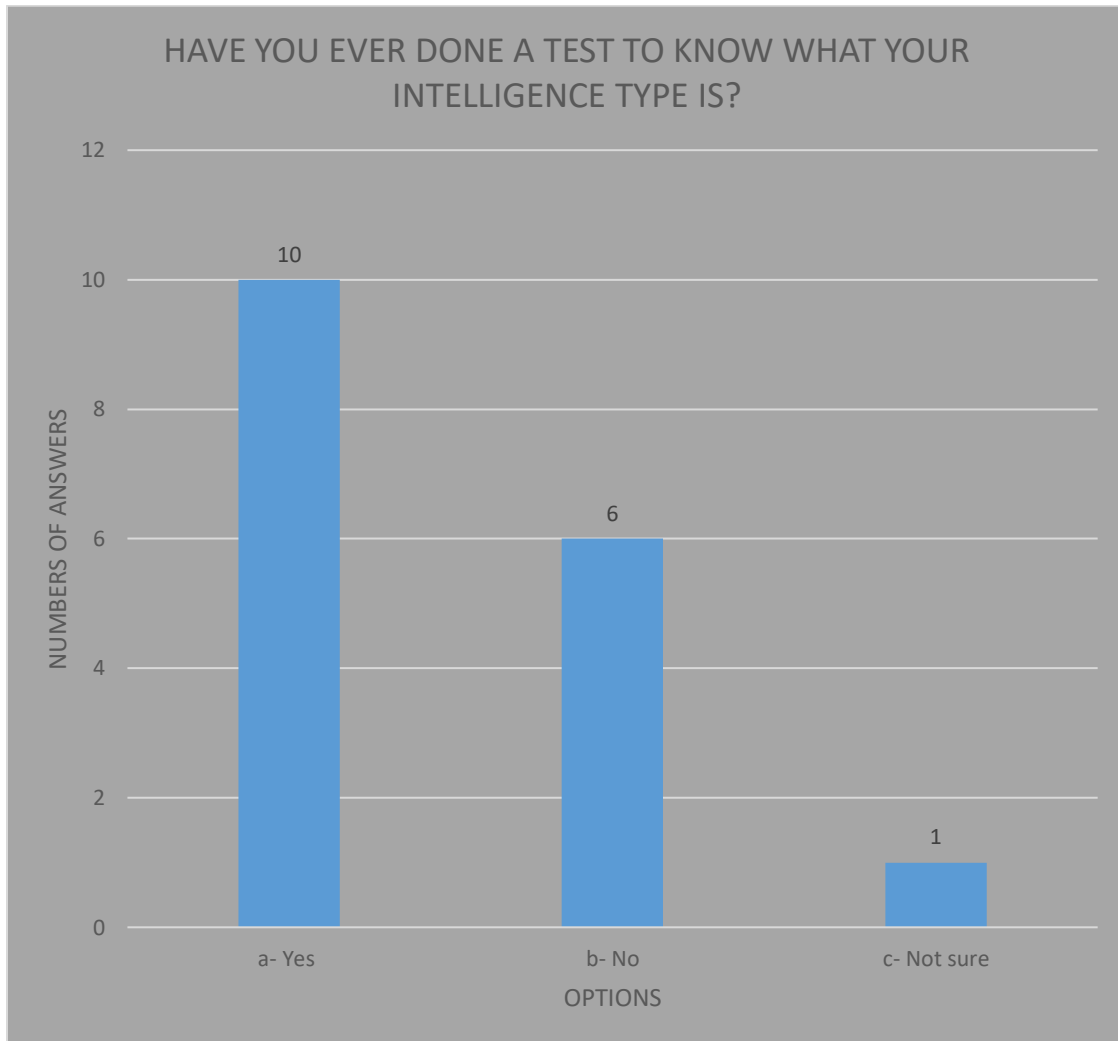


Figure 5 shows if students know their type of intelligence.
 Source: Researcher’s own creation

Ten out of 17 students have been tested to know their intelligence type, 6 of them have not been tested, and one of them is not sure about it. In percentages this means that 58.82% have been tested, 35.29% have not been tested, and 0.05% (3) are not sure if a test of that kind have been applied to him/her.

This question is also important because according to Neurodidactic, one of the basic information that a person should know, besides the general function of the brain is his/her intelligence type; without this information the student will not know which the better techniques to learn are. It is necessary for the professor to know his/ her own type of intelligence as well as his/her student’s one in order to apply the best teaching techniques to transmit knowledge.

Figure 6

Question 7

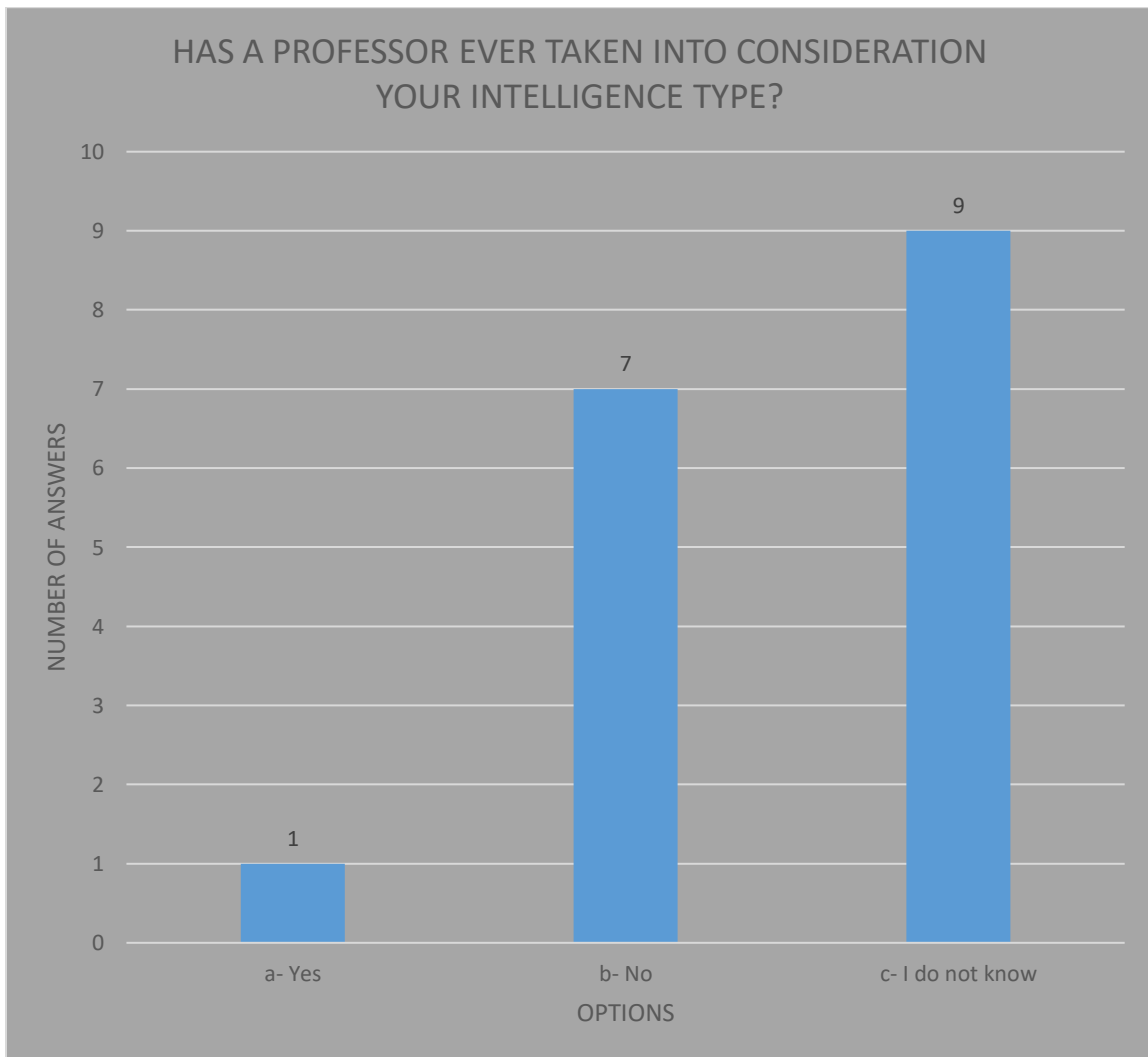


Figure 6 shows if professors consider students’ type of intelligence.
 Source: Researcher’s own creation

In this question, 52.90% of the students (9) answered that they did not know if the professor took into consideration their intelligence type. 41.17% students (7) answered that their intelligence type was not taking into consideration, and only 0.05% of the students (1) assured that the professor took into consideration his/her intelligence type.

Since there are three main types of intelligences, according to Forés, Vázquez and Torre (2014), it is important for the professor to have the knowledge about his/her students' intelligences, in order to apply the correct teaching techniques and find a balance among all these types of intelligences. As every person has his/her own characteristics, experiences, genetic information, and culture among others, everybody learns differently. Therefore, the same techniques cannot be applied to everyone.

Figure 7

Question 8

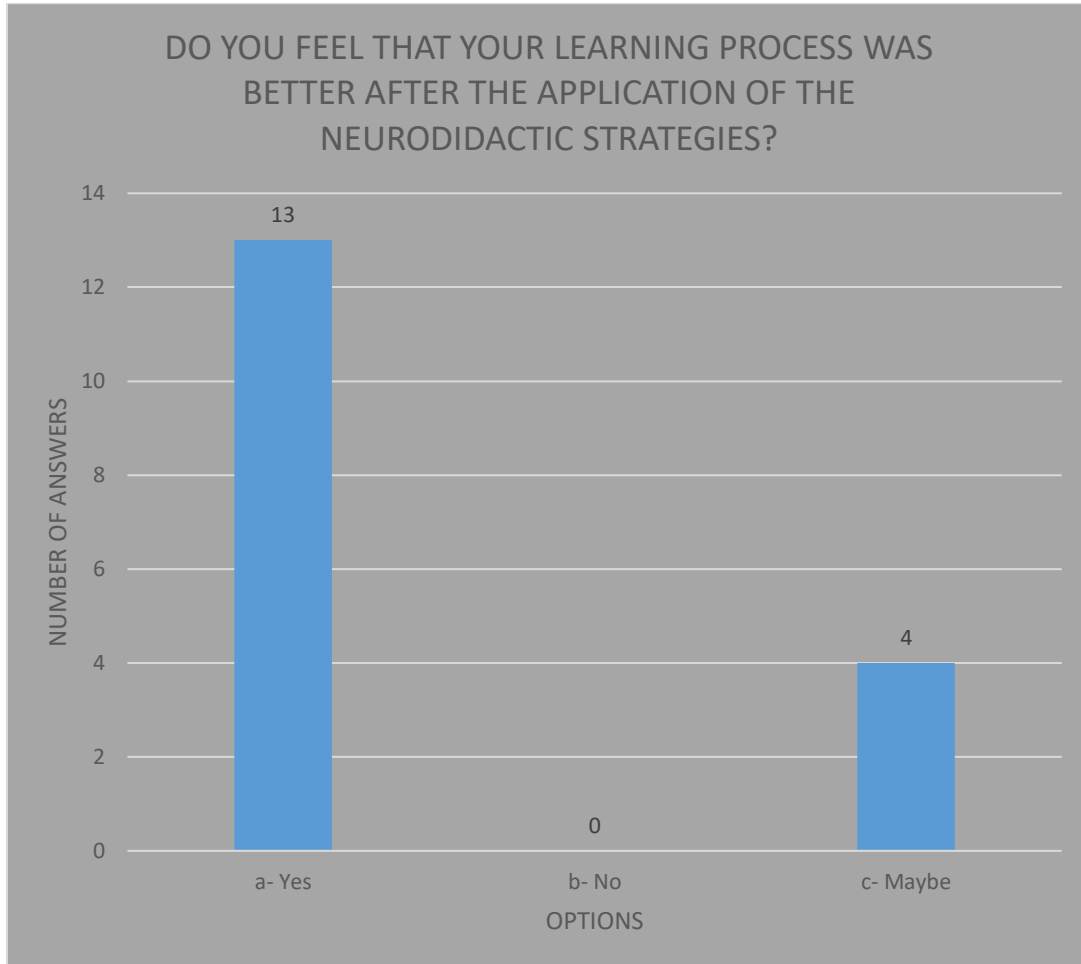


Figure 7 shows how students felt after the application of the strategies.
 Source: Researcher’s own creation

Thirteen out of 17 students answered that they had a better learning process when the Neurodidactic strategies were applied, and 4 out of 17 answered that maybe they could have a better learning process after the application of the Neurodidactic strategies. Neurodidactics promotes an innovate manner of teaching. According to Campos (2010), Neurodidactic allows the professor to understand the peculiarities of the nervous system and brain. At the same time, they can be able to relate this knowledge to the behavior of their students, their learning

proposal, their attitude, the class environment, among other factors. This can be the first step in educational training that will make a difference in the quality of education. Besides the students have obtained an idea about Neurodidactics, based on this information and on the answers received. Now they believe that Neurodidactic strategies can help them to have a successful and enjoyable learning process.

Figure 8

Question 9

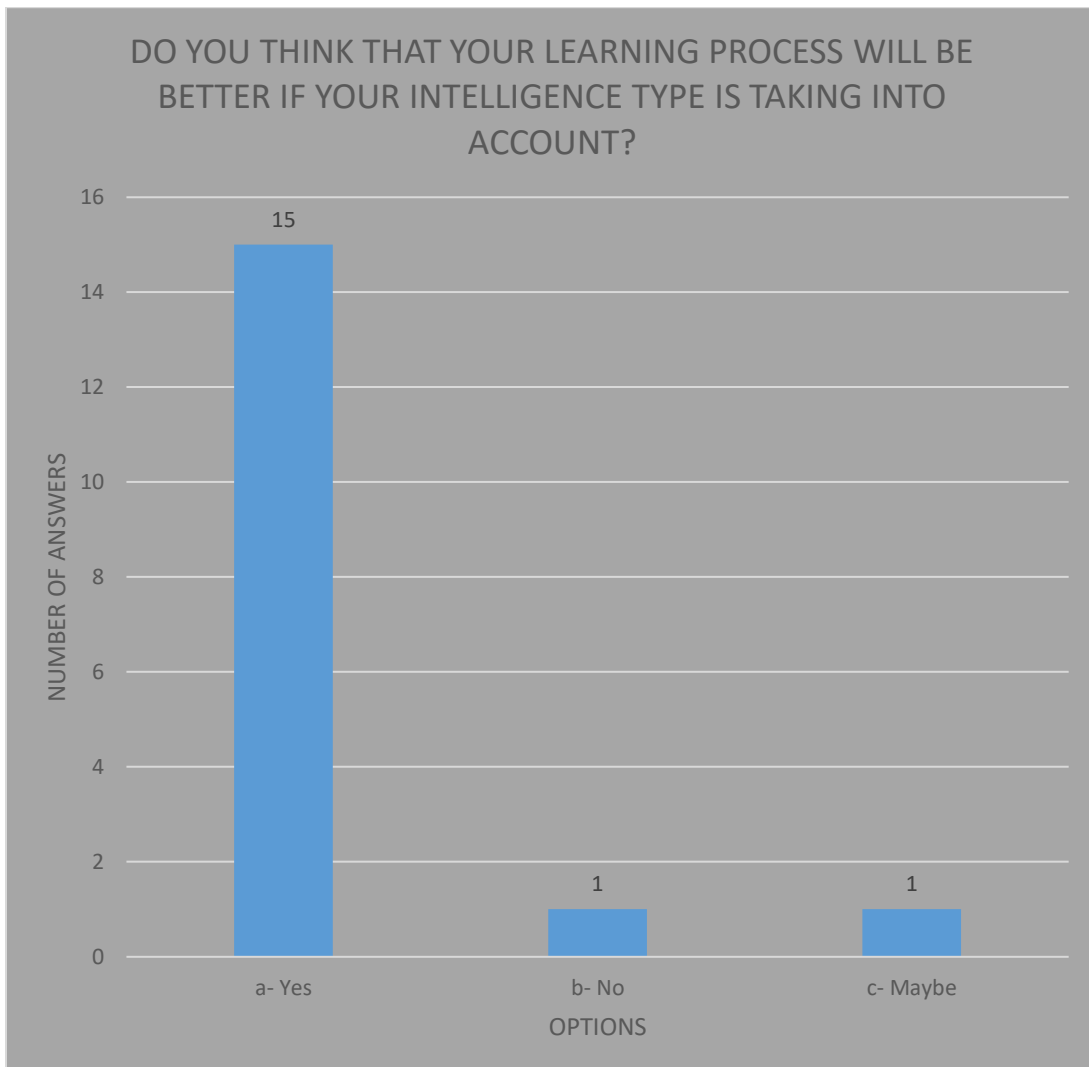


Figure 8 illustrates that students’ learning is better if their intelligence type is taken into account.
 Source: Researcher’s own creation

Regarding this question, 88.23% of the students (15) answered that their learning process will be better if their intelligence type is taken into account. 0.05% of the students (1) answered that it makes no difference if the intelligence type is taken into account or not, and 0.05% (1) answered that she/he is not sure if the type of intelligence can help in the learning process.

Forés, Vázquez and Torre (2014) considered that if the professor develops the three main types of intelligences during a class, he/she will include all the students; he/she will have better results with them; he/she will communicate better with them; and he/she will teach them to practice what they handle less.

Based on Neurodidactic, the intelligence types are like sensory codes that come out from our body. If the professor has a visual intelligence and the students have an auditory one; he/she should apply teaching techniques for the different types of intelligences because the “sensory codes” are different it can be said that this is the only way in which all the students will get the new information.

Figure 9

Question 10

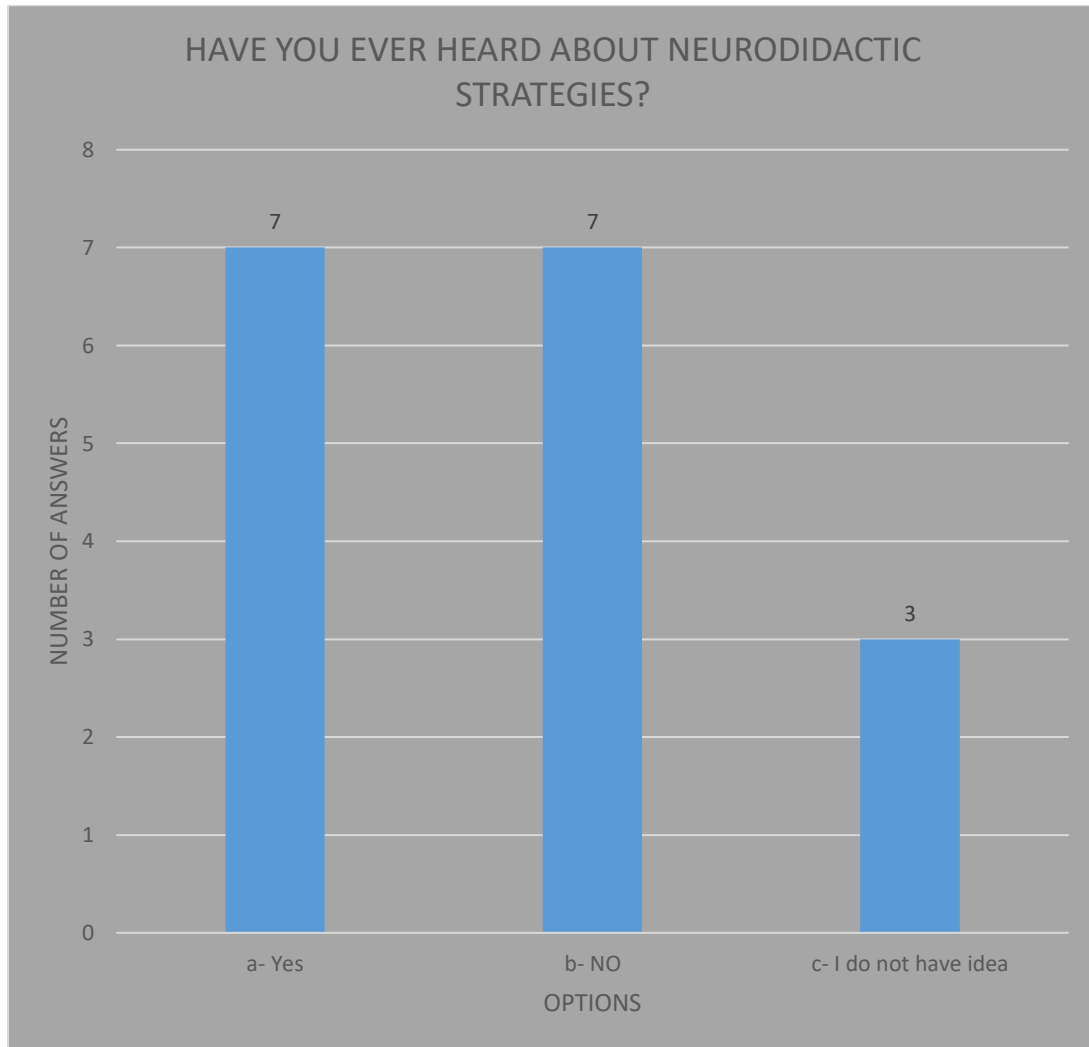


Figure 9 illustrates if students know something about Neurodidactic.
Source: Researcher's own creation

In this question, 7 out of 17 students answered that they had heard about Neurodidactic strategies. It calls to my attention the fact that in question 15, students answered that it was important to take into account the intelligence type, and this represented an 88.23% of the answers. In this question, 7 students answered that they had not heard about Neurodidactic

strategies, which represents 41.17%. According to this data, only 47.06% (8) out of the 88.23% (15) know what Neurodidactic is and think that it is important.

The majority of students (10) answered that they had taken an intelligence test, so it can be assumed that they know their type of intelligence; however, they did not know if the professor took into consideration their intelligence type, but the majority (10) thinks that the learning process will be better after applying the Neurodidactic. However, 41.17% did not know what Neurodidactic strategies are.

Based on the results obtained in this question, one can see the importance of investigating about Neurodidactic strategies because its strategies will help teachers and students develop different types of learning and teaching techniques, in order to obtain good results in the process. Neurodidactic strategies will help students avoid the feeling of frustration or be afraid to study grammar or any other subject that they consider difficult.

In the last question, the students were supposed to explain in their own words, what they thought about Neurodidactic or Neuroeducation. It could be noticed that the students had an idea about Neurodidactic strategies because some answers were: “it’s a creative form to teach into the class with interactive activities, so, the students can learn easier than with traditional classes. The objective is for learning through experiences, rather than memorizing exact words or definitions”, “I think it is a good way to learn easier taking account our intelligence type”, “ It is a kind of education that takes into account the differences among people to learn and apply strategies to attend these differences”, “I believe it is a type of learning where teachers use different strategies according to the way our brain or neurons work”, “The word Neuroeducation sounds like training your mind or about know your type of intelligence and be able to do much

more things; in my own words, Neuroeducation, explores your abilities to learn with different learning methods and this sound interesting for me”.

According to the answers given by the students, it could be seen that they had an idea about what Neurodidactics is, as well as on the new teaching and learning techniques it recommends. It focuses on the intelligence types, emotions, motivation, among others. As was shown that students, at least had an idea about Neurodidactics, while the professor did not know about it.

The important thing is that professors and students should investigate about advantages, disadvantages of Neurodidactics, as well as about all the necessary information to improve the learning and teaching process. It is also possible to start applying the strategies during a class or when students are in the process of learning new information. As a result, the time in schools, high schools, or universities may be pleasant instead of being boring and unpleasant.

Chapter V

Conclusions and Recommendations

5.1 Purpose of the conclusion

In the following chapter, the conclusions and recommendations of the research will be developed. All the data was acquired throughout the different sources and instruments applied such as observation, intelligence test, interview, and questionnaire. After a full analysis of each of them, the researcher is going to explain in detail if the objectives, as well as the problem statement have been achieved.

5.2 Conclusions

5.2.1 To identify the neurological aspects that affect people's learning

As Francis explains (2005), the learning process allows the subject to adapt to the cultural environment, as each process requires changes in the nervous system, it is necessary the plasticity of the brain to be able to learn and adapt to new situations. The ability to learn is also performed by the memory that makes learning possible based on the experience.

According to this this information, one of the neurological aspects that affects people's learning process is related to their cultural information, genetic, and memories stored. Costa Rica has the influence of the United States culture, so the English language is everywhere, If people are exposed to the language constantly, that experience will help them to learn the language easily.

During the observation, the researcher realized that the students were not able to express themselves in English, even though they had understood the grammar rules, words, expressions and pronunciation, when the professor spoke in the foreign language. This was possible because since the students' childhood, they have been influenced by TV shows, movies, cartoons, and so

forth. The memories stored in the brain help them to remember and understand what they heard once.

Mora explains (2017), that the human brain has areas in which the sensations and perceptions of the world are created through the information given by the senses such as, vision, hearing, touch, temperature, pain, taste, smell. There are other areas where the motor programs are made, and where the behavior is executed, also areas of association in which, for example, abstract, and symbolic thoughts and feelings are built.

This means that another neurological aspect that can affect people's learning will be the environment because all the information is received through the senses and then it is processed by the brain, but if that information is not received correctly, it will be not stored. For instance, if a person is sick, his/her attention will be focused on the pain, or if the person is hungry, the attention will be focused on every smell of food instead of on the information that the professor is explaining.

Going back to the observation, the professor tried to create a positive atmosphere during the class. However, since the majority are young people, they distract easily, and as the university is located in San José down town, there is a lot of noise such as, the train, the traffic jam, the rain, among others, that may disturb the students' attention. In that case, the clue is that the professor, as well as the students, should be conscious of the fact and try to find solutions that do not affect the learning process.

According to Posner and Rothbart (as cited by Barrera and Donolo, 2009), current literature shows that emotions, such as feelings, can encourage the learning process. It is very important to have a pleasant educational environment; emotion and motivation direct the system

of attention, and decides what information is stored in the neuronal circuits, and as a result learned.

Based on this information, other aspects that affect the people's learning process are the emotions and motivation because they are related to the responsibility of storing new information. During the two days of observation, the professor used games to promote the students' participation and at the same time their motivation because if they were told that if they won they would receive extra points as a reward.

According to Neurodidactics, these type of activities catch, students' attention, and at the same time if they are tired or they do not feel well, the feeling of competition makes them stop thinking about these things and start focusing on the activity, as well as on the reward that acts as a motivation. "If I win, I will have extra points". This is when the professor has to take advantage to provide new information because the student's attention is focused on the class, and as it was mentioned previously, the attention will store the new information in the brain.

5.2.2 To apply three Neurodidactic strategies to help freshmen students in grammar classes.

As Mora explains (2017), there are more strategies to help the professor to create a better class environment such as, beginning the class with something to get the students' attention, like a phrase, drawing, a thought or something shocking. Another one can be to introduce a daily problem that leads the awakening of students at the beginning of the class. As the same author stated that, these should be created a comfortable atmosphere in which the students feel relaxed, avoiding the feeling of being questioned about their doubts and avoid their feeling of being silly.

The strategy is to start the class with something different in order to have students' attention and at the same create a good atmosphere during its development, so that the students

feel confident to provide their opinions. The second day of observation, the professor began the class with a song related to Halloween. For this activity, he used technological devices. There was a first listening of the song, and once it was finished, the professor started asking questions about Halloween to see if they knew about it, and if in Costa Rica this activity was celebrated. The professor also wanted to know if they knew if in Costa Rica the horror legends were or so.

The students started to give their opinions mostly in Spanish, sometimes in English or combining both languages, besides the professor continued speaking in English. They spoke for around twenty minutes and the atmosphere in the class was totally different from the first observation because with this activity they felt comfortable, laughed when their classmates made funny comments, and learned new vocabulary. The class in which the first observation was carried out, was like a traditional one because they started reviewing homework. Therefore, when the activity was performed the students focused their attention to the class quickly and some of them did not notice that the class had already started.

According to Forés, Vázquez and Torre (2014), there are three types of main memories, which are: visual, auditory, and kinesthetic. For that reason, it is important for the professor to work with the three of them in a balanced way. For instance, the professor should use verbal explanations changing the tones and modulations of voice, in that way the voice would not be flat during the whole class. The professor can also use audiovisual contribution, diagrams, colors, and visual summaries.

Regarding this information, the second strategy is to know the intelligence types of the students in order to find a balance when applying the teaching methods. It is also important to know the professor's type of intelligence. Since the professor only knows his own intelligence type, the researcher applies an intelligence test that showed that eight people had visual

intelligence including the professor, eight people had kinesthetic intelligence, and only two people had auditory intelligence.

Based on these results, the researcher had a short meeting with the professor to advise him about the possible strategies that he could use to cover the three types of intelligences in his lessons. So, during the second observation the professor worked with a song and gave verbal explanations to cover the auditory intelligence. He also used a power point presentation to explain the new topic using visual aids to cover the ones with visual intelligence, as well as a game where the kinesthetic students could also participate. Throughout the development of the class, the professor could find a balance among his own intelligence and his students' intelligence, this increased the students' participation. They were motivated; had a good time, and, at the same, learned the new information.

As Forés, Vázquez and Torre explain (2014), implication and student participation in emotional activities such as games, metaphorical stories, music, short movie scenes, movement, and laughter. In this way, the teaching technique reaches everyone through one channel or another. Moreover if the professor develops the three types of memories during the class, he/she will get better results with the students. He/she will communicate better with them, and teach them to practice what they handle less.

The third strategy applied during both observations was a game. Games develop positive emotions and are useful for storing the new information. When games were applied by the professor, he made sure to create a good atmosphere, encourage the students' participation, and catch the students' attention.

During the game, all the types of intelligences were covered because the game was visual, they had to answer questions, and the professor was providing verbal assistance. He

provided feedback when they made mistakes and improved the students's self-esteem when they answered correctly. The professor encouraged the students' motivation, while they were playing, and learning new information as well.

5.2.3 To analyze the effect of neurological aspects when learning a second language

Moravcová explains (n.d.), that Neuropedagogy and Neurodidactics are considered a revolution in the educational field. However, everything depends on the way of teaching because professors have to be open to new views on education techniques. Also students' motivation play an important role because their success when learning foreign languages will depend on them.

Based on this information, in the first place, professors should be open minded, have the ability to adapt to the changes of teaching methods and apply them on every class, starting little by little and looking for the strategies that work better according to the students' intelligence types in the class. For example, the professor observed, did not know anything about Neurodidactic. However, he did his own investigation and with the guidance of the researcher, he could apply different strategies in which the students had different experiences in their grammar learning process, which is regularly considered one of the most difficult subjects to learn.

Therefore, the neurological effect will depend on the professor techniques to encourage motivation because using same teaching techniques all the time may not work for everybody. The successful result of the learning process will be good for the students because learning a foreign language requires a lot of practice. Since every person learns differently, because of his/her own characteristics, genetic information, experience, among others, each student will have the task to find the best strategy to receive and store new information smoothly and easily.

Moravcová mentions (n.d.), that it is important to know how the brain works, at least in a general way. The same author mentions that several senses are used when learning a foreign language. As the linguistics structures are developed in the brain, they also help to avoid forgetting the new vocabulary, which is installed in the brain and naturally used in speaking.

Another important effect will be to know how the human brain works in a general way, and second, to be conscious that all the senses are involved in the process of learning a new language. There are different structures developed in the brain, in charge of keeping the new information received and using it after to speak in the target language.

This author also mentions that one of the Neurodidactic basic requirements is to work with the individual talent; once this talent is discovered, it should be developed to the maximum potential, and then work with the weak areas. Based on the observation, the researcher noticed that some students had the ability to pronounce well, some others could understand the grammar rules better, and others needed the professor to reinforce the information given. The professor's task would be to identify students' talent and work with them according to it.

According to Samafolova (n.d.), it is important to take into consideration students' social needs in the classroom, as well as to apply technology, language tests, use electronic books, audio files, and so forth. It is very important for the students to learn and improve the foreign language. Moreover, the usage of new and modern teaching methods will help the professor to create a positive learning environment, also by showing respect, a friendly attitude, and a positive motivation, so students can feel more comfortable when learning the foreign language.

Based on the information the human brain is designed to learn by imitation, so the effect would be that the professor should handle the language, have enough expertise knowledge, and be able to communicate accurately in the foreign language. Therefore, the professor is going to

transmit communication skills, motivation, self-confidence, and the positive thought that it is possible to learn a new language.

During both observations, the professor handled the class very well, his pronunciation was clear, and he had the capacity and knowledge to answer every questions that students had. In addition, when he applied technical devices mixed with games, he created a good atmosphere in which students felt comfortable to speak and provide their opinions. The professor encouraged the students' participation as well their motivation; as a result, they were learning new information having a good time in class.

5.3 Restatement of the research question

The research question set at the beginning of this investigation was: What is the effect of using three Neurodidactic strategies to help freshmen students to enhance grammar knowledge? Based on the theory consulted and on the results after applying the Neurodidactic strategies, the effect was very positive because according to the observation, they helped the professor to plan the class activities better by creating a good atmosphere, a friendly attitude, and positive feelings, so that the students enjoyed the process of learning new information.

5.4 Unexpected results

The only unexpected result was that the professor observed did not know anything about Neurodidactic. Therefore, he carried out his own research about it, and also, with the guidance of the researcher, he could apply new strategies. However, when he applied these Neurodidactic strategies during his classes, for example, using technology or games, the only difficulty was that he did not have the knowledge about it or the purpose when applying this teaching method. He applied some techniques unconsciously because of his expertise, as a result, young people enjoyed the activities.

Another thing that it is important to mention is that students have an idea of what Neurodidactics is. According to the results of the questionnaire applied; however, their knowledge about it is very basic, and some others neither have any idea about Neurodidactics, nor about their own type of the intelligence, the information that is important in order to have a good experience throughout the learning process.

5.5 Recommendations

After all the information obtained during the investigation process and based on the results of the instruments applied, the researcher is able to provide the following recommendations. Students and teachers should pay more attention, on how the human brain works in a general way, as well as focus on determining their intelligence type because to know their own talents is an advantage for them. They should also work on the process of reducing their weaknesses, with these three elements, they could have a better experience throughout the learning process and be able to retain information not only for a test, but also for the rest of their lives.

Professors should be open minded with the new teaching techniques and investigate about the advantages and disadvantages of each of them. Professors should create a good atmosphere in every class by transmitting good feelings, such as friendship, communication, trust, motivation, self-esteem, among others. Professors also should know the intelligence type of every student in their classes, in order to create better and effective lesson plans to cover all the students' intelligence types involved.

For future investigation projects, the recommendation will be a deeper study of the brain's functions when learning new information. Besides, investigate more about Neurodidactic strategies, not only to apply them when learning the English language, but also to apply them to the rest of the subjects, so that the students may have a better experience while they are learning.

Another recommendation is to investigate if these Neurodidactic strategies are helpful in skills such as listening, speaking, reading, and writing, and even when learning vocabulary. In addition, the most important fact is that professors, as well as the students, know what their intelligence type is because this is the base of success of the learning process.

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Annexes

This instrument is important, because the researcher will ask a Grammar professor to answer the questionnaire below related to Neurodidactic. Therefore, his answers are going to help the researcher in the development of the research, in order to do the corresponding analysis to accomplish the objectives explained at the beginning of the Investigation work.

Interview to the Professor

1. What do you know about Neurodidactic?
2. What are the regular teaching strategies that you use in class?
3. Which are the Neurodidactic strategies that you know?
4. Which Neurodidactic strategies have you used?
5. What were the results obtained from using Neurodidactic strategies?
6. Do you think that they are useful? Why?
7. Do you recommend Neurodidactic strategies? Why?

The following questionnaire was created with the objective to request some help from the students. The answers provided are going to help the researcher with the analysis of the objectives in the research project due to it is related with Neurodidactic. If the students have some, inconvenient to answer in English they can answer in Spanish. The questionnaire does not represent any extra points on their grades.

Questionnaire to Students

Instructions: Please circle the best answer for you a, b or c. This questionnaire is confidential, and the objective is to help the researcher in the analysis of an Investigation work.

1. How do you feel in a grammar class?
 - a) Good
 - b) Frustrated
 - c) Bad

2. Do you think that grammar is difficult?
 - a) Yes
 - b) No
 - c) Maybe

3. If your answer was Yes or Maybe, please explain why:

4. What is your motivation to study grammar?
 - a) I do not have
 - b) Because, I have to
 - c) I really like it
5. Do you think that emotions are important when you are learning?
 - a) Yes
 - b) No
 - c) Maybe
6. Have you ever done a test to know what your intelligence type is?
 - a) Yes
 - b) No
 - c) Not sure
7. Has a professor ever taken into consideration your intelligence type?
 - a) Yes
 - b) No
 - c) I do not know
8. Do you feel that your learning process was better after application of the Neurodidactic strategies?
 - a) Yes
 - b) No
 - c) Maybe

9. Do you think that your learning process will be better if your intelligence type is taking into account?

- a) Yes
- b) No
- c) Maybe

10. Have you ever heard about Neurodidactic strategies?

- a) Yes
- b) No
- c) I do not have idea

11. Can you explain in your own words, what do you think Neurodidactic or Neuroeducation is?

Observation Rubric

	Yes	No	Sometimes
1. Did the professor begin the class with a motivational story, image, or phrase?			
2. Did the professor use Neurodidactic strategies?			
3. Did the professor provide verbal explanations?			
4. Did the professor use images, colors, visual summaries, or maps?			
5. Did the professor use a flat tone of voice?			
6. Did the professor have a positive attitude?			
7. Was the professor enthusiastic when explaining verb tenses?			
8. Was the professor concerned about the students' feelings?			
9. Did the professor know about the student's intelligence?			
10. Did the professor use different kind of tools such as music, technology, or hands on activities to explain grammar?			
11. Did the professor use an innovate manner to teach?			
12. Did the professor give guidance to solve grammar issues?			
13. Did the professor provide feedback?			
14. Did the professor give exercises to practice the new information provided?			
15. Did the professor create a comfortable atmosphere before and during the class?			
16. Did the professor motivate the students?			
17. Did the professor look for active student participation?			
18. Did the professor create a curiosity feeling in the class?			
19. Did the professor catch the students' attention?			
20. Did the professor handle the bad feelings of the students well?			

Intelligence Test (taken from “What’s your learning style created by the University of Dakota (2009) and adapted by the researcher with the objective to know the types of intelligences that the students have.

What's Your Learning Style?

For these questions, choose the first answer that comes to mind and click on a,b, or c.

Question 1

When you study for a test, would you rather

- a) read notes, read headings in a book, and look at diagrams and illustrations.
- b) have someone ask you questions, or repeat facts silently to yourself.
- c) write things out on index cards and make models or diagrams.

Question 2

Which of these do you do when you listen to music?

- a) daydream (see things that go with the music)
- b) hum along
- c) move with the music, tap your foot, etc.

Question 3

When you work at solving a problem do you

- a) make a list, organize the steps, and check them off as they are done
- b) make a few phone calls and talk to friends or experts
- c) make a model of the problem or walk through all the steps in your mind

Question 4

When you read for fun, do you prefer

- a) a travel book with a lot of pictures in it

- b) a mystery book with a lot of conversation in it
- c) a book where you answer questions and solve problems

Question 5

To learn how a computer works, would you rather

- a) watch a movie about it
- b) listen to someone explain it
- c) take the computer apart and try to figure it out for yourself

Question 6

You have just entered a science museum, what will you do first?

- a) look around and find a map showing the locations of the various exhibits
- b) talk to a museum guide and ask about exhibits
- c) go into the first exhibit that looks interesting, and read directions later

Question 7

What kind of restaurant would you rather not go to?

- a) one with the lights too bright
- b) one with the music too loud
- c) one with uncomfortable chairs

Question 8

Would you rather go to

- a) an art class
- b) a music class
- c) an exercise class

Question 9

Which are you most likely to do when you are happy?

- a) grin
- b) shout with joy
- c) jump for joy

Question 10

If you were at a party, what would you be most likely to remember the next day?

- a) the faces of the people there, but not the names
- b) the names but not the faces
- c) the things you did and said while you were there

Question 11

When you see the word "d - o - g", what do you do first?

- a) think of a picture of a particular dog
- b) say the word "dog" to yourself silently
- c) sense the feeling of being with a dog (petting it, running with it, etc.)

Question 12

When you tell a story, would you rather

- a) write it
- b) tell it out loud
- c) act it out

Question 13

What is most distracting for you when you are trying to concentrate?

- a) visual distractions
- b) noises
- c) other sensations like, hunger, tight shoes, or worry

Question 14

What are you most likely to do when you are angry?

- a) scowl
- b) shout or "blow up"
- c) stomp off and slam doors

Question 15

When you aren't sure how to spell a word, which of these are you most likely to do?

- a) write it out to see if it looks right
- b) sound it out
- c) write it out to see if it feels right

Question 16

Which are you most likely to do when standing in a long line at the movies?

- a) look at posters advertising other movies
- b) talk to the person next to you
- c) tap your foot or move around in some other way

Total your a's, b's and c's.

If you scored mostly a's you may have a visual learning style. You learn by seeing and looking. Visual Learners

- take numerous detailed notes
- tend to sit in the front
- are usually neat and clean
- often close their eyes to visualize or remember something
- find something to watch if they are bored
- like to see what they are learning
- benefit from illustrations and presentations that use color
- are attracted to written or spoken language rich in imagery
- prefer stimuli to be isolated from auditory and kinesthetic distraction
- find passive surroundings ideal

If you scored mostly b's, you may have an auditory learning style. You learn by hearing

and listening. Auditory Learners

- sit where they can hear but needn't pay attention to what is happening in front
- may not coordinate colors or clothes, but can explain why they are wearing what they are wearing and why
- hum or talk to themselves or others when bored
- acquire knowledge by reading aloud
- remember by verbalizing lessons to themselves (if they don't they have difficulty reading maps or diagrams or handling conceptual assignments like mathematics).

If you had mostly c's, you may have a kinesthetic learning style. You learn by touching and

doing. Kinesthetic Learners

- need to be active and take frequent breaks speak with their hands and with gestures remember what was done, but have difficulty recalling what was said or seen find reasons to tinker or move when bored rely on what they can directly experience or perform activities such as cooking, construction, engineering and art help them perceive and learn
- enjoy field trips and tasks that involve manipulating materials sit near the door or someplace else where they can easily get up and move around are uncomfortable in classrooms where they lack opportunities for hands-on experience communicate by touching and appreciate physically expressed encouragement, such as a pat on the back