ACTIVATION OF THE LIMBIC SYSTEM THROUGH THE L1 WITHIN THE L2 LESSONS FOR THE NEURODIVERSE INCLUSIVE CLASSROOM

Master's Degree in English for

Professional Qualification:

FINAL PROJECT

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CHAPTER I:

INTRODUCTION

1.1. ABSTRACT :

The reason of being or motivation for this research project is to explore some of the current approaches and brain-compatible classroom strategies that provide the most relevant and efficient nexus between the emotional and cognitive workings of our brain during the process of learning. For doing so, it is essential to examine the necessity of combining both neuroscientific research and pedagogical knowledge based on efficient teaching practices in the heterogeneous classroom.

Then we will go further and we will analyze the importance of such interface in the case of Special Needs Students (SNS), specifically those suffering from Developmental Delay giving rise to any of the diverse types of Learning Disabilities (LD) that exist. In addition, we will look at the social and also cognitive benefits of enriched environments in inclusive programs in Secondary Education, together with the most influential brain-based strategies used for the construction of such environments, including the role of teachers, families, and materials.

Moreover, we will devote the most important part of the project to explore issues related to the role of Special Needs Students' emotional filters in certain brain structures dealing with emotions, stress, anxiety, and motivation during the process of learning a L2, in this case English, and also the role of their L1, Spanish.

1.2. HYPOTHESIS AND GOALS:

The central hypothesis supporting this study is that the use of the L1 in the L2 class, together with some other brain-based strategies focused on students' learning styles and types of intelligences, have a fundamental role in the construction of an enriched environment within the neurodiverse L2 classroom. And the main reason is that students feel motivated to learn the L2 because their limbic systems have been activated. Such activation is triggered by the creation of a sense of belonging to a community that shares one basic element, the mother tongue. In this way, the use of the L1 at precise moments becomes a perfect brain-compatible strategy for avoiding anxiety and stress, and also for constructing an enriched environment in the neurodiverse L2 classroom. In this sense, the main goals of this research project are the following ones:

- Analyzing the degree of effectiveness of inclusive education programs in private, semi-private and public centers for the neurodiverse L2 classroom.

- Exploring students' perceptions and feelings about studying English in a heterogeneous classroom, together with the advantages and disadvantages of inclusive education.

- Examining teachers' perceptions about inclusive education and their capacities to manage with a heterogeneous class, regarding behavioral issues, students' needs, resources, and professional competency.

- Analyzing the degree of implication of educators with regards to inclusive education, and also the kind of methodologies and brain-compatible strategies that they use in the English class.

- And finally, exploring parents' opinions about the L2 inclusive classroom; what they think are the benefits or limitations of it; and what they expect from their respective children in terms of learning, evaluation, etc.

1.3. CONTEXTUALIZATION:

The present study has been carried out in Córdoba[1] capital city, located at the South of Spain. Its population is about 800.000 inhabitants and, in spite of the worldwide financial crisis, Córdoba can be considered as a middle-class society in general terms.

In the field of politics, Córdoba is ruled in terms of education, health service, etc. by two different entities, a national one, the Spanish Government, and also a regional one, *La Junta de Andalucía*.

Córdoba has been and is already a multicultural city, beginning with the presence of Roman and Muslim influences, the current Catholic culture, and the constant impact of tourism.

Figure 1.3.1 Map of Córdoba [Source: http://www.arquetas.net/images/mapa.gif]

However, such cross-cultural environment does not lead to a multilingual community. In fact, Córdoba is a deeply monolingual society, and that idea is one of the reasons why this study could have an important significance for this city, since we will examine the positive effects of the use of the mother tongue in the second language classroom.

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[1] In the present project, the Spanish term "Córdoba" will be used instead of the English one, "Cordova".

1.4. LIMITATIONS OF THE STUDY:

The main limitations found in the course of this research project have been, for instance, the refusal by certain Secondary Education Centers to participate in the study, alleging that they were not interested in being examined in terms of the effectiveness of their own inclusive programs. The headmasters' denial to take part in the study reduced the number of possible participants.

CHAPTER II: EPISTEMOLOGICAL FOUNDATIONS

2.1. THE TRIUNE BRAIN THEORY: HOW THE BRAIN WORKS:

> The brain is biologically programmed to attend to information that has strong emotional content first (Wolfe, 2010: 120).

According to Paul MacLean's theory of the Triune Brain, the *Homo sapiens sapiens* brain is the result of an evolutionary development provoking a successive establishment of several layers or components in the brain in response to our evolutionary needs. The three components that MacLean proposed were the Reptilian Complex (R-Complex), the Paleomammalian Brain or Limbic System, and the Neomammalian Brain or Neocortex (MacLean, 1974). These areas have specialized functions, but as they interact with each other, some of these functions are also interconnected.

In that way, MacLean claims that the current human brain is the evolution through natural selection processes of a different order of mammals, creating an only brain consisting on these three components: the R-Complex in charge of the basic functions for survival (as we share this primitive part of the brain with reptiles), the Limbic System dealing with the emotional processes (as it happens in the brain of every mammal), and finally, the Neocortex

devoted to the higher order cognitive processes (the newest and more human-like layer of the brain).
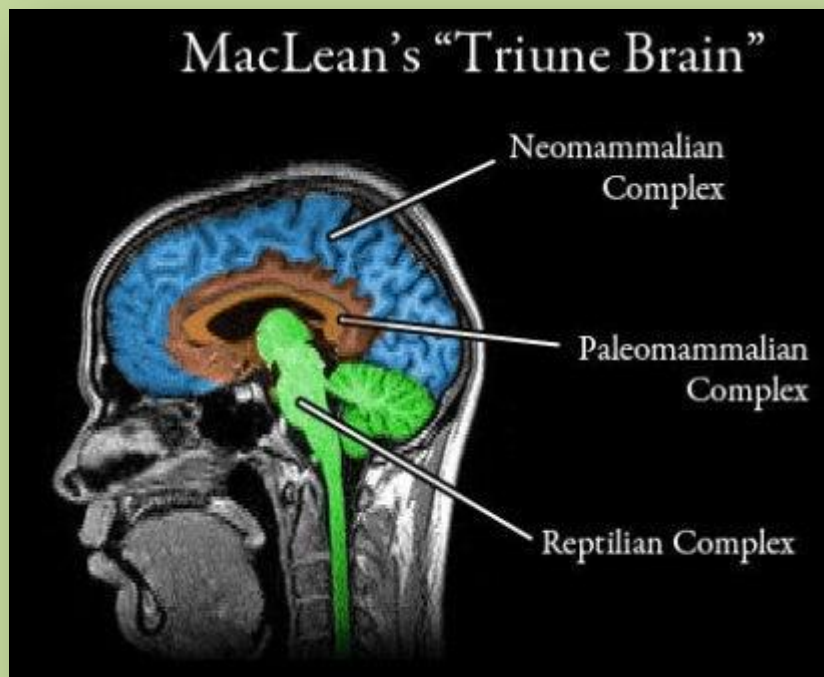
Figure 2.1.1.1. Triune Brain [Source: http://blogs.scientificamerican.com/guest-blog/files/2012/09/TriuneBrainUpdate-8.9.2012.jpg]

Nowadays, cognitive neuroscience uses certain tools for studying how the brain learns and works. Judy Willis, a recognized neurologist and classroom teacher, points out at some of these most important tools, such as the Computerized Axial Tomography scan (CAT or CT scanning), the Positron Emission Tomography scanning (PET scan), the Functional Magnetic Resonance Imaging (Fmri), and the Quantitative Electroencephalogram (EGG or Qegg) (Willis, 2007). Felice Corona also mentions the Transcranial Magnetic Stimulation (TMS) (Corona et al., 2011), and Patricia Wolfe talks about other early brain-imaging techniques, such as X-rays, Magnetoencephalogram (MEG), Event-Related Potential (ERP), and Single-Photon Emission Computed Tomography (SPECT), as well as new imaging techniques, like Near Infrared spectroscopy (NIRS), Voxed-based Lesion-Symptom Mapping (VLSM), and Multimodal imaging (Wolfe, 2010).

These technological and scientific advances, together with recent research on paleontology, comparative anatomy and neuroscience have criticized the oversimplification of MacLean's theory. For example, the studies carried out by Laura Bruce have confirmed that the

ancestors of mammals and reptiles already had a limbic system well-established (Bruce et al., 1995); the studies by George Striedter have proved that, although non-mammals (especially birds and reptiles) do not have a proper neocortex in the human sense, they have developed certain pallial regions that work in an homologous way in comparison to the mammalian neocortex (Striedter, 2005); and recent neurological studies like those by John Allman corroborate the idea that the limbic system is not an isolated and unified system, but on the contrary, some specific parts of it are closely interconnected with some areas in the cerebral cortex, so, the functions of the two systems are no longer separated but they constantly interact during the process of learning (Allman et al., 2001). This is why Chronister and Hardy (Chronister & Hardy, 2010) explain that,

> Algunos sistemas están interconectados de tal manera que una función determinada puede ser llevada a cabo por varios componentes que cooperan entre sí, y cada uno de ellos puede participar en varias funciones. El sistema límbico es uno de estos casos. Comprende estructuras que reciben información de diversas áreas del sistema nervioso central y participa en conductas complejas e interrelacionadas, como la memoria, el aprendizaje y las interacciones sociales (p. 494).

Some of these limbic structures that intervene in other systems are, for instance, the anterior cingulate cortex, the limbic association area, and the hippocampus.

Following the line traced by John Allman, we can mention the case of the anterior cingulate cortex, which is traditionally said to be part of the limbic system. However, according to Allman, the cingulate cortex is a specialized area of the cerebral cortex dealing with the regulation of both cognitive and emotional behavior (Allman et al., 2001). In fact, Allman identifies the cingulate cortex with what Broca called the limbic lobe (Broca, 1878). So, in this sense, the cingulate cortex or limbic lobe would be identified as the only internal lobe of the cerebral cortex (because there are other four external lobes: frontal, parietal, occipital and temporal), and this internal lobe is concerned with both memory and emotions.

In addition, the limbic association area also plays a linking function between the limbic system and the neocortex, since it provides most of the emotional forces for fostering the activation of other areas of the brain and it even provides the motivation drive for the process of learning itself.

Furthermore, a basic element in the limbic structure is the hippocampus, and it also plays a fundamental role in cognition, because it is in charge of some processes for long-term memory, and as we know, learning is impossible without memory.

In this way, and following Joseph LeDoux's criticism about the use of the term "limbic system" as something obsolete in terms of what McLean proposed, and also taking into account the current neurobiological studies, we have to say that the emotional and cognitive processes are no longer separated in two different systems, the limbic and the neocortex respectively, when we talk about the process of learning. On the contrary they are constantly interacting in that way: the emotions associated with certain events during the process of learning will determine whether or how long something will be remembered, and this is what is meant by learning (LeDoux, 2003).

To sum up, we could say that there exists some criticism about MacLean's theory of the Triune Brain Theory due to the oversimplification of the idea of such phylo-genetic evolution process of the human brain, but, for practical reasons and also because the term "limbic system" is well-spread, we will use this theory and its labels to construct the basis of a further development and study, taking into account the interconnections among the neuronal networks operating in our brain and also the interaction among the diverse components of it. As Patricia Wolfe declares,

It is imperative that we possess a system that quickly separates the essential from the frivolous, and we do. At one time, this system was called the limbic system, but this term proved to be somewhat limiting and perhaps even inaccurate. Scientists disagree about which structures compose this system, and, more importantly, they disagree over whether it is even a system. Perhaps the terminology isn't that important; what is important is that a group of structures work together to help us focus on those aspects of environmental input that are critical to our survival (Wolfe, 2010: 119).

Once these terms have been explicitly referred, now we can start explaining the fundamental ideas around the different components of our brain: the R-Complex, the Limbic System, and the Neocortex.

2.1.1. The Reptilian Complex

In the first place, we will deal with the Reptilian Complex. The R-Complex[2] consists of the brainstem and the cerebellum.

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[2] The term *R-Complex* is the abbreviation of the concept of *Reptilian Complex*.

On the one hand, the brainstem is composed by the medulla oblongata (which helps controlling our basic vital functions, such as the regulation of the heart rate, breathing, body temperature, or blood pressure), and the pons and the midbrain (both dealing with the interconnection of several brain structures involved in motor control and some sensory nuclei). The brainstem connects the brain to the spinal cord, which is the part of the Central Nervous System (CNS) within the vertebral column. The spinal cord transmits sensory information from the body up to the brain, and finally motor commands from the brain down to the muscles. In addition, the spinal cord also deals with certain unconscious and non-voluntary reflex pathways that operate independently from the brain. The brainstem intervenes in the transmission of the data processed by the hypothalamus for the execution of the so-called "fight-or-flight" response in stressful situations when we feel fear, so it is also concerned with the instincts of keeping safe, social dominance, and defending territory, together with the sexual and feeding drives.
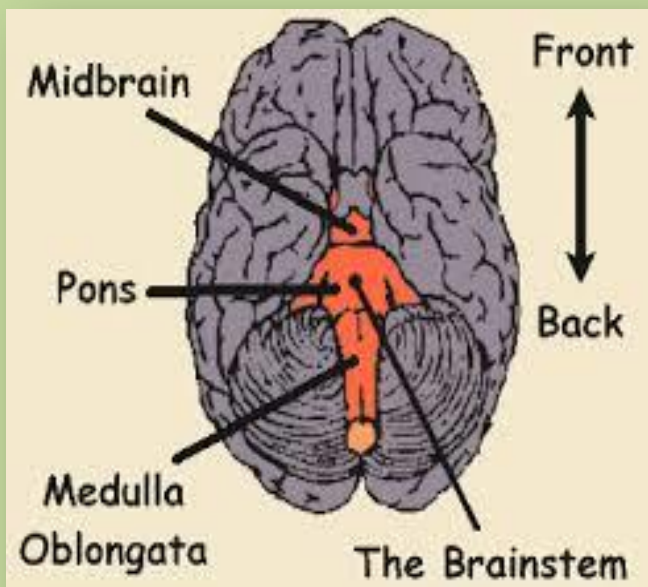
Figure 2.1.1.2. Brainstem [Source: http://www.mult-sclerosis.org/brainstem.gif]

On the other hand, the cerebellum deals with the integration of the information received from the rest of motor areas of the brain so that co-ordination of body movements is fluid and precise, posture and balance are maintained, and the muscle tone is controlled. As David Sousa proposes, the cerebellum is the main storing centre for the automated movements and mastered skills. So, for example, when the ability to perform a certain cognitive process (such as learning a foreign language) has been transformed from declarative into procedural, the cerebellum is the area that stores such automated memories and performs them in an unconscious way, but we will deal with that topic further in our research. In so doing, as the cerebellum is now in charge of a task that previously required consciousness and attention from the cognitive centers

operating at the cortex but at this time performed in an automatic way, the focus of conscious attention can be directed towards other mental activities (Sousa, 2006).

In other words, according to Carl Sagan, we can also talk about conscious learning turned into unconscious or ritualized behavior. That is to say, explicit or declarative information operating at the neocortex can be turned into implicit or procedural knowledge working at the level of the Reptilian Complex (Sagan, 1977).

So, the R-Complex is concerned with our physical survival (resembling in that way the behavior of animals), and with our more primitive instincts and automatic, unconscious, mechanical, and spontaneous behaviors, movements, and mastered skills. It is characterized by a compulsive nature and resistance to changes. It is thought that certain mental health problems (such as the Obsessive Compulsive Disorder, the Post-traumatic Stress Disorder, and the Panic Disorder) have their roots in the R-Complex. In a sense, this variety of instinctive, mechanical, unconscious, and we could even say, ritualized behaviors are in opposition to the explicitly learned behaviors.

2.1.2. The Neocortex

In the second place, we will devote to the understanding of the workings of the Neocortex. The neocortex is the outer layer of the cerebral cortex, and in general terms, it is in charge of our cognitive abilities, such as rational thinking, problem-solving, analytical processes, creativity, synthesis, reflection, attention, conscious processes, and other cognitively-demanding tasks, such as reading and writing. The neocortex is also concerned with the reception of explicit or declarative information.

An important amount of our neurons are housed in the neocortex, which is mainly composed by the so-called grey matter. On the other hand, the connecting and supporting cells (that is to say, dendrites and axons, respectively) are basically composed by white matter, being their function to bring information to and fro the neurons.

Every lobe is covered by its cerebral cortex and neurons, so, it will be the lobe the one that determines what conscious activity the cortex neurons will mediate. The neocortex is split up into two almost symmetric hemispheres, right and left ones. Each hemisphere is subdivided into four external lobes. According to David Sousa, these lobes are characterized by the following features (Sousa, 2006):

- The frontal lobe is involved in executive functions and higher order thinking processes, such as problem-solving, decision-making, anticipation of the future in order to ensure that the experience will be gratifying rather than painful, thinking, analyzing, planning, understanding the consequences of one's actions rather than giving rise to emotional impulses, prioritizing, forming judgments, and other conscious processes. In addition, the frontal lobe is in charge of the brain's rational and executive control centre, and the regulation of the emotional system, linking this cortical area to the limbic centers. Working memory is basically housed in the frontal lobes, because focus of attention comprises that area of the brain.

- The parietal lobes are related to spatial perception and orientation, functions related to movement, calculation, and certain types of sensorial recognition and reception processes.

- The occipital lobes, located at the back part of the brain, are fundamentally in charge of visual processing.

- And finally the temporal lobes are associated with speech comprehension and recognition, perceptual tasks, hearing, and long-term memory storing.

The two hemispheres are interconnected through the so-called *corpus callosum*, a thick band of nerve fibers containing millions of neuronal networks. Although the two hemispheres are closely interconnected, each of them is in charge of certain specific capacities. For instance, the left hemisphere is concerned with analytical and logical processing, planning and the execution of elaborated plans, sequential operations, verbal communication, and it deals with realistic and intellectual issues.

On the other hand, the right hemisphere is in charge of intuitive and holistic processing, global operations, non-verbal communication, and it deals with imaginative, creative and emotional issues.

Humans, in comparison to other primates, have a larger volume of white matter concentrated in the prefrontal cortex. This is the reason why we have developed more cognitive abilities, since this white matter is composed by neurons with a myelin sheath or myelin-covering layer that makes broader interconnections with other parts of the brain. And this extra interconnection which other primates' brain lack is what makes the human species unique.

This connectivity between the prefrontal cortex and the rest of parts of our brain is essential for the well-functioning of the so-called working memory, since it is involved in most

of our cognitive abilities. An example of it could be how we retain information while we perform a certain task and, at the same time, keeping the objective of the task in mind. The neocortex is flexible and we could dare to say that it is able to comprise almost an infinite number of learning abilities, and this is what has enabled the human race to develop so much in cognitive terms.

In addition, the human expansion of the neocortex has been achieved due to its association with the development of language and complex social interactions. So, this expansion of the prefrontal cortex together with the associative capacities of the neocortex and its plasticity are the key sources for the majority of our cognitive abilities.

2.1.3. The Limbic System

In the third place, we will deal with the Limbic System. The limbic system is said to be the emotional core of the human brain, as Judy Willis clarifies, dealing with stress reactions, emotional responses, and fear patterns (Willis, 2007). The limbic system is a group of interconnected brain structures in charge of olfaction, emotion, motivation, behavior, learning, memory, and certain automatic functions.
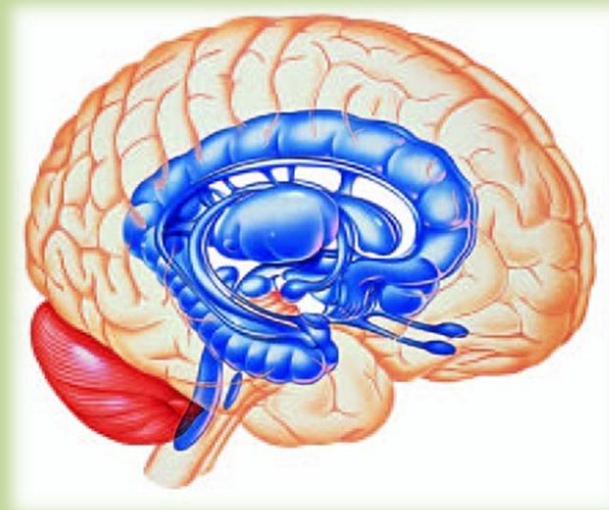

Figure 2.1.3.3. Limbic System [Source: http://psynauts.com/wp-content/uploads/2014/05/limbic_system.jpg]

According to Duane Haines and Gregory Mihailoff, the limbic system is composed by the limbic lobe, and its afferent and efferent connections to other nuclei belonging to the telencephalon, diencephalon, and brainstem. On the one hand, the limbic lobe is made of the subcallosal area, the cingulate circumvolution and its isthmus, the parahippocampal circumvolution, and the uncus. On the other hand, the limbic lobe has afferent and efferent connections to the thalamus, the hippocampus, the medial temporal lobes, the amygdala, and some areas of the frontal lobes (Haines & Mihailoff, 2010: 241 -242).

When sensory input enters the brain, this data passes through two filters: the reticular activating system (RAS) and the affective filter. The first one belongs to the Reptilian Complex, whereas the second one is part of the limbic system. Once the input has been filtered by these two systems, it can be "acknowledged, recognized, connected with relational memories, patterned, and ultimately stored in long-term memory" (Willis, 2007: 18). It is at this moment when the declarative or explicit information is more likely to become procedural or implicit knowledge, giving rise to the process of learning.

Following Eric Eich's reasoning, the RAS filter is a brain pathway dealing with emotion. It is located at the brainstem and it is in charge of switching activation and attention. The sensory receptors of our head, neck, trunk, arms and legs send the sensory input up through the nerves converging into the spinal cord. Then, this incoming data passes along the RAS, and finally through the rest of the brain (Eich, 1995).

According to Patricia Wolfe, the RAS is the filter that selects which incoming stimuli will be attended to or ignored before it can reach the relational, patterning, and memory storage areas of the brain.

> The brain is constantly scanning the environment for stimuli, a process done largely by automatic mechanisms (...) The reticular activation system (RAS) plays an important role in filtering thousands of stimuli, excluding trivial information, and focusing on relevant data. In other words, your unconscious brain is usually in control of the initial decision-making process for you (Wolfe, 2010: 114).

Therefore, as Jack Cooper and others point out, if learners perceive the teaching situation as a threat and as a stressing state, they will never get engaged in the task of learning, because the RAS will filter out the teaching input and will only attend to the basic survival needs or life-sustaining sensory input (Cooper et al., 1996).

Judy Willis attends to this same issue (that she refers to as the *survival mode of attention*) but just focusing on the case of ADHD students. I personally believe that such idea can be extrapolated not only to ADHD learners but also to those students suffering from any kind of learning disability (LD). So, this quotation that I have selected from Willis' work, in a sense, can be applied to LD students in general:

Ideally, students are beyond the basic survival mode and can direct their attention to more than just securing safety. However, too much stress[3] can push students into this survival mode. Excessive stress commonly arises in AD/HD students when they feel confused and overwhelmed by a lesson or separated from classmates because of their inability to connect with, focus on, or create meaning from the lesson's information. From this state of tension and agitation, it is difficult to get back on track, make sense of the data, and know what to focus on. This stress-induced survival mode, like the adrenalin fight-or-flight response, blocks students' abilities to select the meaningful input from their sensory environment (Willis, 2007: 67).

Another fundamental filtering pathway for the process of learning is the amygdala. We could say that the amygdala is the heart of the limbic system since it is in charge of the issues dealing with threat, fear, and anxiety, so much related to stress and emotions that can also facilitate or block memory storage and consequently, the learning process. The amygdala is a part of the limbic system interconnected to the temporal lobes, and it is closely related to the concepts of memory and the

Figure 2.1.3.4. [Source:
http://knowingneurons.files.wordpress.com/2013/02/words-amygdala-small.jpg?w=610]

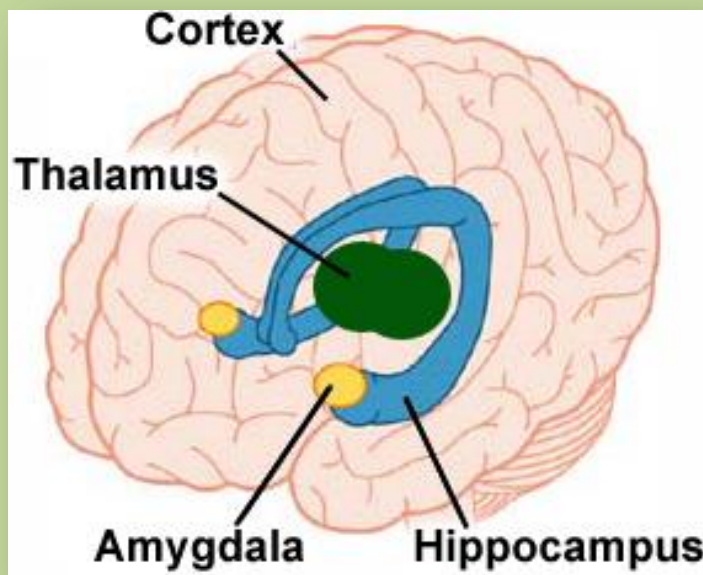[3] In my opinion, stress, as it is explained by Willis in this quotation, can appear, for instance, in a learner who could not follow the instructions for a determined exercise because the teacher did not make an explicit reference to the task in question by using the L1 to clarify what has been explained by using the L2. This situation can trigger a stressful reaction in the mind of the learner.

so-called Affective Filter. In 1988, Steven Krashen developed the hypothesis of the affective filter within his theory of language acquisition and development. As William O'Grady and others explain, Krashen's hypothesis postulated that low stress rates leaded to a more successful acquisition of the second language. On the contrary, stress produced anxiety and low self-confidence, and consequently, learners suffered from a mental blockade that provoked failure to process the new information (O'Grady et al., 1997).

Judy Willis defines the term affective filter in these terms, connecting this notion with the function of the amygdala:

Subsequent research revealed that after presentation of pleasurable, comforting, positively reinforcing, intrinsically motivating stimuli, the amygdala could be moderately stimulated or warmed up to the alert state that actually facilitates active processing and neuronal transport of information. This represents the actual neuroimaging visualization of what has been called the affective filter – an emotional state of stress in students during which they are not responsive to processing, learning, and storing new information. This represents objective physical evidence that during periods of high stress, new learning doesn't get in to the information processing centres of the brain (Willis, 2006: 25).

According to Víctor Uriarte Bonilla, the notion of anxiety can be defined as the response when facing a threatening situation provoked by the individual's lack of security in physical, psychological, or even social terms (Uriarte, 2013: 175). In this way, the main mechanism dealing with the concept of anxiety is the amygdala, since it participates in the elaboration of an emotionally adaptive response when there is a stimulus of emotional content. As Patricia Wolfe clarifies,

The amygdala could also be called the psychological sentinel of the brain because it plays a major role in the control of emotions (…). All incoming sensory data, except smell, travel first to the thalamus, which relays the information to the appropriate sensory-processing areas of the cortex. At the same time that the thalamus is sending information to the cortex, it sends the same information to the amygdala for evaluation. If the amygdala determines that the stimuli are potentially harmful, it triggers the hypothalamus, which in turn sends hormonal messages to the body, thus creating the physical changes that ready the body for action: heightened blood pressure, increased heart rate, and muscle contractions (Wolfe, 2010: 29).

When the individual is repeatedly exposed to a certain threat, there will be a process of increasing sensitivity towards it, and finally the amygdala will develop an emotionally learnt state in such individual.

Memory and learning are cognitive abilities, normally associated to the neocortex; whereas the affective filter is generally associated to the limbic system. That is the reason why the workings of the amygdala are fundamental for learning something in a successful way, since both systems become interconnected. When the senses register input, the brain responds to such sensory information by passing it along different filters, being the amygdala one of them. It is in the amygdala where the input can be finally moved to memory storage. The incoming data, at this moment, can be accepted or blocked by the affective filter function of the amygdala. That is to say, if the learner is suffering from stress or any negative emotion during the lesson and consequently the amygdala is overloaded with such emotions, then, the affective filter will irrevocably block the opportunity of the input to become stored in memory.

On the contrary, if the learner is involved in a positive, pleasurable, engaging, and motivating environment, the affective filter will be low and will allow the processing of information, giving more opportunities for such data to become stored in the long-term memory bank. This learning process will be successful if the learner happens to be in what Judy Willis calls the *interest mode of attention*. In that way, when learners are in this mode, they pay attention to what is of interest for them, what calls their attention due to newness, pleasure, familiarity, surprise, or creativity, and they feel emotionally comfortable and willing to focus on learning (Willis, 2007)[4].

Furthermore, as Willis explains, there is a third level of attention that she calls the *selective mode*, and it is fundamental so that the process of learning is successful and the information is finally stored in the long-term memory:

> Students who have reached the highest level of selective attention can focus on the sensory input they need to understand the lesson. This state is most likely to occur when students link their own ideas to a topic of study and raise questions to which they want answers or embark on paths they want to follow. During this state, they will be motivated to work through interesting problems that puzzle and challenge them (...). During this elevated state of selective focus, the frontal lobe executive functions are stimulated. Just as with any repeatedly used and stimulated brain circuitry, the more students use these brain regions, the stronger the circuits will get. More dendrites and synapses will grow, and presumably this brain region will increase its efficiency (Willis, 2007: 68).

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[4] For further information about the physiological processes under this explanation, see page 57 of the report.

According to Ines Introini-Collison and others, if there is a low metabolic activity in the brain regions that process input coming from the amygdala, it is due to the fact that the amygdala is involved in a hypermetabolic state in response to stress, and consequently, the input is being blocked by the affective filter and will not reach the secondary processing areas. This has been demonstrated by the application of Fmri and PET scans, corroborating that low metabolic activity in the brain is provoked by less oxygen and glucose use (Introini-Collison et al., 1990; and Introini-Collison et al., 1991).

Furthermore, the hippocampus, located close to the temporal lobes, is another limbic system element so fundamental for the connection between learning and memory. Following David Sousa's explanation, one of the main differences between the amygdala and the hippocampus is that, although both areas are limbic system structures related to long-term memory storage, it is only the amygdala the one that comprises the recall of emotional or personal memories which are fundamental for a proper learning process (Sousa, 2006).

2.2. MEMORY & LEARNING:

FROM DECLARATIVE TO PROCEDURAL

> Hay una tendencia a considerar el sistema límbico como un conjunto de estructuras que influyen no sólo sobre la emoción, sino también sobre las funciones cognitivas. El área donde existe un mayor acuerdo en este tema es la memoria (Chronister & Hardy, 2010: 504).

The workings of the different brain memory systems can explain the process through which explicit or declarative information is turned into implicit or procedural knowledge. First of all, it is necessary to make a distinction between short-term and long-term memory storing banks.

Short-term memory is also labelled sensory and working memory. On the other hand, long-term memory processing, according to Patricia Wolfe, is divided into declarative and procedural. Declarative memory is a conscious process that requires explicit retrieval or recall; whereas procedural memory works in an unconscious way for implicit recall and retrieval (Wolfe, 2010: 144).

Then, Patricia Wolfe provides a subclassification of long-term memory banks by using a different terminology to that of Judy Willis, but the concepts are equivalents. So, as Patricia Wolfe states, declarative memory is made of episodic and semantic memory (using the same terms that Judy Willis employs); and procedural memory is split up into skill learning (identified as procedural memory by Judy Willis) and priming (called automatic memory by Judy Willis) (Wolfe, 2010: 144 – 145; Willis, 2007: 114 – 116)[5].

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[5] From now on, we will use both terminologies, provided that their notions do not contradict each other.

2.2.1. Short-term memory

Short-term memory, also labeled working and sensory memory, is located at the prefrontal cortex, and it can be considered the third filter which information passes through, after the RAS and the amygdala's affective filter. The short-term memory is the system in charge of the information that will remain in our brain for about 20 seconds and then it will be discarded due to the fact that it did not make any meaningful connection along the neuronal networks. On the other hand, the information that finally reaches the cortex and makes any meaningful connection will be retained and encoded by other memory systems. Patricia Wolfe explains that,

> Working memory allows us to integrate current perceptual information with stored knowledge and to consciously manipulate the information (think about it, talk about it, and rehearse it) well enough to ensure its storage in long-term memory (...). Working memory is also involved in higher cognitive executive functions, such as planning, organizing, and rehearsing (Wolfe, 2010: 124).

2.2.2. Long-term memory

Long-term memory is defined by Patricia Wolfe as "the last part of our information-processing model" (Wolfe, 2010: 143). It is subclassified into two categories, declarative and procedural memories.

Declarative memory:

Declarative memory deals with explicit and conscious recall about events and about what something is. There are two types of declarative memory, episodic and semantic:

- Episodic or event memory system is located at the hippocampus, and its stored memories are recollections of events together with the emotions associated to such events. Following the research by Bliss and Collingridge, the stronger the emotional charge associated to an event is, the better and easier it will be remembered and retrieved once it has been stored in the long-term memory (Bliss & Collingridge, 1993). As Patricia Wolfe explains,

> Episodic memory is sometimes called source memory because it involves remembering where and when information was acquired (...). It is your record of faces, music, facts, and individual experiences – a sort of autobiographical reference (…).The brain does not store memories in a linear manner (...), it stores memories in neural circuits or networks. When we recall an event, we are actually reconstructing it. Even though many events are important or

emotional to be remembered, the details often escape us. In these cases, the brain fills in the details by a process known as refabrication (Wolfe, 2010: 145).

- Semantic memory is also stored in the neurons of the hippocampus and some areas of the temporal lobes, and it is configured by means of repetition and drill. That is why these kinds of memories are the hardest to remember and retrieve, and consequently, the most difficult to be patterned and finally stored in the long-term memory, since they lack in having any connections to positive emotions or to relational memory. According to Baddeley and Andrade, when the contents of a lesson are presented in the format of a static list, learners will require some useful strategies to remember such information, such as mnemonic devices, rhymes, outlines, frequent reviews, graphic organizers, activities fostering mental manipulation of the information, metaphors, etc. (Baddeley & Andrade, 2000). Patricia Wolfe compares semantic memory to episodic memory in the following terms,

> Semantic memory, on the other hand, is generally fairly accurate. Semantic memory includes words, their associated symbols, rules for manipulating those words, and the relevant definitions. It also consists of rules of grammar, chemical formulas, mathematical rules, and your general knowledge about the world. These facts are normally independent of a particular time or place (Wolfe, 2010: 146).

Procedural memory

Procedural memory implies the storage of information about how to do something in an implicit and unconscious manner. There are two types of procedural memory, skill learning and automatic memory:

- Skill learning memories (as Patricia Wolfe refers to the concept) or procedural memories (according to Judy Willis), are the stored information on how to perform certain procedures. These memories are located at the cerebellum, the brain region in charge of the control of balance and coordinated movement. Some examples of procedural memories are, for instance, physical patterns or routines for riding a bike, walking, typing, etc. By using movements and kinesthetic strategies, for example, teachers in inclusive classes can make more accessible certain contents once the learners store such information as procedural memories.

According to Larry Squire and Eric Kandel, at the early stages of skill learning there are three main elements working together: the prefrontal cortex, the parietal cortex, and the

cerebellum. Their goal is to allow the individual to pay attention to the task or skill being practiced. In the next stages of skill learning, after rehearsal and repetition of the task, these three elements show less activity little by little, letting other components to become more engaged: the motor cortex and the cerebellum, so that finally the skill reaches the automatic level (Squire & Kandel, 2000).

- Automatic memories are also located at the cerebellum. They possess a conditioned-response nature, since they deal with the information which is needed to be automatically activated due to its frequent use or because it is the basis on which other actions are constructed. For the contents of a lesson to be stored as automatic memories, it is a good strategy to use songs, rhymes, mnemonics, etc. Patricia Wolfe talks about the notion of priming, rather than automatic memories:

> Priming involves the influence of a past experience without any awareness or conscious memories of that experience. In a sense, priming is similar to skill learning; in neither case are you consciously aware of what you are doing – which is why both skills and priming are sometimes called *implicit* memory (...). It may be that, for a period after seeing a word, less neural activity is required to process that word again (Wolfe, 2010: 147).

When the priming process has been fulfilled, according to Judy Willis, information is stored, it can be remembered correctly, and it can be used with executive functions. Nevertheless, such information stills need to be reviewed from time to time through repetition of the task resulting in reinforcement of the neuronal networks. Thus, the outcome will be the consolidation of such information in the memory storage banks. (Willis, 2006: 29 - 30). Judy Willis defines the notion of consolidation in these terms:

> Consolidation of information involves using the most effective strategies to first acquire information and then practice and rehearse it. The best-remembered information is learned through multiple and varied exposures followed by authentic use of the knowledge by processing it through the executive functions centres (Willis, 2006: 30).

Other memory systems

In addition, Judy Willis explores other two types of memory systems that Patricia Wolfe does not contemplate as such, although she also talks about the same notions along her work. These two memory systems are the relational and the emotional memories.

When we talk about emotional memory we have to refer to the fact that learning is always affected by emotions. In that sense, the incoming information or sensory data will enter the brain's cortical information-processing regions after being filtered by the amygdala's affective filter. So, when students are engaged in a positive, motivating and reasonable challenging classroom environment and they feel safe because they know that their class community always turns mistakes into opportunities for learning, the information will be rapidly filtered by the amygdala and it will be also connected to the learners' encouraging and positive emotional state felt during the lesson. On the other hand, as Gardner and Lambert expose, when learners feel stressed, frightened, or unmotivated, it is probable that the information taught will never reach the long-term memory bank (Gardner & Lambert, 1972)[6].

Finally, relational memories are those that develop into neuronal networks. These already established neuronal circuits recognize patterns. Such structures are basically sensory input that has entered the brain and has been patterned. When new input comes, there is a process of searching already stored memory banks for categories to compare and link them to such new entering information. Then, two things can happen: first, the incoming information, according to Patricia Wolfe, can be related to previously existing memories due to a process called pattern recognition, or the information is totally novel and, consequently, not recognized by the former neural arrangements (Wolfe, 2010: 114). In this last case, if the novel information is personally relevant and meaningful for the individual, he or she will pay attention to it, and then new circuits will be formed in the brain, or even the previous ones could be reshaped in order to include this new incoming data. As Patricia Wolfe states,

> The brain may attend to the meaningless information for a short time because it is novel, but if it can make no sense out of the incoming stimuli, the brain will probably not process this information further (...). If the brain can find no previously activated networks into which the new information fits, it is much less likely to attend to this information (Wolfe, 2010: 117).

This relational memory process stimulates the workings of the executive functions. By means of frequent practice, review and repetition, the relational memories reactivate and the connections to the new input (either creating other circuits or reshaping the existing ones) are strengthened.

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[6] For further information about how emotions influence the process of learning, see page 57 of this report.

2.2.3. Memory and the process of learning: The three brains working together

To sum up, and following Judy Willis, we can say that our memory systems follow this path:

> From the most basic awareness of our environment, our memory skills progress to rote memory, working (short-term) memory, pattering and connections to relational memory, and ultimately, long-term memory storage (Willis, 2006: 5).

On the other hand, the process of learning happens in that way: the student takes in sensory data and the brain generates patterns by relating new information to already learnt information. These patterns then pass from sensory response regions through the emotional filters: the RAS and the amygdala. When there is an ideal amount of comfort and stimulation, the emotional filters pass the information along to memory-storage neurons, which now are ready for the arrival of data due to the sufficient release of dopamine, adrenaline, and norepinephrine. In this way, information moves first to short-term memory, then to relational memory, and finally to long-term memory. After it, the information is relayed on the cerebral cortex. Next, the information can be activated and sent to the frontal lobes, our executive function regions dealing with the higher order processes of cognition and manipulation of information. And finally, when the learnt skill is frequently practiced and reviewed, and there is motivation for doing it, the information that had been previously stored consciously as declarative or explicit will become automated and controlled in an unconscious way by the cerebellum in the form of procedural or implicit knowledge. When information has been consolidated, it can be easily retrieved and applied to future situations for problem-solving issues (Willis, 2006: 33 – 34).

2.2.4. Brain plasticity and pruning

The fact that more neuronal networks can be constantly created when learning something new, together with the possibility of recognizing established patterns or reshaping the ones that are already structured are the consequences of the plasticity of our brain. According to Jay Giedd, this plasticity is possible because dendrites connecting neurons are growing throughout life because of our processes of learning. Such dendrites increase not only in number but also in size, creating powerful neuronal circuits. In addition, neuronal networks can be

reshaped, recognized, and even pruned, depending on their frequency of use (Giedd et al., 1999).

The incoming data passes along from one neuron to the next one within the neuronal network. Such information travels as electrical impulses along the dendrites and axons of neurons, but as chemical impulses when crossing the synapses. The synapses are the gaps between one neuron and the next within the neuronal circuit. When data is crossing synapses as chemical impulses, there is a release of neurotransmitters that carry the information to the other side of the synaptic connection, that is, to the next neuron. In so doing, neurotransmitters stimulate the next neuron so that the information goes on travelling through the axon and dendrites as electrical impulses. As David Sousa explains, the most common neurotransmitters are serotonin, epinephrine, acetylcholine, and dopamine (Sousa, 2006).

Neuronal pathways cross-connect to the diverse storage areas of the brain. If the information received is emotionally and personally relevant, these neuronal pathways will activate. When they are activated repeatedly because of the frequent presence of these emotionally and personally relevant and motivating stimuli, the neuronal circuits will be strengthened and the process of memory retrieval will take less effort. Patricia Wolfe talks about the reactivation of neuronal networks in these terms:

> One current hypothesis is that the synapses among neurons that represent experiences become strengthened over time. This is referred to as long-term potentiation (LTP) (...). When two or more neurons are active at the same time, they become more sensitive and are more likely to fire a second time. The more often a pattern of neurons is activated, the more efficient the associated synapse becomes. This increased efficacy of the synapses is what many scientists refer to as LTP (Wolfe, 2010: 149).

So, when certain neuronal pathways are frequently used, their connection is maintained and the information they store can be retrieved easily. According to Judy Willis, dendrites grow when being stimulated by proteins called neurotrophins in response to information, experience, and especially, learned skills (Willis, 2006: 1). Furthermore, when a certain neuronal circuit has become automatic due to practice, repetition and frequent use, it gets pruned. As Judy Willis comments, "Pruning generally happens when a practiced routine or thought process has become so well established over time that the steps building up to the action or memory can be eliminated" (Willis, 2007: 152).

In that way, when a process turns automatic it is because the neuronal circuits involved in such process are not needed any more or they are no longer stimulated. That is to say, the dendrites and synaptic connections formerly working at the first stages of the acquisition of a

certain knowledge or skill (as it is the case of learning a foreign language) are pruned, allowing a restructuration or reshaping of the neuronal networks. Consequently, declarative knowledge can be finally turned into procedural, by means of practice, frequent review, and training. As Judy Willis assures,

> Repeated multisensory stimulation brings new memories from the brain's data storage areas to its executive function processing centers. When the brain's highest cognitive levels use the facts, processes, sequences, and routines that it has acquired as memory, all learning comes together (Willis, 2007: 20).

Rod Ellis, another expert on this dual issue about declarative and procedural knowledge, exposes that:

> [E]xplicit learning typically involves memorizing a series of successive facts and thus makes heavy demands on working memory. As a result, it takes place consciously and results in knowledge that is symbolic in nature (…). In the case of implicit learning, learners remain unaware of the learning that has taken place, although it is evident in the behavioral responses they make. Thus, learners cannot verbalize what they have learned. In the case of explicit learning, learners are aware that they have learned something and can verbalize what they have learned (Ellis et al., 2009: 3).

We could say that our procedural memory is shown up through the capacity of execution or praxis, never through cognitive recall. That is the reason why procedural memory is located in the cerebellum, amygdale, and neostriatum, as Uriarte Bonilla explains (Uriarte Bonilla, 2013: 389).

Furthermore, according to Benjamin Bloom, automaticity consists of performing a skill unconsciously at the same time that other brain functions are being carried out consciously (Bloom, 1986). Such automaticity is reached through what Patricia Wolfe identifies as *rehearsal* or practice. In that way, when we are exposed repeatedly to certain information stored in our long-term memory bank, stronger neural connections are formed, and consequently, the skill practiced (such as decoding a text) will get the automatic level (Wolfe, 2010: 133)

2.3. SPECIAL NEEDS STUDENTS:

DEVELOPMENTAL DELAY & LEARNING

DISABILITIES

"There needs to be a lot more emphasis on what a child can do instead of what he cannot do" (Grandin, 2013, Online magazine).

The concept of "Intellectual and Developmental Disorders" (IDDs) involves great difficulty in both its definition and also in its taxonomy, since it is a very complex term that can be analyzed from different sources of information. For example, the American federal law called *Individuals with Disabilities Education Act* (IDEA) offers a different classification and clinical conditions for the definition of IDDs if we compare it to the one provided by the Social Security Administration (SSA). But in general terms, according to the National Institute of Child Health and Human Development (NICHD) and what certain experts uphold, such as Kostas Fanti and Christopher Henrich, we can define the concept of IDDs as a group of disorders that affect the individual in his or her physical, intellectual, and/or emotional development (Fanti & Henrich, 2010).

Some of the most recurrent symptoms for the so-called Intellectual and Developmental Disorders, sometimes even co-occurring in the same individual, are: impaired mental functioning, cognitive impairment, physical impairment, reduced IQ, impaired communication ability, impaired mobility, impaired learning ability, impaired ability to make decisions for oneself, and impaired ability to live independently.

In addition, the most important medical or clinical conditions working as causes of any intellectual or developmental disorder can be: mental retardation (MR), Down syndrome (DS), learning disorders (LD), metabolic disorders (MD), physical diseases, nervous system disorders, and other brain conditions (such as cerebral palsy, brain injury, or cerebral tumor).

The concept of IDDs covers a pool of possible causes, symptoms, treatments and outcomes, and its diagnostic is so difficult because it can show up in many different forms and

levels. However, in this report, we will just focus on developmental delay that, for whatever reason, has finally caused any kind of learning disability (LD) on the student. As the pediatric neurologist Angharad Walters exposes, "children with developmental problems (...) will usually have continuing difficulties with learning later in life" (Walters, 2010: 32).

Following Walters' explanation, developmental delay can be described as a significant chronological lag in any of these developmental domains: hearing, speech & language; social, emotional, and behavioral; vision and fine motor; and gross motor. In that way, developmental delay happens when there is a chronological gap between the child's age and the expected development at that age in the previously mentioned domains.

In addition, there are two kinds of developmental delay, global and specific. When the delay happens in just one domain (especially in motor or in speech and language domains), we will refer to Specific Developmental Delay; whereas when the lag occurs in two or more realms, we will deal with Global Developmental Delay.

The focus of this research project will be directed towards global developmental delay, which is described by Walters in that way: "Global developmental delay can be the presenting feature of a huge number of neurodevelopmental disorders, from learning disability to neuromuscular disorders" (Walters, 2010: 32).

In our case, we will just deal with those students who suffer from any kind of learning disability that has been caused by a former global developmental delay. According to Judy Willis, the term *learning disability* can be defined as:

> A cognitive, neurological, or psychological disorder that impedes the ability to learn, especially one that interferes with a person's communicative capacities and potential to be taught effectively. Some states require that students labelled *learning disabled* have normal or above-normal intelligence and difficulties in learning specific skills. Other states extend the definition to include people of below-normal intelligence who have such conditions as perceptual handicaps, minimal brain dysfunction, dyslexia, developmental aphasia, and AD/HD, but they do not include learning problems due to mental retardation, emotional disturbance, cultural or environmental disadvantage, or physical handicaps (for example, impaired sight or hearing or orthopedic disabilities) (Willis, 2007: 12).

The term "learning disabled student" should not be a permanent label, because, although there is a slower or less efficient and precise functioning in certain brain regions and networks dealing with the processing of information and learning, this can be just temporal if the learners receive the adequate intervention as soon as possible. As Parvaneh Karimzadeh and Sepideh Tabarestani expose, "physicians should attempt to differentiate between (...) stable

cognitive deficits (...) and transient cognitive impairment and its consequences" (Karimzadeh and Tabarestani, 2010: 1663).

Following the University of Michigan Health System's and also Kyla Boyse's explanations, learning disabilities have a neurobiological basis. Consequently, students with any kind of learning disability have a diverse brain structure and function, and their process of learning will be different from the norm (Boyse, 2009).

This is the reason why curricular adaptation and multiple intelligence classroom strategies are fundamental so that the Special Needs Students (in this case, those having developmental delay causing any kind of learning disability), can achieve success within the educational field. But this is a topic that we will explore in the following sections of this report.

According to Kyla Boyse, the main etiological causes grouping the wide range of learning disabilities refers to a genetic or hereditary basis, Central Nervous System infections, prematurity, low birth weight, stress before or after birth, poor nutrition, severe head injuries, etc. A fundamental condition for being a learning disabled student is that such different way of processing knowledge and learning is not due to any physical handicap, visual or hearing impairment, mental retardation, environmental factors (such as cultural differences), poor quality teachings, or social disadvantage. Sometimes, learning disabilities go hand in hand with the so-called Attention Deficit/Hyperactivity Disorder (AD/HD) (Boyse, 2009). As Judy Willis exposes,

> Attention Deficit Disorder (ADD) refers to a condition that interferes with a person's ability to concentrate and control impulses and behavior. A student who has ADD is not hyperactive but will often experience difficulty sustaining a functional level of attention in performing (and completing) tasks or play activities. Attention Deficit/Hyperactivity Disorder (AD/HD) describes a disability that interferes with a person's ability to regulate activity level, inhibit behavior, and attend to tasks in developmentally appropriate ways. Common characteristics of AD/HD include difficulty sustaining attention and concentration, developmentally inappropriate levels of activity, distractibility, and impulsivity (Willis, 2007: 62).

Learning disabilities are so varied that they cover many different areas. The areas proposed by Kyla Boyse are the following: reading, writing, math, spoken language, memory, reasoning, metacognition, physical coordination, social behavior, and organization (Boyse, 2009).

- Reading learning disability deals with the learner's difficulty in recognizing, decoding, and understanding written words.

- Writing learning disability is related to the student's problems with spelling, organization of ideas, and writing in general.

- Math learning disability consists in having difficulty in understanding basic math concepts, and doing arithmetic.

- Spoken language learning disability has to do with problems in the oral skills (listening and speaking).

- Memory learning disability deals with the learner's problems to memorize facts and remember instructions.

- Reasoning learning disability is related to the student's difficulty in analyzing, connecting thoughts and ideas, and organizing.

- Metacognition learning disability has to do with the student's problems for using and self-monitoring thinking and learning strategies.

- Physical coordination learning disability is related to the learner's difficulties in manipulating small objects (such as the pencil, the eraser, etc.), handwriting, and more dynamic activities (such as jumping or running).

- Social behavior learning disability deals with the learner's problems for making friends, social judgment, or even tolerating frustration.

- Finally, organization learning disability is related to the student's difficulty in planning, and managing with time and belongings.

According to the University of Michigan Health System's classification, also compiled by Kyla Boyse, the Specific Learning Disabilities are dyslexia and reading problems, dysgraphia, speech and language delay and disorders, discalculalia, dyspraxia, non-verbal learning disorders, information processing disorders, and Gerstmann's syndrome (Boyse, 2009).

As the research provided by Heiman and Precel explains, LD students normally are exposed to suffer from more stress, anxiety, and frustration than non-disabled learners, especially during examinations. They need more time to process information, they must make a

greater effort to achieve their goals, and they need constant regulation or monitoring. The main reason is that LD students have lack of self-confidence and an extreme critical attitude toward their own failures and mistakes (Heiman & Precel, 2003).

In the following sections of this report, we will see how to manage in the classroom with this kind of students so that their process of learning a foreign language is as successful as possible, by following certain effective brain-compatible strategies. These strategies are based on the notion of Neurodiversity, explained by Thomas Armstrong in these terms:

> The idea of Neurodiversity is really a paradigm shift in how we think about kids in special education. Instead of regarding these students as suffering from deficit, disease, or dysfunction, Neurodiversity suggests that we speak about their *strengths* (Armstrong, 2012: 9).

In this sense, an educator that feels inspired by the notion of neurodiversity in his or her teaching is necessarily a teacher that shows up a deep respect for the uniqueness of every learner's brain and tries to provide students with the most appropriate conditions to create an enriched learning environment.

2.4. METHODOLOGICAL PROPOSAL:

THE ROLE OF TEACHERS, FAMILIES, AND

RESOURCES

> Obviously, it would be helpful for teachers to know just how long students' brains need to consolidate a particular skill before moving to another. Unfortunately, the available research doesn't give us this kind of detailed information. We do know, however, that consolidation occurs and that it takes time. We also know that teaching something new too soon disrupts consolidation of previous learning (...). Neuroscience seldom provides information that can be applied directly to classroom practice, but we need to take what we know about consolidation into account when we design instruction (Wolfe, 2010: 157).

It is absolutely necessary to combine Neurology and Pedagogy in order to maximize learning. That is to say, it is essential to convert neuroimaging data into classroom strategies thought to stimulate parts of the brain that are activated during the stages of learning.

If we transfer neurological research into the educational field, we will carry out more effective teaching practices. Besides, the neurobiological basis of learning disabilities has been proved thanks to genetic research and neuroimaging studies. Furthermore, another issue that is totally crucial for a successful learning process, especially taking into account the case of SNS, is the continuum between school and home. In other words, I mean the collaboration among mainstream teachers, specialists, families and students for the sake of enjoying the process of learning. In that way, the inclusive classroom would be a place where every student will feel the joy of learning.

2.4.1. An Inclusive Education for All

Once the child is suspected of having any developmental delay, parents should go to visit an expert in early intervention and diagnostic, the pediatrician first, and then other

specialists depending on the degree of delay and its consequences. The diagnosis is not a responsibility of the teacher but of a group of experts. However, teachers can help identifying some learning difficulties, differences and school problems.

The second stage is starting schooling. When the child enters the school for the first time, I personally believe that the best way to do it is in an inclusive classroom, one that allows different children to live and learn together in a heterogeneous environment in which being different from the norm is the usual thing; a classroom in which tolerance and cooperation are a motto; and a classroom where every child is potentiating and making the most of his or her abilities rather than feeling frustrated due to his or her weaknesses.

Although nowadays, Spanish inclusive education is more utopian than real, little by little, it is changing and evolving towards the right path, but there is still a long way to walk. In this sense, some of the most important state and autonomic legislations dealing with the notion of inclusion in Spain, and especially in Andalusia, are the following ones:

❖ UNESCO, La Declaración de Salamanca, 7 – 10 de junio de 1994, ED-94/WS/18, available in: http://www.unesco.org/education/pdf/SALAMA_S.PDF [Last accessed: 13th September, 2014].

➢ The Salamanca Statement included a recurrent guiding principle in debates of policy level which announces that inclusive programs in mainstream schools are the most effective ways of fighting against discriminatory attitudes, and consequently, creating a welcoming community for all.

❖ España. Ley Orgánica 1/1990, de 3 de octubre, de Educación. *Boletín Oficial del Estado,* 4 de octubre de 1990, núm. 238, pp. 28927 – 28942.

➢ After the implementation of this law, Spain faced an important development in its legislative issues about Special Needs Education. For example, the conditions for the diversity awareness matter were regulated through the incorporation to the centers' curricular projects of pedagogical, organizational, and functional measures. The only goal during these years was to develop an education based on quality, equity, individualization, and normalization.

❖   España. Ley 9/1999, de 18 de noviembre, de Solidaridad en la Educación. *Boletín Oficial de la Junta de Andalucía*, Sevilla, 2 de diciembre de 1999, núm. 140, pp. 15429 – 15434.

➢   This law emphasized the necessity of carrying out an appropriate educational response for students with any kind of disorder (physical, psychical, or sensory). And in doing so, it was looking for a sense of equality of opportunities for all, and following the main principles regulating the so-called UDL.

❖   España. Ley Orgánica 2/2006, de 3 de mayo, de Educación. *Boletín Oficial del Estado,* 4 de mayo de 2006, núm. 106, pp. 17158 – 17207.

➢   This law was governed by the principles of an education of quality for all, tolerance, equity and equality of opportunities, and respect.

❖   España. Orden de 25 de julio de 2008, por la que se regula la atención a la diversidad del alumnado que cursa la educación básica en los centros docentes públicos de Andalucía. *Boletín Oficial de la Junta de Andalucía*, Sevilla, 22 de agosto de 2008, núm. 167, pp. 7 – 13.

➢   This regulation talked about the need of allowing students to achieve the maximum development of their personal, intellectual, social, and emotional capacities in order to acquire the basic competences present in the curriculum.

❖   España. Real Decreto 1635/2009, de 30 de octubre, por el que se regulan la admisión de los alumnos en centros públicos y privados concertados, los requisitos que han de cumplir los centros que imparten el primer ciclo de la educación infantil y la atención al alumnado con necesidad específica de apoyo educativo en el ámbito de gestión del Ministerio de Educación. *Boletín Oficial del Estado*, 3 de noviembre de 2009, núm. 265, sección I, pp. 91697 – 91702.

➢   This regulation pointed at the obligation of the Administration of assuring that non-mainstream students have the necessary resources and materials to improve their conditions due to learning disabilities, or high intellectual capacities.

❖ España. Ley Orgánica 8/2013, de 9 de diciembre, para la mejora de la calidad educativa. *Boletín Oficial del Estado*, de 10 de diciembre de 2013, núm. 295, pp. 97858 – 97921.

➢ The current law governing our educational system timidly outlines the importance of notions such as equity, universal accessibility, and equality of opportunities for all students[7].

One of the main reasons why our inclusive education does not really reach the highest expectations is that SNS are *integrated* within the mainstream classrooms but they are not always *included* in them. I mean, it is essential to differentiate between integration and inclusion. In an integration classroom, there is a heterogeneous group of students but they do not cooperate among them. In fact, they are segregated into sub-groups. For instance, the mainstream teacher is in charge of the students who can follow the standard curriculum, whereas the special education teacher or special support teacher comes into the classroom to attend to the disabled students. I think that this internal segregation is even worse than the previous external separation between the mainstream and the special education centers, since those students who join the disabled group feel that they are different in the bad sense, they underestimate themselves, and finally, they feel frustrated and they lose their motivation to learn. Judy Willis explains the difference between integration and inclusion with these words:

The word *inclusion* carries positive connotations of belonging. Indeed, full inclusion of all inclusion – even those with severe disabilities – in general education classrooms doesn't mean LD students work separately with their aid while the rest of the class does other work. Truly inclusive classrooms integrate and coordinate specialized school support programs within the general education program. This approach has replaced what was previously dubbed *mainstreaming* – non-academic inclusion, in which LD students joined general classes for non-academic work and were removed for academic special education (...). In the past, many students with severe disabilities were separated into special education classes and missed out on the benefits of having long-term social relationships with classmates who did not also have severe disabilities. As a result, when they left the supervised classrooms, they were not ready to join the larger, heterogeneous communities in which they would live and work for the rest of their lives (Willis, 2007: 14).

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[7] This reflection is profoundly subjective, based on my personal opinion, not on any comment from any author.

So, we could say that a truly inclusive classroom is a place in which the curriculum is flexible and tries to cover the individual necessities of each student, and it can adapt to the different learning styles and different types of intelligences of the learners. So, the inclusive classroom is one that advocates for the individualized necessities and tries to reduce to the minimum the time in which SNS are in need of specialized assistance, both inside or outside the mainstream room. However, I also think that at certain exceptional moments, only when it is absolutely necessary, SNS may need some special support in the resource room.

In this sense, in an inclusive classroom different children learn together, independently from the fact that they have any kind of LD or not. The important thing is the recognition and appreciation of the other classmates' skills and unique attributes. For this reason, the teacher should adapt the curriculum individually and should apply certain brain-compatible strategies to foster the creation of a community within the class. For instance, some of these strategies can be used at the beginning of the academic course in order to build connections among students and discover interests, talents, hobbies, etc. A couple of these strategies could be peer interviews or class interest graphs. In addition, there are more strategies that can be followed along the whole educational process. These strategies are long-term and they are usually more effective, and we will have a further look at some of them afterwards in the section called *Brain-based classroom strategies* of this report in page 47.

2.4.2. Universal Design for Learning

In the United States of America, the inclusive education classrooms offer an Individualized Education Program (IEP), which is called Individualized Education Plan in countries like England and Canada. The American program is mandated by the 2004 public law named *Individuals with Disabilities Education Act* (IDEA).

The IEP follows the path of the truly inclusive education and effective teaching practices due to the fact that it identifies the individualized objectives of each disabled student so that these students can reach their educational goals. This is possible because the IEP is thought to tailor the specific needs of each student after an evaluation process to know the weaknesses and strengthens of each learner. In so doing, it is possible to potentiate the abilities and learning preferences of each individual, at the same time that a sense of belonging to an

educational community is fostered; a community in which interaction, participation, and tolerance are the pillars to achieve an education for all.

Americans and Canadians are also pioneers in another truly inclusive education concept called accessible learning (a-learning). The a-learning initiative is thought to provide a positive and inclusive learning environment for everyone, being the less restrictive as possible, and assuring that there is no barrier for the learning process of students with any kind of disability. In this way, a-learning is governed by the principles of barrier-free access and Universal Design for Learning (UDL). Patricia Almond and others explain the origins of the term Universal Design in these words:

> The universal design concept was founded in the 1980s within the field of architecture by Ron Mace at North Carolina State University. The goal of universal design is to build structures and products that are inherently accessible by considering individuals' diverse needs from the outset (e.g., mobility and communication needs), thus reducing the need for retrofitting (Almond et al., 2010: 10).

So, the notion of Universal Design was extended towards the pedagogical space, hand in hand with recent cognitive research and digital technologies, consequently developing into a new notion, the Universal Design for Learning. In this respect, Elizabeth Hartmann states that,

> Universal Design for Learning (UDL) is a new way of thinking about education that has the potential to reform curriculum and make learning experiences more accessible and meaningful for all students. UDL is a framework, a philosophy of education that changes how people think about education and helps them to value the diversity of all learners (…).The UDL framework was developed by a group of educators and researchers with the mission to use technology to improve educational outcomes for students with multiple disabilities. Through their work in schools, they found that existing curricula were often inflexible, largely text-based, and irrelevant to the lives of many students, including those without special needs. When adaptations or accommodations were made to a curriculum, it was often after the fact and failed to provide students with timely and appropriate learning experiences. The UDL framework evolved as they began to think of ways to fix curricula from the beginning to support learning for all students. They created the UDL framework using research and best practices in the fields of neuroscience, education, and technology (Hartmann, 2011: 1 – 2).

According to Dave Edyburn, the principles of UDL are based on the application of the following elements (Edyburn, 2010):

- Different methods of presentation of the information. According to Elizabeth Hartman, each learner understands information in a different way; so, it is fundamental to provide

them with a curriculum that employs a variety of methods of presentation for the teaching contents. Some of these methods could be the combination of words, images, objects, sign language, Braille, audiovisual materials, etc. (Hartmann, 2011: 1).

- Multiple means of engagement. The main reason is, following Elizabeth Hartmann's explanation, that learners' motivation is of a diverse nature; consequently, the curriculum should provide different levels of challenge, and personally relevant and engaging contents (Hartmann, 2011: 1).

- Diverse modes of expression, different learning activities, multiple assessment options, and staff-students interaction. That is to say, providing students with diverse means of action and expression (like writing, drawing, speaking, switch, use of graphic organizers, etc.), because, as Elizabeth Hartmann holds, the curriculum should be flexible in order to allow students to show up what they are learning in multiple ways (Hartmann, 2011: 1). To this respect, Patricia Almond and others explain that,

> The goal of UDL is not to create a single assessment condition that is accessible for all students. Instead, a universally designed assessment will anticipate the variety of accessibility needs of potential students and build in methods that allow all students to access, engage with, and respond to test content in the most accessible manner possible (Almond et al., 2010: 11).

In other words, a-learning initiatives try to accommodate diversity by using methods that are beneficial for all students, with or without any disability. So, UDL is focused on designing an educational environment that can accommodate a wide range of learning differences and guarantee their academic success.

On the other hand, the barrier-free-access issue refers to the future construction of facilities in the school centers to supply the necessities of any disabled student so that he or she can acquire the desired education without unnecessary inconvenience or hardship.

As Dolores Polo Cobo explained in a conference, Spanish educational system should change. It is absolutely necessary to create an education for all by providing the appropriate conditions for it, and it implies some important changes in our current systems and educational politics, in the organization and workings of the educational centers, in the attitudes and teaching practices of the educators, and in the relationship among the different areas related to the educational community (Polo Cobo, 2014). In relation to that idea of the attitudes of the educators, as Shireen Pavri and Richard Luftig state,

Some evidence indicates that students without disabilities as well as teachers in general education classrooms often do not accept a student with disabilities (Bryan, 1997; Sale & Carey, 1995). Peers and teachers often ignore or actively reject the overtures of such students, praise them less, and consider them less desirable than students without disabilities (Pavri & Luftig, 2000: 8).

Polo Cobo upholds that every student has a better version of himself, but it cannot be spread out if there is not enough stimulation from the family, the center, the teacher, the paraprofessional specialists, and the resources and materials. Every student is able to overcome his or her difficulties. The only thing they need is to have the opportunity to do so. In that way, it is our duty to identify and then to eliminate the barriers which interrupt the effective inclusive education. Such barriers are of a diverse nature, mainly attitudinal, organizational, methodological, curricular, and socio-economical (Polo Cobo, 2014).

In Spain, we need to maximize the quality and training of the human resources we have, rather than looking for more aids and support teachers in the same classroom. The main reason is that having more teachers and specialists in the same classroom is not possible due to the financial crisis we are still facing these days. So, we are in need of well-trained educators who can manage with a heterogeneous class without waiting for the assistant's help every time that a SNS is in the classroom.

In other words, and going back to the beginning of that section, it is required that educators know the basis of the current brain research together with their knowledge on pedagogy. It is such combination of neuroscience and teaching the one that will lead to the most effective and successful learning processes for every student. If teachers know how the brain learns in normal conditions and how it works when there is any dysfunction, then, they will be able to apply this information into their lessons to maximize learning for everyone. As Sue Bos explains,

I'm a classroom teacher. My job is all about helping young students learn. I've been trained in learning theory and learning styles, curriculum development and assessment techniques, child development, human behavior, and classroom management. Little of my educational training, however, involved learning about the brain and how it works. Yet, the brain is where learning happens (Bos, 1997: 1).

Furthermore, according to Pablo Pineda[8], it is also fundamental although utopian that these teachers and paraprofessionals supporting mainstream teachers feel a vocational drive for their profession and believe in the possibilities of every student, independently of his or her difficulties. We need specialized human resources for the sake of fostering and improving the quality of the inclusive education (Pineda, 2014).

Maximizing the human resources we have available for managing with the heterogeneous class would mean, for instance, that current ordinary teachers are trained to acquire the essential knowledge about special education, therapeutic pedagogy, audition and language, speech therapy, etc.; and curricular support teachers are in charge of co-tutoring the curricular adaptation together with the ordinal teacher. In addition, the psychologists and psycho-pedagogues of the pedagogic orientation departments of the centers should advise teachers and even families about the pertinent curricular adaptations and evaluation processes.

But most important, maximizing human resources means that educators know how to put into practice the most effective brain-based classroom strategies.

2.4.3. Learning styles and types of intelligences

The more ways something is learned, the more memory pathways are built (…). Multiple stimulations mean better memory (Willis, 2006: 4).

Multiple learning styles, especially those based on the use of cross-curricular topics and the stimulation of the senses, lead to the growth of more brain connections, and consequently, more effective teaching practices and learning. With regards to the notion of cross-curricular relational memory building, Judy Willis states that,

Learning related material across the curriculum involves activities that increase the connections between different areas of the brain where related information is stored (...). When subjects are interrelated, they are more easily recalled and there is less need for memorization, because higher levels of thinking have been stimulated and there are increased numbers of

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[8] Pablo Pineda is a Spanish actor who was awarded the *Concha de Plata* in 2009 in the *Festival Internacional de Cine de San Sebastián*, and also the first person in Europe being able to get a degree at university in spite of his Down syndrome condtion.

pathways by which information can travel in and out of long-term memory banks (Willis, 2006: 22).

As I mentioned before, curricular adaptations should be based on students' multiple intelligences, learning styles, and strengths. In other words, the curriculum should be adapted so that every student is able to maximize his or her strengths and cover his or her needs. In addition, in the case of SNS, the curriculum must also compensate for the deficit or challenge in one or more of the executive functions of the cortex neurons, mainly those housed in the frontal cortex. So, the strategies and methodologies followed in the class should be compatible with the different types of learning in each brain: how students acquire, retain, retrieve, and use information. The reason is that each brain seems to preferentially respond to the presentation of sensory stimuli in a different way.

I feel strongly that the curriculum should be only one in the classroom, one of flexible, open, and diversified nature, one able to be adaptive to the real necessities of every student, and one which presents a multilevel character. We are in need of an educational system that potentiates students' capacities and possibilities, rather than one that discourages the weaknesses. We are in need of an education of quality for all. That is the reason why teachers should appreciate, respect and adapt their teachings according to the wide range of students' diverse interests, abilities, backgrounds, talents, skills, learning styles, and intelligences. Because, as I see it, the problem is not caused by the fact that there are students with special needs within the mainstream classroom, but it is caused because we haven't offered yet the pertinent and correct measures to give an answer to those needs.

In addition, students' assessments and evaluations should be also diversified and made as suitable as possible for each learner, again relying on his or her type of intelligence and learning style. So, there must be an open window for students to choose, for example, between an oral or written exam.

So, by following brain-compatible approaches, teachers will offer a proper variety of opportunities so that every student is able to participate in the class. A classroom atmosphere focused on participation, peer interaction, and co-operative working (for instance, task-based projects) will reduce LD students' anxieties and will increase their confidence and motivation, and consequently, their learning process will be more successful, because within this environment they will also receive positive recognition for their work.

As Judy Willis suggests, "teachers who have used brain-compatible learning strategies to build on LD students' strengths report an additional long-term benefit over the course of 5 to

10 years" (Willis, 2007: 15). Indeed, according to Roberta Goldberg and others, LD students can develop the typical features of academically successful students when strategies derived from brain-compatible research are applied to them in the classroom (Goldberg et al., 2003).

So, it is crucial for a teacher in an inclusion class to identify the different individual learning styles, abilities, and also developmental levels of students. Judy Willis defines the concept of learning preferences in that way:

> The term *learning styles* refers to the way the brain perceives and processes what it needs to learn. When teachers tailor their teaching strategies to students' learning styles, (...) students will enter learning experiences with more confidence and connectedness and will become active participants in their learning (Willis, 2007: 52).

This concept of learning styles is closely related to the Multiple Intelligences Theory developed by Howard Gardner. According to Gardner's theory, intelligence does not work as an all-or-nothing entity, but rather it is formed by different learning proficiencies that can function together or individually. Gardner explained eight different learning styles or intelligences: logical-mathematical, visual-spatial, verbal-linguistic, bodily-kinesthetic, musical-rhythmic, intrapersonal, interpersonal, and naturalistic (Gardner, 1999).

Other scholars, such as Daniel Goleman, have proposed another learning style: the emotional intelligence, focused on self-motivation, empathy, optimism, self-awareness, hope, and self-regulation (Goleman, 1995).

The eight multiple intelligences proposed by Gardner can be described in these terms, according to Kathy Checkley (Checkley, 1997):

- Students with logical-mathematical intelligence are good at logic problems, structure recognition, abstractions, equations, cause and effect patterns, multiple-choice or standardize tests, puzzles, computer activities, and sciences in general.

- Learners with visual-spatial intelligence have a strong grasp of visualization memory strategies, graphic organizers, following maps, playing board games, engaging in hands-on science projects, conceptualizing in three dimensions, building models, understanding the relationships of objects, images, concepts; diagramming; and artistically representing what they perceive.

- Students with verbal-linguistic intelligence have the ability to analyze language use and they are good at conveying language information, rhyming, storytelling, reading, writing,

talking, word games, vocabulary, memory, and acquisition of foreign languages. In addition, they are sensitive to the rhythm, order, and nuances of words.

- Learners with bodily-kinesthetic intelligence have the ability to use fine and gross skills in sports, visual arts, and scientific manipulative experimentation (basically through ICT devices and materials). Teachers should use with these learners certain strategies to connect body movement to the contents, ideas, information, etc. through dramatizations, models or even crafts.

- Students with musical-rhythmic intelligence are sensitive to rhythm and pitch of sounds, together with listening and performing music. For this kind of students it is beneficial to use strategies that put in connection their learning contents to songs, dance, and music.

- Learners with interpersonal intelligence are good at group work, interaction with others, leadership, cooperation, and empathy, because they are sensitive to others' feelings, moods, and behaviors.

- Students with intrapersonal intelligence are more introverted, independent, and focused on their own goals. They are good at constructing relational memories by connecting learning to personal experiences or positive emotions. In addition, they are better at written skills than at oral ones.

- Learners with naturalist intelligence have the ability to recognize patterns and characteristics of the natural environment (basically plants and animals), and they are good at categorization, observing details, and pointing out at differences and similarities (for example, metaphors or even Venn diagrams).

I think that teachers should use and vary these different learning styles based on students' multiple intelligences in their lessons so that every student has the opportunity to have his or her brain stimulated in the process of learning. With regards to that issue, Judy Willis upholds that:

> When students learn in an environment rich in varied intellectual and sensory stimuli, they are better able to engage and develop both their dominant and their secondary intelligences. Given the choice, most students will initially select study modes and activities that match their intelligences and learning styles. (...) For teachers of inclusion classes, this shift in student learning styles is further evidence that instruction and review geared toward multiple intelligences are valuable for engaging all students in successful learning (Willis, 2007: 55 – 56).

At the beginning of the academic year, it can be difficult for teachers to have a clear idea of which learning style better fits each student, because it is too early to know in depth the kind of intelligence that the learner is good at. For that reason, I strongly agree with Judy Willis when she suggests a different way of identifying students' abilities and needs. It is a temporal way of grouping students, but more efficient at the beginning, and easier for teachers. This strategy consists in grouping two or more of the intelligences proposed by Gardner into a broader category. In that way, Judy Willis proposes these three broader groupings of learners: sequential or analytic, global, and exploratory (Willis, 2007).

▪ Gardner's intelligences under Willis' label of sequential or analytical learners are verbal-linguistic, visual-spatial, and logical-mathematical. These students have the ability to process information in a parts-to-whole way, that is to say, they tend to work from the particular or specific to the broader. As Willis explains,

> They respond to logic, order, and sequence and work best with information that is presented methodically, with learning activities broken down into sequenced steps. Lessons that progress sequentially can actually benefit all students because they offer frequent opportunities for assessment and feedback, enabling students to build on knowledge and skills they have mastered with more complex concepts or processes (Willis, 2007: 57).

▪ Gardner's intelligences falling under Willis' category of global learners are musical-rhythmic, naturalist, bodily-kinesthetic, and sometimes, visual-spatial. These students are capable of processing information in a whole-to-parts manner, that is to say, instruction starts with the whole picture of what is going to be taught and then the contents are separated into parts. This is a good idea to stimulate students' brains when introducing a new unit. For this reason, teachers should connect the contents to something concrete or familiar for this kind of learners before the processing of information happens. These students are good at recognizing patterns, creativity, and problem-solving activities.

▪ Finally, Gardner's intelligences belonging to Willis' category of exploratory learners are bodily-kinesthetic, interpersonal, and visual-spatial. The most successful teachings for these students are those based on discovery and hands-on learning strategies. So, these students perform well in class when the activities incorporate participatory learning experiences, manipulatives, dramatic representations, rhymes, visualizations, movement, construction, tactile experiences, etc.

As Spencer Kagan and Miguel Kagan upholds, not every exploratory learner suffers necessarily from ADHD, but normally, these learners can take advantage of the most beneficial and successful teaching strategies for ADHD students (Kagan & Kagan, 1998).

For me[9], the gist of the matter is that all these brain-compatible strategies deal with and are closely connected to certain educational domains (such as the arts, experiential learning, discovery and hands-on approaches, kinesthetic learning, etc.), and these domains have traditionally been criticized and put out of the Spanish educational system in terms of time and funding, just because they are thought to be a waste of time, as if they were less important or even useless for achieving academic success. What is more, education policies have promoted the teachings of educational domains that basically rely on rote memorization. Due to such reduction in the options for students to access the information taught in class, the students whose learning styles, strengths, and abilities do not fix this kind of teachings will not be able to achieve success. Consequently, the incoming data will never reach students' relational memory centers and hippocampus. In that way, information cannot be processed in students' brains and it is impossible that the retention of information takes place. This is why Patricia Wolfe states that,

> Some of the information we teach in school requires students to engage in hours, if not years, of rote rehearsal. Examples include reading (decoding), writing, classroom procedures, and basic arithmetic. Much of the curriculum, however, falls into the semantic memory category, where rote rehearsal is not an effective method of practice (...). For these types of learning, elaborative rehearsal strategies are much more effective (...). These strategies encourage learners to elaborate on information in a manner that enhances understanding and retention of that information. Usually, elaborative strategies increase memory by making the information more meaningful or relevant to learners (Wolfe, 2010: 134).

So, on the other hand, when the lesson follows the dynamics of the brain-compatible research, taking into account students' learning styles and intelligences, including personally meaningful contents, then, students' affective filters are lowered and the brain information processing centres are open to receive the incoming data, connect this data to their previous relational memories, patterning the new data, and finally, store it in the long-term memory. In this sense, I would dare to say that, using the Spanish title of Alberca de Castro's work, *every student can become an Einstein*, provided they have the appropriate conditions for it (Alberca de Castro, 2011).

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[9] This reflection is absolutely personal and not based on any comment from any author, although in the following paragraphs this idea is supported by the thoughts of authors such as Patricia Wolfe and Alberca de Castro.

However, all these strategies, approaches, tips, and methods will be useless, especially in the case of LD students, if there is not collaboration and continuum between the educational centre and the family. In fact, sometimes, families can provide teachers and other specialists with crucial information, because parents usually know what special skills and interests their children have. It is also really important that at home, the LD learners find an organization conducted by parents that supports the one provided by teachers when out of school.

On the other hand, teachers can also involve parents in their children's education in different ways. For instance, teachers should contact parents in order to individually advise them about how to help their children with their homework.

Speaking personally[10], when referring to this issue of parents, I would like to say that affection and fondness is the best path towards education. That is to say, despite the fact that LD students may not be able to overcome a certain difficulty as easy as others do, they need to know that their parents' love and affection is unconditional, and this motivation is really effective.

2.4.4. Brain-based classroom strategies

Brain-based strategies can be used to reduce the amount of rote memorization required, and what remains can be less tedious because these strategies help students access and use more effective types of memory storage and retrieval (...). Effective teaching uses strategies to help students to process the new working memories so they can travel into the brain's long-term storage areas (Willis, 2006: 6).

Following Judy Willis' tips for teachers, some of the essential brain-compatible strategies for planning a lesson in the heterogeneous class are the following ones: observing students; accommodating the arrangement of desks; monitoring and providing students with individualized realistic challenges, depending on the personal goals set for everyone; offering opportunities to choose; providing a previewing lesson at the end of the class; teaching

[10] This is a personal reflection based on my own observation of reality, coming from a close situation within my own socio-affective environment, but it is not based on any comment from any author.

organizational strategies; providing feedback; and planning developmentally appropriate lessons (Willis, 2007: 20 – 34).

In addition to these strategies, I propose that the use of the L1 within the L2 class would be an essential tool for the sake of fostering an atmosphere of relaxation and motivation, trying to avoid stress and anxiety at certain moments during the lesson, especially in the case of SNS in general and developmental delay students in particular.

In the following subsections, each of the brain-compatible strategies proposed by Judy Willis will be examined, together with a detailed analysis of that new brain-friendly strategy regarding the use of the L1.

Observing students

I think that the main benefit of observing students is that the teacher will know more about their interests and needs, and consequently, teachers will be able to recognize which learning strategies best fit everyone. For instance, when meeting a new group of students for the first time, each day, teachers could spend some time thinking of the possible needs and interests of two or three students in particular. After a few weeks, the teacher will know what kind of learning strategies best fit with every student in the class.

In this sense, teachers should make their lessons relevant and meaningful for their students. As a research carried out by Anthony Wagner and others explains, neuroimaging has proved that rote memorization of isolated facts and skills is the less effective memory strategy (Wagner et al., 1998). Jacqueline Brooks and Martin Brooks assure that rote memorization requires more practice and rehearsal, and that is the reason of its poor benefits (Brooks & Brooks, 1993).

Furthermore, according to Howard Gardner, if the contents of the lesson take into account the students' interests and goals, they are personally relevant for the learners, and they are connected to their prior experiences and to the real world, then, it is more likely that the incoming data is stored in the long-term memory (Gardner, 1991). The reason is that, as it is explained by Brooks and Brooks, incoming data carrying personal relevance will activate the already existing neuronal networks, and finally, it can be more easily processed and will require less practice to be stored in long-term memory (Brooks & Brooks, 1993). Patricia Wolfe sums up this idea in her sentence "The most effective associations link new information to something that is personally relevant to students" (Wolfe, 2010: 137).

So, in order to maximize personal relevance, teachers can follow some strategies and tactics, like the so-called realia, which consists of learning from real objects and experiences. Other useful strategies are the use of stories and narrative lessons, which are those that present the lesson contents in a story-like format making the same connections as stories do.

In addition, according to Johnmarshall Revee and Elizabeth Bolt, if the lesson being taught is able to stimulate multiple senses, then, the teaching will be much more effective and successful. The fact of consciously manipulating and having opportunities to apply the new information learned is directly associated to an increase in brain stimulation. That is the reason why just rote memorization and direct lecturing are not enough for an efficient and long-term learning. However, if learners are exposed to information through a multisensory teaching strategy, together with a student-centred approach, and the use of hands-on learning experiences, then, their neuronal networks will be strengthened and long-term memory will be effected (Revee & Bolt, 1999).

Multisensory learning is especially crucial in inclusion classes because of the wide and varied range of students' developmental stages, learning styles, and multiple intelligences. This kind of teaching is more likely to be accessed by everyone, providing equality within the heterogeneous group. As Judy Willis sums up,

> Linking new information to more than one sensory experience (visual, auditory, tactile, and so on) connects multiple brain regions to the lesson because each sensory system has a separate storage area in the brain. Multisensory input travels to memory storage along more than one pathway, resulting in enriched, reinforced information transit. This redundancy of pathways and storage regions leads to better memory retention, faster and more accurate recall, and increased ability to retrieve stored memories through a variety of stimuli (Willis, 2007: 111).

Desk arrangement in the classroom

With regards to the arrangement of desks in the classroom, I have to say that these physical accommodations can be a strategy to foster collaborative work. I mean, by arranging the seats in small groups (as in a horseshoe configuration, in rows, or simply in groups) rather than being sat down individually will provide students with the necessary opportunities to communicate and interact among them, and it will also contribute to achieve a sense of belonging or creating a community within the class. Such arrangements should be done according to the students' learning styles, and behavioral and psychological characteristics. In

other words, for instance, it is not a good idea to locate students with attention problems near a window.

Furthermore, some students with certain learning styles or even visual limitations can benefit from the use of electronic devices, big charts, or large graphic organizers depending on the place of their seats. In addition, introverted students may feel more comfortable if seated near the teacher, rather than surrounded by mates. Or the other way round, interpersonal learners (those who are more extroverted, good at conversing, and tend to be distracted by their mates) may maintain better their academic focus when located at the corners of group-desks or at the ends of the rows, trying to avoid being surrounded by other mates.

The fact of creating a positive and enriching environment in the classroom, giving students the opportunity to feel that they belong to the same community independently of their differences, is absolutely indispensable. Such sense of belonging must be created from the very beginning of the educational stage of the child so that in the next stages, especially in the case of SNS, the inclusion teachings are really effective.

As Alfie Kohn upholds, kindergarten students are usually eager to learn, so during this first moment in the educational process, teachers should keep students motivated and stimulated to learn, so that this positive teacher intervention will low students' affective filters, and will reduce the anxiety, frustration, inhibition to learn, and stress for the LD students in the following educational stages. Indeed, LD students need even more attention during this first stage within the educational process (Kohn, 2004).

It is essential that in the following stages, before adolescence, students learn how to appreciate and be tolerant towards differences when learning in an inclusion classroom. In these terms, Judy Willis assures that:

> If students with learning differences have not been brought into the class and school community or developed social and academic coping strategies by middle school, they will be particularly vulnerable to the loneliness and isolation that can mark this developmental period. During the tumultuous changes of adolescence, students without peer support may be overwhelmed by memories of earlier school frustration and embarrassments. If they don't have the social skills to gain the support of a peer group, they can fall farther behind in all areas of their lives (...). By carefully planning partnerships and cooperative groups, teachers can ensure that excluded students receive opportunities to offer input that their group partners will acknowledge and appreciate (Willis, 2007: 40 – 41).

The importance of enriching the environment is made even clearer when we talk about neurological studies. Research in the field of neuroimaging supports that human brain plasticity

allows the growth of neuronal connections associated with stimulating activities and enriched environments. In this sense, Judy Willis explains that "enriching the learning environment of all students in inclusion classes may maximize their cognitive, emotional, and social development" (Willis, 2007: 109).

Preventing school failure, especially in the case of SNS, begins with environmental enrichment for the sake of achieving academic success and empowering students. These enriched environments are featured by having high expectations for student achievement; a sense of security within the classroom; suitable systems of evaluation and assessment, together with appropriate curricula and ways of instruction; and collaborative work and decision-making among educators, other school staff, and families.

Challenging and setting the appropriate goals for students

When dealing with the issue of how to challenge students, it is fundamental that the teacher monitors students and provides them with individualized realistic challenges that wake up their curiosity and interest, and motivate them to reach the goals set for each one. As Judy Willis explains,

> If goals do not provide sufficient challenge to engage students, or if the challenge exceeds students' levels of capability, frustration replaces motivation (...) Without reasonable challenge, LD students are at risk for learned helplessness, dependency, and feelings of inadequacy (Willis, 2007: 25).

Our brain is always stimulated when its cognitive capacities are challenged. However, too much challenge can result into frustration and loss of motivation. Recent studies on neuroimaging have proved that when students are in a positive state of mind and teachers provide them with the appropriate amount of motivating challenge, their amygdales become stimulated, and consequently, such students show up better learning conditions, since their working and event memory systems work better, and their verbal fluency and problem-solving capacities improve. Furthermore, these students also demonstrate better social behaviors: they are more helpful with their peers, more sociable, and patient (Willis, 2006: 24 – 25).

The important thing is to tailor each learner's needs to his or her most appropriate goals. In the case of SNS this issue is even more crucial because at the beginning these students need more time to reach their goals, so teachers should set for them the most appropriate goals, that is, challenging but plausibly reachable. In that way, when SNS recognize their own success,

they will be able to advance in their learning process once the teacher has identified the most effective brain-compatible techniques for them. Judy Willis also directs her attention to the issue of how to set the appropriate goals for each individual:

> Teachers must demonstrate to all students in inclusion classes that success is measured not only by standardize tests and grades, but also by the ability to set and reach appropriately challenging goals. Planning these personalize goals is time-consuming, but teachers' efforts will be rewarded by students' improved confidence, attitudes and behaviour, and academic achievement (Willis, 2007: 26).

Offering opportunities to choose

The next useful teacher strategy for achieving success in the heterogeneous classroom is that of offering opportunities to choose, for instance, among different reading materials, homework projects or assignments, and other aspects of the curriculum. I mean, teachers should offer a choice-time during the class, so that students can choose which activity they want to do first. It is a way of motivating students to do what they prefer and in the order they want to do it. This pattern will be more effective as it becomes a classroom routine. In addition, I think it is also a good idea to give students the opportunity to participate in open-ended discussions through active learning, and discovery or hands-on learning experiences. That is to say, following a student-centred approach instead of a more traditional one, I mean the teacher-centred one. I think that nowadays, the role of the teacher must be that of a mediator rather than the old-fashioned figure of absolute authority in the class. Furthermore, the Internet is a fantastic class resource for the sake of finding useful information and bringing lessons to life. Indeed, it can be used as a stress-reducing strategy, especially for those students whose learning preferences and intelligences are more visual and active.

Providing a previewing lesson at the end of the class

One of the most beneficial and I would say effective strategies in the case of SNS, from my opinion[11], is that of providing a previewing lesson at the end of the class. It can help LD students prepare the following lesson in advance, or with parents at home. In that way, LD students can feel more comfortable and confident and less frustrated in the next class.

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[11] My own experience as teacher has shown me that this strategy is really effective to provide not only students but also teachers with a sense of confidence in themselves based on the anticipation of their future tasks, leading to a more comfortable situation for the next lesson.

Teaching organizational strategies

Especially in the case of ADHD students, I personally believe that teaching organizational strategies is fundamental. For instance, it is a good idea that at the end of the class, teachers provide students with a few minutes to make a short list, chart, diagram, sketch or summary of the four or five main points learned in the lesson. As Judy Willis writes,

> Another way to help students stay organized is to have them start homework, reports, and projects in class. Daily homework can be overwhelming once students leave the classroom, especially when that classroom includes a wide range of abilities. Information and instructions that seemed clear during class can become confusing when the scaffolding and security of teacher supervision is removed. Students with LD may be especially disturbed when they feel they have lost what they learned and can't do the work they are expected to do (Willis, 2007: 30 – 31).

Providing feedback

Setting the appropriate goals is as important as to provide feedback on the reached goals. So, I think that examining students' progress and seeing if they have reached the expected goals will benefit them. In fact, rewarding students' efforts will lead to the establishment of stronger neuronal networks and more relational connections, allowing the data to be stored in the long-term memory more likely. In order to maximize individual success, teachers can use pre-assessments and advance planning. In so doing, they will know what the students know, what they need to know to reach their goals, which methods are more effective for each student depending on their learning styles and multiple intelligences, and what kind of assessment is more beneficial for each learner. Teachers can use both assessment rubrics and formative assessment.

Normally assessment rubrics include different categories of measurement, so, every student will feel capable of getting good outcomes and levels in at least one of these rubric categories, even when he or she fails in another category. Some of these rubric categories of measurement are the quality of work, the effectiveness in following instructions, the organization, grammar, cooperation in group work, etc.

On the other hand, when talking about formative assessment, we can say that there are different ways in which teachers can put into practice some effective and creative ongoing assessment strategies during the lesson in order to give individualized feedback and assessment to every student. For example, teachers can provide students with whiteboards and when a

question is made, students write the answer on the whiteboards and then hold it up for the teacher to see and provide the feedback. Judy Willis assures that,

> A variety of assessment modalities and some student choice in assessment type can bring students to the assessment with less anxiety and increase the positive learning experience, as well as provide the opportunity for them to demonstrate what they know and not simply what they memorized, forgot, or never learned. Examples include tests where notes or textbooks are permitted, take-home tests, and student-made tests that they prepare and the teacher can alter so that the answers are not just memorized (...). When the teacher rewrites the question, it could prompt more analysis and executive function connections if it is rephrased (Willis, 2006: 91).

In addition, in the same way as students with learning disabilities should be taught by setting appropriate goals and expectations for the speed of their learning process, their assessments should also be differentiated, especially in the case of ADD learners, whose frontal lobe executive functions are less mature and perform in a different way.

Planning developmentally appropriate lessons

Finally, regarding how to plan developmentally appropriate lessons, Judy Willis explains:

> Just as children mature physically at different rates, chronologically age may not reflect students' readiness to learn. Jean Piaget set forth guidelines for average stages of development in multiple aspects of thinking. He noted that the average 7 – or 8 – year – old is in the pre-operational stage, able to think symbolically to the extent that he or she can represent concrete objects and experiences with symbols in his or her mind. By age 10 or 11, the average child is in the concrete operational stage and able to think in abstract terms, generalize, and make connections (...). Developmental variation is much greater in inclusion classes than in non-inclusion classes, and teachers may find it useful to assess struggling students' developmental stages so that they can direct instruction to their appropriate levels. If LD students in 5th grade are having difficulty grasping such abstract principles as warfare, taxation, property rights, sound waves, and light reflection, they might need more concrete material and structured, sequential instruction and practice to prepare them at their developmental level. When they have reached the concrete operational stage, they will have the background they need to perform executive function reasoning tasks. Children cannot be pushed through a developmental stage. They need time to assimilate information before passing to a higher cognitive level. The confusion and frustration caused by developmentally inappropriate lessons can lead to withdrawal from active learning, disruptive behaviour, and decreased motivation and confidence. As long as teachers provide a safe, supportive environment for learning, students will reach the higher

developmental stages at the time appropriate for them. Giving them opportunities to practice and build on the cognitive skills they have and are learning will ensure their successful experiences as learners (Willis, 2007: 32 – 33).

Another key idea when planning developmentally appropriate lessons is to take into account these two aspects: giving students time to learn and process the new information, and also planning frequent and short breaks or brain rests. For example, it is a good idea to give students a three-minutes vacation for telling a joke or a personal experience. When teachers do that, they are taking the students' RAS out of its survival response to stress. It seems to me that this is even more vital when dealing with SNS. For instance, in the case of students with attention problems, teachers should provide these learners with an extra time to finish their activities or tests; or for example, in the case of dyslexic students, teachers should offer them the possibility of taking oral exams.

To sum up, I believe that if all these teacher strategies are followed, then teachers will be fostering students' motivation, interest for their subject, optimism towards their learning process' achievements, and self-confidence. However, we should also take into account another brain-compatible strategy so effective in monolingual communities learning a L2: the use of the L1 at certain moments as an approach to promote a sense of belonging, a relaxed atmosphere, and lack of stress and anxiety in a neurodiverse classroom.

2.4.5. Use of the L1 within the L2 class

If we direct our attention to the process learning a second language (L2), specifically, in an English as Foreign Language (EFL) class, if teachers use a particular list of vocabulary items for the first time, it will be declarative knowledge for learners. However, when these same items are presented in a motivating way for students, and it appears repeatedly, giving students the opportunity of working and practicing with such vocabulary, for instance, in a book or novel they are reading in class, the knowledge and use of such items can be turned into procedural or automatic: they will acquire that vocabulary within their L2 lexical repertoire.

As Michel Paradis exposes, when learners are engaged in communicative environments where they are exposed to certain L2 input, and they have the opportunity to practice, repeat, and manipulate such input, it is likely that such consciously learnt and explicit information becomes acquired and stored as implicit knowledge, and finally it will be used in an automatic

way. Furthermore, Paradis assures that this same effect of practice and exposure to the L2 input can be reached and potentiated through the learners' motivation towards the process of learning itself (Paradis, 2004).

When we acquire our mother tongue or first language (L1), we learn how to signify, that is, we discover that the language is used for the sake of communicating and sharing ideas with other people. On the other hand, when we learn a second language (L2), we already know how to signify. That is why when we learn an L2, we do it in an artificial or learnt way, rather than in a natural manner. This idea has been largely explored by John Schumann. According to Schumann, the basic difference between L1 and L2 is that when learning the L2 there is a lack of motivation or desire to communicate a message, because this necessity has already been already supplied by the L1, and consequently, during the process of learning an L2 there will be a low release of dopamine in the student's brain (Schumann, 1988).

However, although in technical terms the L1 is naturally acquired whereas the L2 is artificially learnt, we could say that the knowledge and use of the L2 can be also acquired when the appropriate factors are reached. In other words, the L2 explicit or declarative information that is first learnt can be turned into implicit or procedural knowledge through practice, frequent review, and motivation.

The physiology of emotions and motivation

> Emotion is a double-edged sword with the ability to either enhance or impede learning. Understanding the biological underpinnings of emotion helps educators see why we need to provide emotionally healthy and exciting school environments to promote optimal learning (Wolfe, 2010: 142).

According to Chronister and Hardy, within the limbic system there are diverse structures that cope with emotions. Some of these structures are identified as aversive or punishment areas, and others are labelled pleasure or reward areas. When an aversive area is stimulated, then the individual suffers from feelings of sadness and fear. On the other hand, when a pleasure area is stimulated, the subject feels delight. The majority of the limbic structures possess both types, aversion and pleasure areas. However, in some of them there happens to be a certain predominance of one or another. For instance, the amygdala, the medial thalamus, and the anterior cingulate cortex have plenty of aversive areas; while the accumbens

nucleus, the posterior cingulate cortex, and the septal nucleus are rich in pleasure areas (Chronister & Hardy, 2010: 504; & Uriarte Bonilla, 2013: 140, 386, 387).

One limbic structure that contains both types of areas is the hypothalamus. The hypothalamus, following Charles Noback and others' words, is in charge of the bodily homeostatic processes and their automatic reactions (like regulation of heartbeat, sweating, facial blushing and paleness, mouth dryness, mydriasis [that is, pupil dilatation], and sanguine glucose concentration alterations) (Noback et al., 1993: 321 - 322).

That is why the function of the hypothalamus is closely related to the corporal reactions of emotions and behaviors. So, according to Hardy and others, the two areas in the hypothalamus work in that way: the stimulation of the caudolateral hypothalamus leads into behaviors and conducts that are closely related to anxiety. On the contrary, the stimulation of the rostromedial hypothalamus results in behavioral manifestations that deal with the feelings of achievement, success, and satisfaction (Hardy, Chronister, & Parent, 2010: 491).

Following Lamendella's studies, there is a close relationship between the implicit linguistic competence and the emotions filtered by the amygdala of the limbic system. On the other hand, metalinguistic knowledge lacks such connection to emotions (Lamendella, 1977). This is also the path that Schumann has followed in his studies about the process of learning a second language, the importance of motivation, the role of the amygdala, and dopamine release (Schumann, 1994 & 1988).

As Judy Willis explains, when learners expect an intrinsic reward, dopamine release will happen, and learning will be more likely to be successful (Willis, 2007). Kevin Black also adds that such dopamine release in the learners' brain will increase as a response to certain positive experiences, for instance, receiving positive feedback from the teacher and the rest of mates, playing, laughing, doing exercise, etc. (Black, 2002).

Laughter and humor[12] have a fundamental role in the release of endorphin, adrenaline, and dopamine, together with an increased breathing volume permitting more oxygen to enter the brain (Willis, 2006: 42). Furthermore, laughing is a perfect community builder. When a lesson starts with humor, the information being taught will be attached to a positive emotional moment.

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[12] I strongly support this idea as a teacher, since I have contrasted its effectiveness in my own lessons. No doubt, it is the teacher's duty to try to create an atmosphere that potentiates wellbeing and relaxation for students.

In fact, Judy Willis goes beyond that simple explanation and upholds that there is a connection between the previously mentioned dopamine release when expecting a reward and the stimulation of the hippocampus due to a consequent acetylcholine release:

> Because dopamine is a major chemical neurotransmitter associated with attention, decision making, and executive function, it follows that the brain's release of dopamine in connection with pleasurable experiences has the benefit of increasing the efficiency of the synapses controlling attention and executive function. An additional bonus is that dopamine released in expectation of reward triggers the release of acetylcholine, a neurotransmitter that in turn directly stimulates the hippocampus, the modulating centre for consolidating new learning to related stored memory (...).When learning activities are repeatedly linked to enjoyable experiences, students' brains learn to seek out those activities. When students perceive a cue that the pleasure-linked learning activity will begin, their brains release dopamine in expectation of the experience (Willis, 2007: 71 - 72).

However, according to Uriarte Bonilla, anxiety and stress are physiologically provoked by an increase in the production of certain neurotransmitters[13], like dopamine, noradrenaline, serotonin, GABA, glutamate, and others. Consequently, the aversive areas of the limbic structures (specifically, the amygdale, the prefrontal cortex, the hippocampus, the hypothalamus, and the locus coeruleus) will be stimulated and will segregate those neurotransmitters, impeding the process of learning to happen successfully (Uriarte Bonilla, 2013: 178 - 179).

Larry Cahil assures in a speech that adrenaline, noradrenaline, and cortisol are the three major hormones related to the stress response. Adrenaline and noradrenaline put the stress

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[13]   Research on neuroimaging and brain mapping, such as the studies carried out by Kinomura and others, has found the correlation between neurotransmitters and ADHD. When there is a low quantity of certain types of neurotransmitters, especially norepinepherine (also called noradrenaline) and dopamine, together with a poor interconnection among the neuronal networks, and low levels of brain metabolism, then, there is a variation from the norm which is more prominent in the RAS, the limbic system, and the frontal lobes. Consequently, when the RAS filter is activated by emotion, this information must be sent to the frontal lobes and memory centers so that learning is likely to happen. However, if the RAS's levels of activity are abnormally lower, the frontal lobes will be hardly stimulated, and there will be difficulties in memorization, learning, and it could even result in impaired self-control. On the other hand, when the RAS is overactivated and the frontal lobes receive more stimuli than necessary, then, the learner can suffer from hyperactivity and even hyperketic behavior (Kinomura et al., 1996).

Experimental research on that field, as the one developed by Pawlak and others, has studied the use of stimulant medications (like Ritalin), for increasing the levels of norepinepherine and dopamine in the RAS and the frontal lobes. These experiments try to solve attention focusing difficulties and problems with processing information in learners with ADHD (Pawlak et al., 2003).

response in motion altering the homeostatic regulation processes just in seconds. On the contrary, a third hormone, called cortisol, is able to back up the activity of the stress response for a long time. Such hormone is segregated when, for instance, students are engaged in an emotional and motivational task, and consequently, their process of learning will be carried out in a more effective way (Cahil, 2000). Judy Willis connects the notions of stress and learning in these terms:

> Stress in the classroom or elsewhere, especially when associated with anxiety or fear, releases a chemical called TMT, or trimethyltin, into the brain. TMT disrupts brain cell development. When it is present in brain regions during short stressful periods, there is impaired short-term memory and work efficiency. After extended periods of stress, TMT is associated with reduction in long-term memory storage and retrieval, motivation, and creative problem solving. While students under stress may appear to work 'harder', the quality of the work decreases (Willis, 2006: 59).

Consequently, teachers should learn how to stimulate the pleasure or reward areas of the limbic systems of their students, and try to avoid the teachings that foster an environment that promotes the activation of the aversive areas of the brain. As Judy Willis upholds,

> When we take into account the information-blocking potential of both the RAS and the affective filter in the amygdala, it becomes clear how important it is for teachers to create environments low in destructive anxiety and high in appropriate challenge (Willis, 2007: 43).

That is why David Kumar refers to the importance and role of the teacher in being able to connect the contents of the lesson to the personal interests and lives of the learners, so that stress and anxiety are reduced at the time that motivation and self-confidence increases (Kumar, 1991).

For instance, in the English class[14], if teachers incorporate physical activities and enjoyable tasks in their vocabulary lessons, each time that there is a vocabulary lesson, students' brains will be stimulated and they will unconsciously associate such lessons with the expectation of fun. When such expectation happens, there is a dopamine release in students'

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[14] In the case of Special Needs students (SNS) learning English at school as a Second Language, it is even more important to take into account the research provided by the current brain studies. And for the sake of awaking these students' motivation and lowering their sense of failure and frustration, I personally believe that the use of their L1 is essential. This is the main hypothesis maintained in this research project.

brains that will allow them to maintain the focus of attention on the lesson and their executive functions will work better.

Interlanguage: the continuum between the L1 & L2

The process by which learners finally acquire the L2 starts with the interference of what Larry Selinker coined as *interlanguage*[15]. The interlanguage is a changing linguistic system, a continuum between the L1 and the L2, used at a particular moment during the process of learning a L2 when the learner is not still fully proficient in the L2, and consequently there is certain interference with the L1. In other words, the L1 is already arranged in the learners' mind, so students use this knowledge as the basis for their learning of the L2 (Selinker, 1972).

This idea is critically important in the case of SNS, since they will find a fundamental support in their L1 when learning the L2, due to the fact that the developmental stage of each learner will be different, and their mastery of the L1 will be different too. In this way, they could feel more confident when using their L1 at certain moments during the lesson, rather than using the L2 all the time. When students feel self-confidence and motivation in the classroom due to the fact that the teacher has created the appropriate conditions and safe environment, then, the students' pleasure or reward areas of the limbic system will be stimulated, and the aversive ones will not. Consequently, the process of learning will be more easily successful. Judy Willis explains that a clear type of stressful experience in which students' amygdala or affective filter will irrevocably block the learning process could be the case of "teaching a lesson in a language that students don't understand without using TPR (Total Physical Response, with gesturing, pointing to objects, pantomime, and other techniques to give them the information they need" (Willis, 2006: 25). In this respect, from my point of view, the use of the L1 within the L2 class is of superior importance.

As Ernesto Macaro explains, there are three different teachers' perspectives on the idea of the learning process of the L2:

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[15] In this project, and as Enrique Leganés expresses in his thesis, the term *interlanguage* will not refer to the fact that there is a direct and negative consideration of the mistakes made by learners in the use of the L2 as a consequence of the interference of their L1; but on the contrary, the *interlanguage* will be considered as an inevitable phase during the process of learning the L2 which will show up what is happening within the brain of such learners in that exact moment (Leganés, 159).

Some believed that the second language could only be learnt through that language, and that exclusively use of the second language provided a kind of virtual reality classroom which mirrored the environment both of the first language learner and the newly arrived migrant to the target language country (…). Some believed that the second language was only really learnt through the second language but that this was an unattainable ideal because in second language classrooms the perfect learning conditions did not exist. One therefore had to use the second language as much as possible. However, since with each use of the first language the ideal was tainted, a sin was being committed and, as many people know, sinning leads to feelings of guilt" (…). Some believed that there was some recognizable value in first language use. That at certain moments during the teaching and learning process the use of the first language might actually enhance learning more than by sticking to the second language (Macaro, 2009: 36).

The main theories supporting the last perspective come from three different sources, according to Ernesto Macaro: Cognitive Processing Theory, Sociocultural Theory, and Codeswitching in naturalistic environments Theory.

Following Nick Ellis, the Cognitive Processing Theory states that both the L1 and L2 are contained in the same conceptual storing banks, with no necessity of language specific division until it is required, and consequently, there is an increasing number of neural connections and higher possibility of repeated activation of such neural pathways (Ellis, 2005).

The Sociocultural Theory holds that our L1 governs the way we think and act. So, provided that our inner voice and private speech are usually shown up through the L1, it is inevitable to use this ability to learn the L2.

Finally, the notion of codeswitching, described by Chad Nilep as "an alternation in the form of communication that signals a context in which the linguistic contribution can be understood" (Nilep, 2006: 17), could be also applied to the field of L2 learning. As Miles Turnbull and Jennifer Dailey-O'Cain hold,

Learners' codeswitching resembles that of advanced bilinguals, which suggests that the use of the first language in classroom discourse in fact is an essential step toward bilingualism, the ultimate goal in language learning (Turnbull & Dailey-O'Cain, 2009: 183 – 184).

From my point of view, there is nothing wrong with using the L1 in the L2 class. Indeed, as Heidi Dulay and Marina Burt expose, "L2 learners use their first language knowledge to help, rather than hinder, their use of the new language" (Dulay & Burt, 1980: 8).

For instance, recent research within the field of L1 and L2 use in French immersion programs, carried out by Brian McMillan and Miles Turnbull, holds that,

The fact of both teacher-participants used the students' first language to some degree over the course of the first few weeks (...) is an important finding. Contrary to Ministerial guidelines which state that immersion classes are to be conducted exclusively in the target language from the first day of classes (...) employing codeswitching at this early stage may be of great benefit to learners who otherwise may not have the chance to properly acquire the basics (McMillan & Turnbull, 2009: 32).

In fact, some research carried out in Texas by Joseph Perozzi and María Lourdes Chávez assures that bilingual children with language delay perform better in their L2 if they have the support of their L1 during the lessons (Perozzi & Chávez, 1992). These authors try to extend their ideas from the previous studies by Jim Cummings. Cummings explores a concept that I think it is very closely connected to what he calls the "interdependence hypothesis", meaning that children without language developing problems in their native language will be more proficient in their L2 when instruction in the L1 is best processed. So, the more they master the L1, the more proficient they will be in the L2, because L1 proficiency can be transferred to L2 (Cummings, 1979).

In that way, Perozzi and Chávez have examined Cummings' hypothesis but taking into account the case of bilingual children suffering from language delay. So, I would like to extend their research into my idea that a minority of Special Needs students, specifically Spanish non-bilingual children with developmental delay provoking any learning disability, can improve their proficiency in the L2 through the support and the appropriate intervention of the L1 during the lesson.

To sum up, in the case of SNS, each learner will have a different level in the mastery of both the L1 and the L2. This is the reason why it will be fundamental for teachers to rely their lessons, to a great extent, on the use of metalinguistic knowledge and learners' declarative memory, so that little by little, such explicit information can turn into implicit, and finally it will be stored in the procedural memory as the skill has finally been acquired and mastered.

So, teachers should take advantage of the proper strategies that activate SNS' motivation and confidence through the pleasure or reward areas of the limbic system when teaching a L2 on the basis of the L1. During this process of learning, students will make mistakes when using the L2 because of that interference from the L1, the interlanguage. But, by means of practice and motivation, students will acquire progressively new skills and knowledge. In that way, the declarative information will be turned into procedural and more automatic knowledge.

According to Michel Paradis and Jan Hulstijn, metalinguistic knowledge is not acquired but learned in a conscious way, then it is stored in an explicit manner, and finally it is used in a controlled way (for example, in those cases in which the learners of an L2 apply certain grammatical rules they have learnt and memorized intentionally). Such metalinguistc knowledge is closely related to declarative or explicit memory, which is the combination of both semantic and episodic memories. Declarative memory, consequently, depends upon the workings of the hippocampus and the temporal lobes, together with some areas of both sides of the tertiary cortex, surrounding the temporal lobes' zone.

On the other hand, the necessary linguistic competence of our L1 is acquired in a natural way, then it is stored in an unconscious or implicit manner, and finally it can be used automatically. In that way, such linguistic competence is in connection to procedural and automatic long-term memory since it has become an implicit skill. Such automatic skill basically depends upon the cerebellum, the amygdala, some areas of the left cortical region (especially the basal forebrain), the basal ganglia, and the corpus striatum (Paradis, 2004; and Hulstijn, 2005).

So, if teachers of an EFL class follow a formal teaching method, students' learning process will basically rely on declarative memory, and they will be conscious of the cognitive effort they are explicitly making. On the contrary, if teachers bring into play a communicative approach, little by little, students' learning will be more likely to rely on procedural memory, and finally they will be able to use the L2 in an automatic and implicit way. The higher the degree of automaticity and management with the L2 with the support of the L1, the stronger the feelings of self-confidence and motivation for the expectation of a reward, thus, releasing dopamine and stimulating the pleasure areas of the limbic system in their brains. That is why Miles Turnbull and Jennifer Dailey-O'Cain explain that,

> Optimal first language use in communicative and immersion second and foreign language classrooms recognizes the benefits of the learner's first language as a cognitive and meta-cognitive tool, as a strategic organizer, and as a scaffold for language development (Turnbull & Dailey-O'Cain, 2009: 183).

CHAPTER III:

RESEARCH DESIGN

3.1. METHOD & METHODOLOGY

The present research project follows a focalized descriptive and transversal method, and it employs a quantitative methodology.

This study has a focalized descriptive nature since it tries to specify the fundamental characteristics, proprieties, and profiles of a certain group of people, in this case, Special Needs Students learning English as second language in a secondary education inclusive classroom.

In addition, this research project is transversal because it analyzes a determined situation in a concrete point in time. That is to say, this study analyzes the effectiveness of classroom management with regards to brain-based strategies for building an enriched environment during the academic year of 2013/2014. The idea is to leave the longitudinal study correlating and continuing the current one for future researches.

Finally, the instruments employ a quantitative methodology so that the variables can be measured with the highest degree of objectivity possible. Questionnaires are found annexed at the end of the project.

3.2. LIMITATIONS OF THE METHODOLOGY

The main limitation found in the methodology of this research project has been, from my point of view, the fact that there will be always a subjective perspective that we cannot obviate when measuring the variables and analyzing the data obtained; and the reason is that every instrument has been filled by a human being. So, in spite of all the posterior statistical measures, complete objectivity will never be reached in this kind of studies.

3.3. INSTRUMENTS, VARIABLES, AND PARTICIPANTS

There are five different instruments employed in this study, and each of them is directed to a specific group of participants. Every instrument has been delivered in Spanish, the mother tongue of the participants.

- **INSTRUMENT 1:**

DESCRIPTION OF THE INSTRUMENT:

This first instrument is directed to the headmasters of the three centers chosen for this study. It consists of a validated adaptation of the "Quality Indicators for Effective Inclusive Education" questionnaire by the New Jersey Coalition for Inclusive Education, & the New Jersey Council on Developmental Disabilities in 2010. The instrument used in this study is made of 30 quantitative items measured with a 4-point Likert scale. The values of the scale are: 1- Totally; 2- Considerably; 3- Partially; and 4- Not yet.

Its aim is to analyze the degree of effectiveness of inclusive education programs in the neurodiverse L2 class in each of the three centers.

The three centers in Córdoba capital city finally chosen for the present study were the following ones:

- Colegio María Inmaculada, a private religious center.
- Colegio Ferroviario, a semi-private non-religious center.
- Instituto Blas Infante, a public non-religious center.

VARIABLES:

The variables measured in this instrument are the following ones:

❖ Independent variables:
  o Type of center (Private, Semi-private, or Public).
  o Grade of Secondary Education selected in the center (1st or 3rd grade).

❖ Dependent variables (all of them measured by using the 4-point Likert scale):
  o Center's attitude towards students' goals.
  o Center's attitude towards family-school partnership regarding their involvement.
  o Center's attitude towards standard curriculum as base for instruction for all students.
  o Center's attitude towards students' outcomes and teachers' professional development.
  o Center's attitude towards the provision of incentives for teachers fostering inclusion.
  o Center's attitude towards collaborative teaching and planning.
  o Center's attitude towards teachers' assessment regarding students' individual goals.
  o Center's attitude towards teachers' assessment regarding Special Needs students' participation.
  o Center's attitude towards teachers' strategies regarding Universal Design for Learning's ways of presentation.
  o Center's attitude towards special support teacher's role.
  o Center's attitude towards diversity in the classroom.
  o Center's attitude towards academic and non-academic inclusive activities.
  o Center's attitude towards special support teachers' organization regarding students' individual support and curricular adaptation's criteria.

- o Center's attitude towards Special Needs students regarding social interactions in academic activities.
- o Center's attitude towards Special Needs students' regarding social interactions in non-academic activities.
- o Center's attitude towards teachers' strategies to present information regarding visual and tactile materials.
- o Center's attitude towards teachers' individual curricular adaptations.
- o Center's attitude towards teachers' ways of engagement regarding Universal Design for Learning.
- o Center's attitude towards Special Needs students' curricular adaptations regarding individual abilities and necessities.
- o Center's attitude towards staff's collaborative work regarding Special Needs students.
- o Center's attitude towards Universal Design for Learning's ways of expression.
- o Center's attitude towards curricular adaptation's criteria and assessment.
- o Center's attitude toward teachers' collaboration regarding curricular adaptation's goals.
- o Center's attitude toward family-school partnership regarding decision-making.
- o Center's attitude toward families regarding diversity awareness.
- o Center's attitude toward family-school partnership regarding problem-solving.
- o Center's attitude toward teachers' abilities to manage the heterogeneous classroom.
- o Center's attitude toward teachers' collaborative assessment and evaluation.
- o Center's attitude toward the implementation of Best Practice regarding inclusion for teachers.
- o Center's attitude toward Best Practice improvement and assessment.

PARTICIPANTS:

The sample for this first instrument consists of three participants, the three headmasters of each of the Secondary Education centers being analyzed. The three centers have a different organization: one is public, another one is private, and the third one is semi-private. The three centers have been chosen randomly.

✚ INSTRUMENT 2:

DESCRIPTION OF THE INSTRUMENT:

This instrument is directed to students. This anonymous questionnaire consists of 10 quantitative items measured with a 5-point Likert scale. The values of the scale are these ones: 1- Strongly agree; 2- Agree; 3- Neutral; 4- Disagree; and 5- Strongly disagree.

The aim of this instrument is to explore students' perceptions and feelings about studying English in a heterogeneous classroom, together with the advantages and disadvantages of inclusive education.

VARIABLES:

The variables measured in this instrument are the following ones:

❖ Independent variables:
   o   Type of center (Private, Semi-private, or Public).
   o   Grade of Secondary Education selected in the center (1st or 3rd grade).
   o   Students' gender (Male or Female).

❖ Dependent variables (measured by a 5-point Likert scale):
   o   Students' attitude towards classroom atmosphere.
   o   Students' attitude towards inclusive education.
   o   Students' attitude towards collaborative planning and teaching.
   o   Students' attitude towards teacher's support and help.
   o   Students' attitude towards special support teacher's role.
   o   Students' attitude towards their school performance.
   o   Students' attitude towards their school performance regarding inclusion.
   o   Students' attitude towards participation and motivation.
   o   Students' attitude towards the appropriateness of goals and challenges.
   o   Students' attitude towards assessment and evaluation methods.

PARTICIPANTS:

The participants for this instrument belong to two different levels of the Secondary Education in Córdoba city: the group of students from the private center comes from the 1st level of Secondary Education; whereas the other two groups of students from the public and the semi-private centers belong to the 3rd level of Secondary Education.

The sample for this instrument is a total number of 74 participants. The sample from the private center is 20 participants; the sample from the semi-private center is 30 participants; and finally, the sample from the public center is 24 participants.

INSTRUMENT 3:

DESCRIPTION OF THE INSTRUMENT:

The third instrument is directed to both mainstream English teachers and special support teachers of the 3 groups of students. This questionnaire is the "Attitudes Toward Inclusion in Africa Scale" instrument (ATIAS), already used in another research by Joseph Agbenyega in 2007. This instrument consists of 20 quantitative items measured with a 7-point Likert scale. The values of this scale are the following ones: 1- Strongly agree; 2- Agree; 3- Agree somewhat; 4- Neutral; 5- Disagree somewhat; 6- Disagree; and 7- Strongly disagree.

The main goal of this instrument is to examine teachers' perceptions about inclusive education, and their capacities to manage with a heterogeneous class, regarding behavioral issues, students' needs, resources, and professional competency.

VARIABLES:

The variables measured in this instrument are the following ones:

❖ Independent variables:
  o Type of center (Private, Semi-private, or Public).
  o Grade of Secondary Education selected in the center (1st or 3rd grade).
  o Type of educator (Mainstream English teacher or Special support teacher).

❖ Dependent variables (all measured with the 7-point Likert scale):

- o Teachers' attitude towards behavioral issues: Acceptance of norms.
- o Teachers' attitude towards students' verbal aggressiveness.
- o Teachers' attitude towards students' physical aggressiveness.
- o Teachers' attitude towards students' impulsiveness.
- o Teachers' attitude towards scholar absenteeism.
- o Teachers' attitude towards motor disabilities.
- o Teachers' attitude towards sign language.
- o Teachers' attitude towards expressive disorders.
- o Teachers' attitude towards functional disorders.
- o Teachers' attitude towards students' persisting difficulties in expressing thoughts.
- o Teachers' attitude towards attention problems.
- o Teachers' attitude towards diction and oral language difficulties.
- o Teachers' attitude towards Braille.
- o Teachers' attitude towards the barrier access issue.
- o Teachers' attitude towards resources and materials regarding inclusion.
- o Teachers' attitude towards the size of classrooms.
- o Teachers' attitude towards anxiety and stress regarding inclusion.
- o Teachers' attitude towards their management in the heterogeneous classroom.
- o Teachers' attitude towards their abilities and knowledge regarding SNS.
- o Teachers' attitude towards equitable attention to all students.

PARTICIPANTS:

The sample for this instrument consists of three mainstream teachers of English and two special support teachers. The only center that does not count with a special support teacher for the English class is the public one.

⊕ INSTRUMENT 4:

DESCRIPTION OF THE INSTRUMENT:

The fourth instrument is also directed to the same mainstream teachers of English and special support teachers mentioned in the previous instrument. Instrument 4 consists of a 10-items quantitative questionnaire measured with a 5-point Likert scale. The values of this scale

are the following ones: 1- Of course yes; 2- Yes, sometimes; 3- Neutral; 4- No, rarely; and 5- Of course no.

The main objective of this instrument is to analyze the degree of implication of educators with regards to inclusive education, and also the kind of methodologies and brain-compatible strategies that they use in the English class.

VARIABLES:

The variables measured in this instrument are the following ones:

❖ Independent variables:
  o   Type of center (Private, Semi-private, or Public).
  o   Grade of Secondary Education selected in the center (1st or 3rd grade).
  o   Type of educator (Mainstream English teacher or Special support teacher).

❖ Dependent variables (all measured with the 5-point Likert scale):
  o   Teachers' attitude towards their concern about inclusion.
  o   Teachers' attitude towards their experience and training regarding diversity.
  o   Teachers' attitude towards their knowledge about support services and resources promoting inclusion.
  o   Teachers' attitude towards equality of opportunities for all students.
  o   Teachers' attitude towards curricular adaptations' execution.
  o   Teachers' attitude towards curricular adaptations' criteria.
  o   Teachers' attitude towards the use of brain-compatible strategies.
  o   Teachers' attitude towards the creation of a sense of belonging in the classroom.
  o   Teachers' attitude towards the use of the L1.
  o   Teachers' attitude towards the use of a communicative and collaborative method.

PARTICIPANTS:

The sample for this instrument is the same as the one mentioned in the previous instrument, three mainstream teachers of English and two special support teachers.

✚ INSTRUMENT 5:

DESCRIPTION OF THE INSTRUMENT:

Finally, the last instrument is directed to families. It is an anonymous 10-item quantitative questionnaire measured with a 7-point Likert scale. The values of this scale are the following ones: 1- Strongly agree; 2- Agree; 3- Agree somewhat; 4- Neutral; 5- Disagree somewhat; 6- Disagree; and 7- Strongly disagree.

The intention of this instrument is to explore parents' opinions about the EFL inclusive classroom; what they think are the benefits or limitations of it; and what they expect from their respective children in terms of learning, evaluation, etc.

VARIABLES:

The variables measured in this instrument are the following ones:

❖ Independent variables:
  o   Type of center (Private, Semi-private, or Public).
  o   Grade of Secondary Education selected in the center (1st or 3rd grade).
  o   Type of family member (Mother, Father, or Another).

❖ Dependent variables (all measured with the 7-point Likert scale):
  o   Families' attitude towards inclusion.
  o   Families' attitude towards segregation.
  o   Families' attitude towards the acceptance of diversity.
  o   Families' attitude towards the limitations of inclusion.
  o   Families' attitude towards classroom environment.
  o   Families' attitude towards collaborative teaching and planning.
  o   Families' attitude towards educators' management and students' scholar performance.
  o   Families' attitude towards academic development regarding inclusion.
  o   Families' attitude towards social and emotional development regarding inclusion.
  o   Families' attitude towards assessment and evaluation.

PARTICIPANTS: 74

The sample in this instrument is constituted by the parents of the students that participated in the first instrument and that finally accepted to fill in the questionnaire voluntarily. So, the sample consists of 20 participants, organized in this way: two participants belong to the private center; seven participants come from the public center; and eleven derive from the semi-private center.

3.4. DATA RECOLLECTION, TIMING, &
TECHNICAL PROCEDURE

The field research part of this project for the recollection of data covers the last month of the academic course 2013/2014, June. Along this month, the three different centers agreed to participate in the study after signing the pertinent consent documents, one type for the headmasters of the centers, and another one for parents. Once such authorizations were achieved, the five instruments were delivered to participants in the date agreed for each center. The two different formats of consent document are annexed at the end of the project.

The technical procedure employed in this study for the statistical analysis of data is the IMB SPSS Statistics (19 version) program.

CHAPTER IV:
RESULTS, DATA ANALYSIS, & DISCUSSION

4.1. RESULTS AND DATA ANALYSIS

The results obtained in this study, having as its purpose to reach the proposed objectives, have been analyzed through descriptive statistics of frequency together with the statistic test provided by the 19 version SPSS programs.

Now, the results of the study will be presented by means of the following tables and figures:
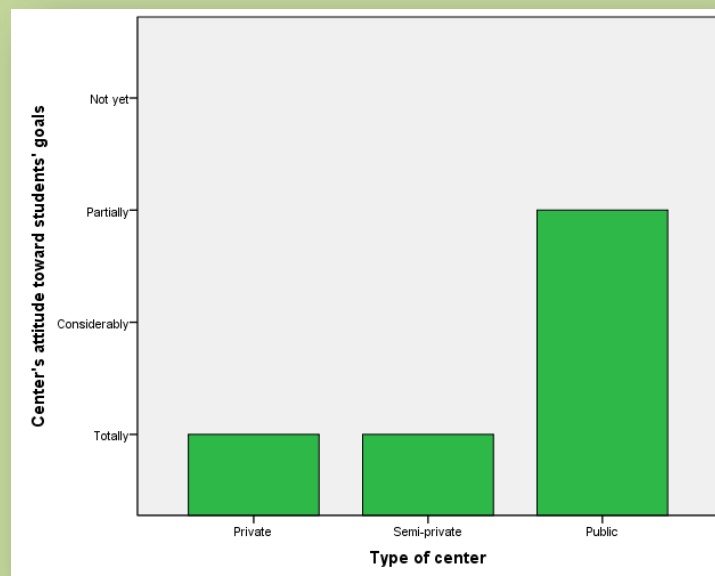
Figure 4.1.1.4. Centers' attitude towards students' goals [Source: Own preparation]

Figure 4.1.1.4 shows up that the Private and Semi-private centers' philosophy totally reflects that every student is able to achieve the agreed goals. On the other hand, the Public center's attitude partially agrees on that.
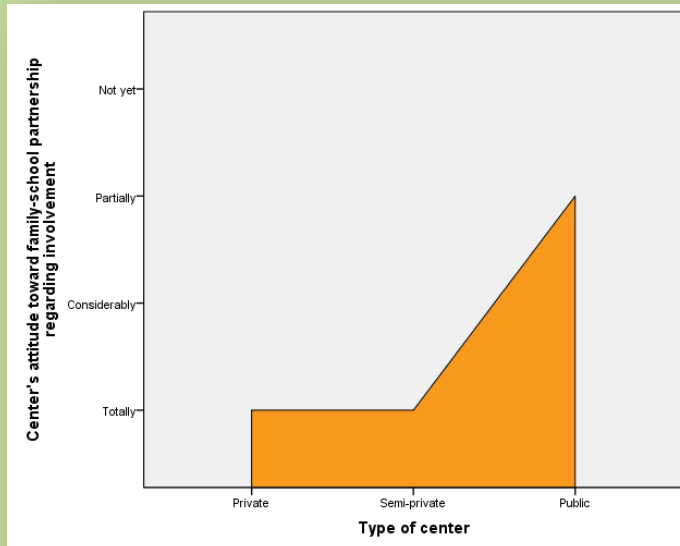
Figure 4.1.1.5. Centers' attitude towards family-school partnership regarding involvement [Source: Own preparation]

Figure 4.1.1.5 reflects that the Private and Semi-private centers' normative includes all the involved agents regarding inclusion practices, that is to say, families, administration, students, and teachers. However, the Public center partially agrees on that again.
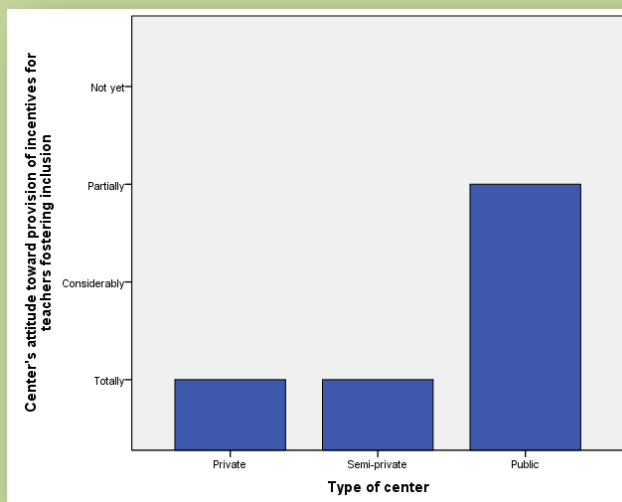
Figure 4.1.1.6. Centers' attitude towards provision of incentives for teachers fostering inclusion [Source: Own preparation]

Figure 4.1.1.6 repeats the same dynamic of answers: the Private and Semi-private centers totally agree that their normative implements incentives fostering teachers of English to accept and practice inclusion teachings; whereas the Public center partially agrees on that idea.
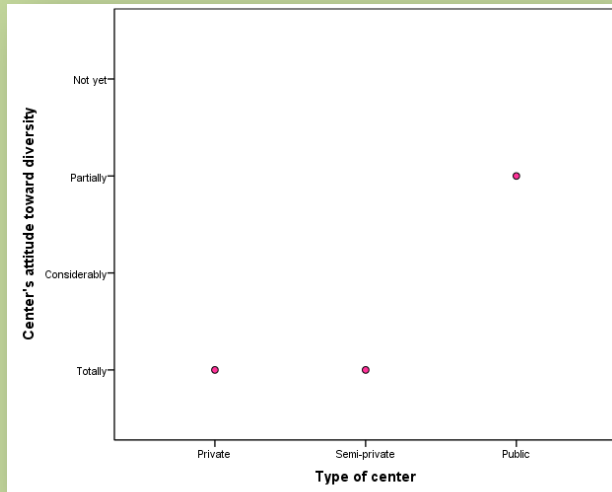
Figure 4.1.1.7. Centers' attitude towards diversity [Source: Own preparation]

Figure 4.1.1.7 shows up that the Private and Semi-private centers' normative fosters an environment which celebrates diversity and creates an atmosphere of acceptance of differences; while the Public center partially agrees on that idea.
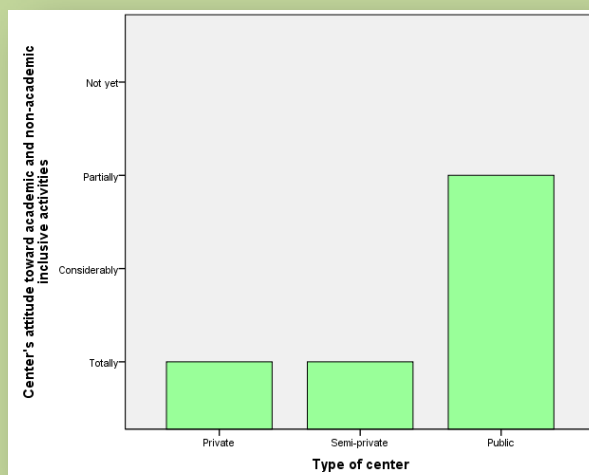
Figure 4.1.1.8. Centers' attitude towards academic and non-academic inclusive activities [Source: Own preparation]

Figure 4.1.1.8 once more reflects that the Private and Semi-private centers' normative promotes academic and non-academic activities fostering the construction of positive relationships among all students; whereas the Public center partially agrees on that.
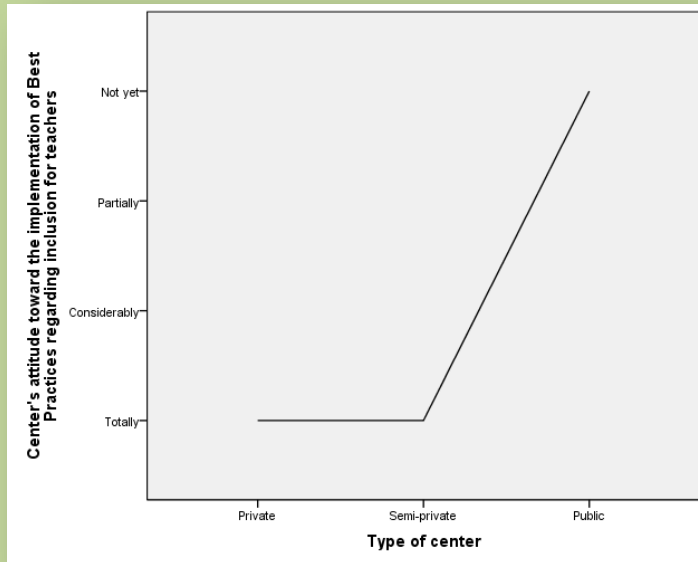
Figure 4.1.1.9. Centers' attitude towards the implementation of Best Practices for teachers regarding inclusion [Source: Own preparation]

Figure 4.1.1.9 dramatically reflects the distinction between Public, and Private and Semi-private centers. The Public center's normative does not support the implementation of Best Practices for teachers to promote inclusive education. On the other hand, the Private and Semi-private centers do totally support it.

Figure 4.1.1.10. Centers' attitude towards collaboration and teaching planning [Source: Own preparation]
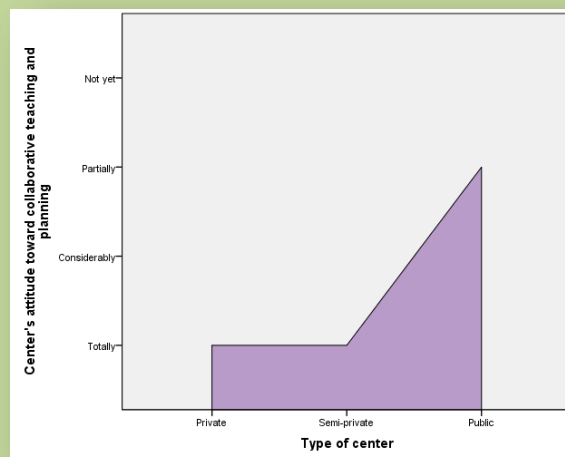
Figure 4.1.1.10 illustrates that in both the Private and Semi-private centers, mainstream teachers of English and special support teachers are involved in the design of curriculum, instruction and assessment. On the contrary, the Public center partially fosters that collaborative working.
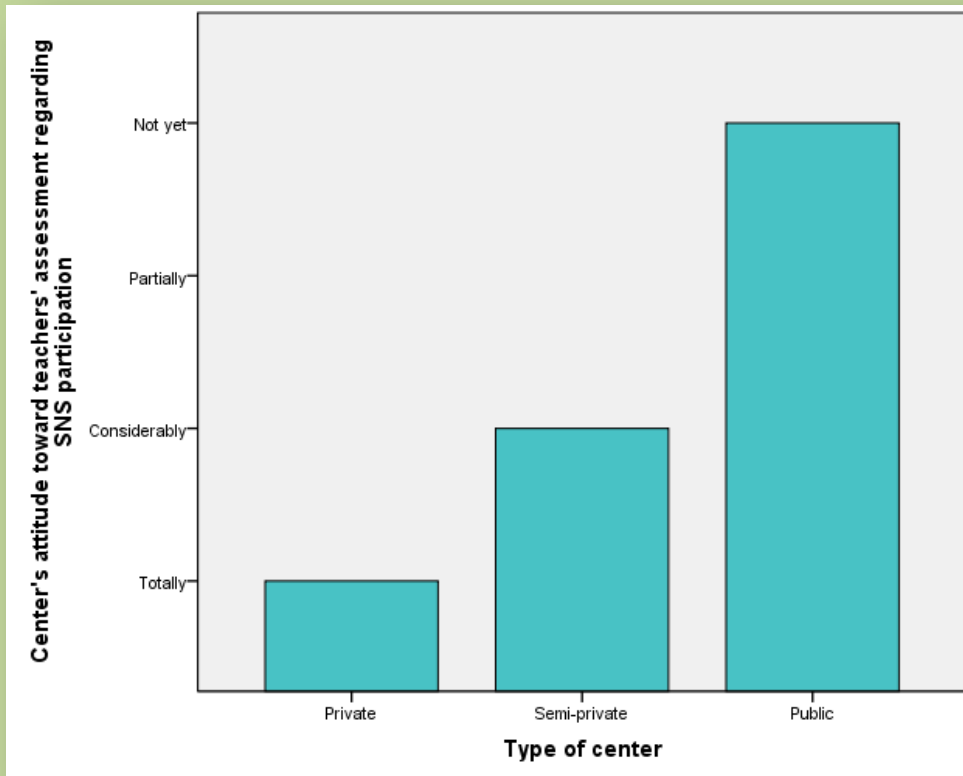
Figure 4.1.1.11. Centers' attitude towards teachers' assessment regarding SNS' participation [Source: Own preparation]

Figure 4.1.1.11 reflects that the Private center's normative totally agrees that teachers of English should be evaluated after taking into account the effectiveness with which SNS are actively engaged and participate in the classes. The Semi-private center's normative considerably agrees on that idea; but the Public center's normative has not considered this option yet.
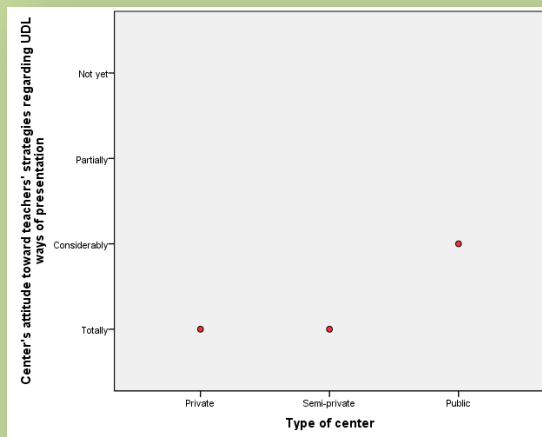
Figure 4.1.1.12. Centers' attitude towards teachers' strategies regarding UDL ways of presentation [Source: Own preparation]

Figure 4.1.1.12 illustrates that both the Private and Semi-private centers' normative uphold that teachers of English should use a variety of strategies regarding the different learning styles, needs and interests of their students. In contrast, the Public center's normative considerably agrees on that.
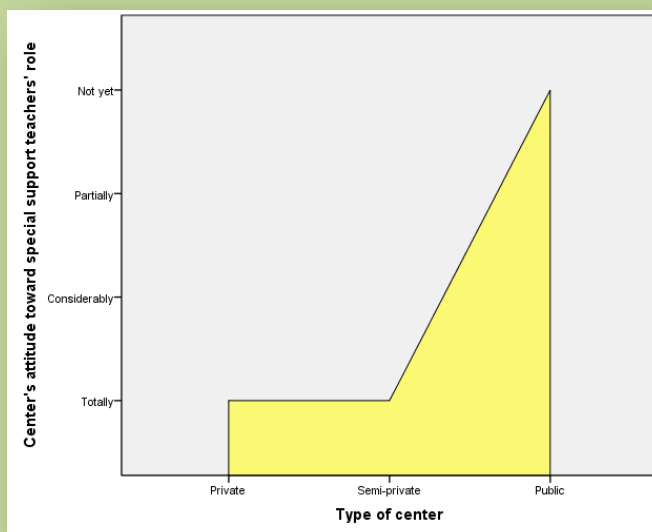
Figure 4.1.1.13. Centers' attitude towards special support teachers' role [Source: Own preparation]

Figure 4.1.1.13 shows up once again an intense contrast between the Private and Semi-private centers and the Public one. The Public center's normative does not consider the possibility of having the support of specialist educators who can come into the L2 classroom to

help the mainstream teacher; whereas the Private and Semi-private centers totally define the role of their special support teachers for the L2 class.
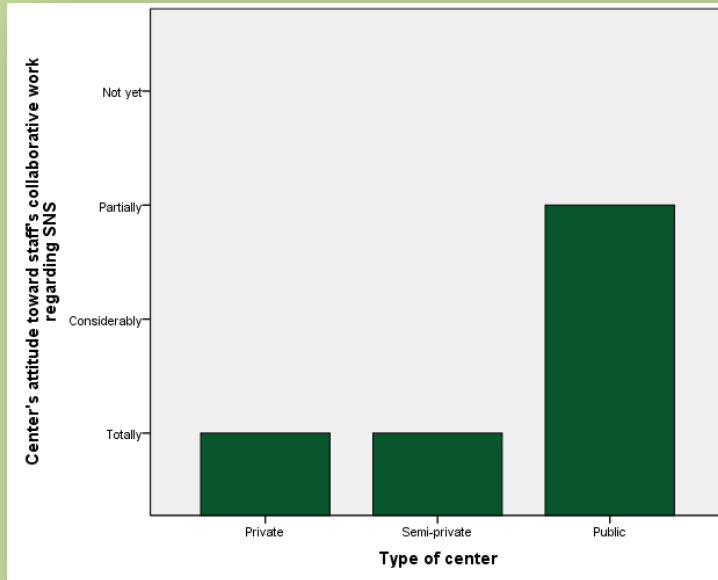
Figure 4.1.1.14. Centers' attitude towards staff's collaborative work regarding SNS [Source: Own preparation]

Figure 4.1.1.14 illustrates that in spite of the fact that they lack a special support teacher, the Public center's normative partially considers fundamental the collaboration among the different staff members for the sake of improving SNS education. In addition, again, the Private and the Semi-private centers' normative totally agree on that idea.

Figure 4.1.1.15. Centers' attitude towards SNS regarding social interactions in academic activities [Source: Own preparation]
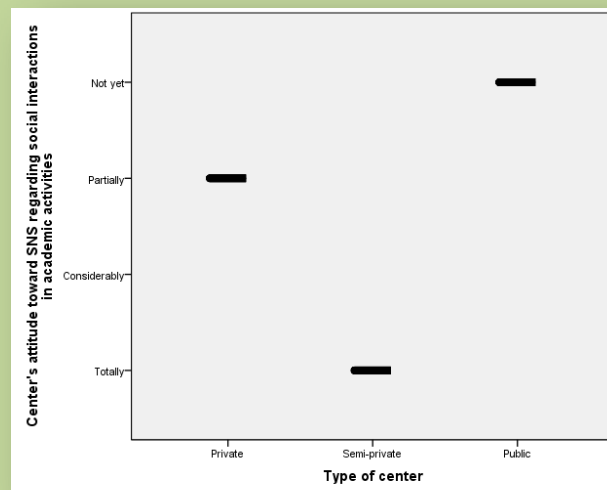
Figure 4.1.1.15 shows up that the Semi-private center's normative totally agree that SNS should spend most time possible in age appropriate mainstream classes to learn English. However, the Private center's normative partially accepts that idea of offering equal opportunities for social interactions during the academic activities for all students; and furthermore, the Public center's normative does not consider it at all.
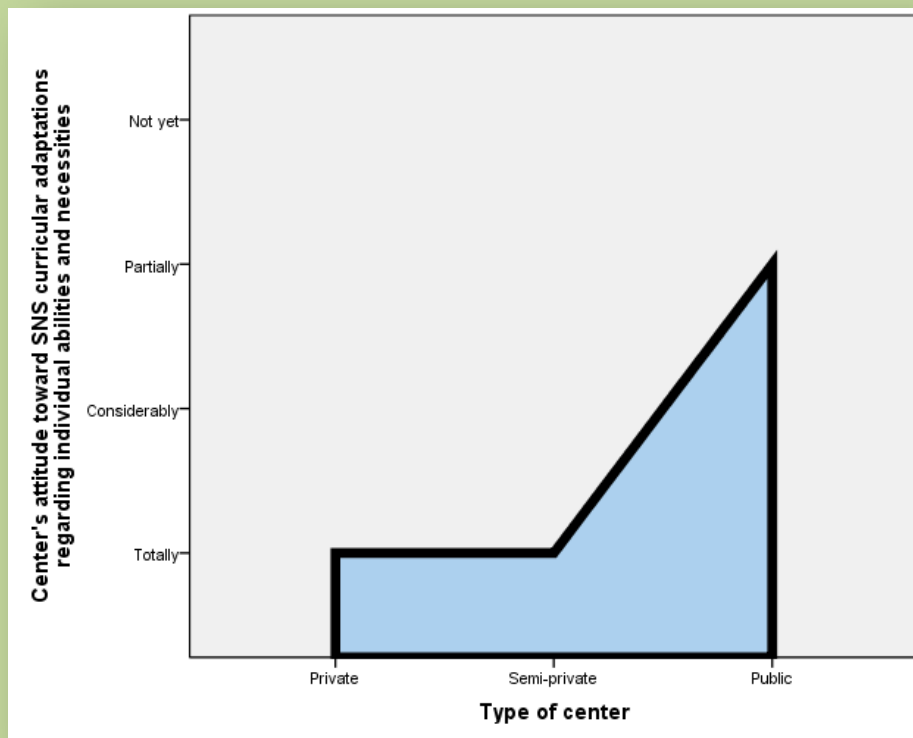
Figure 4.1.1.16. Centers' attitude towards SNS curricular adaptations regarding individual abilities and necessities [Source: Own preparation]

Figure 4.1.1.16 illustrates that the Private and Semi-private centers' normative totally considers fundamental the fact of designing curricula for SNS by taking into account their individual needs and both their academic and functional abilities in order to access the general curriculum. On the other hand, the Public center's normative partially agrees on that idea.
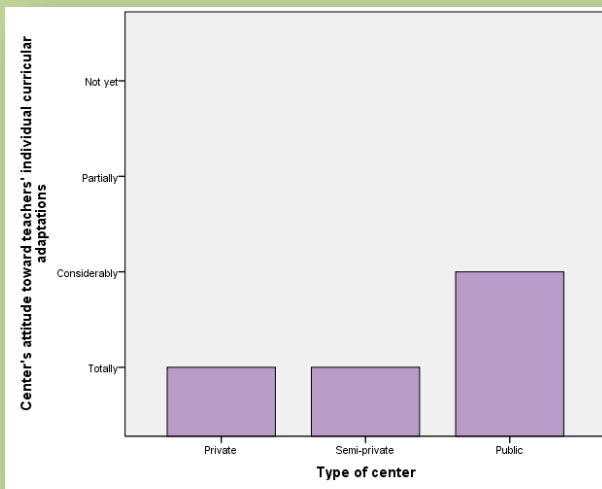
Figure 4.1.1.17. Centers' attitude towards teachers' individual curricular adaptations [Source: Own preparation]

Figure 4.1.1.17 demonstrates that the three centers' normative have a positive attitude towards the elaboration of individual curricular adaptations, always taking into account that such adaptations should fit the student's real and specific necessities and should be age appropriate.

Figure 4.1.1.18. Centers' attitude towards teachers' UDL ways of engagement [Source: Own preparation]
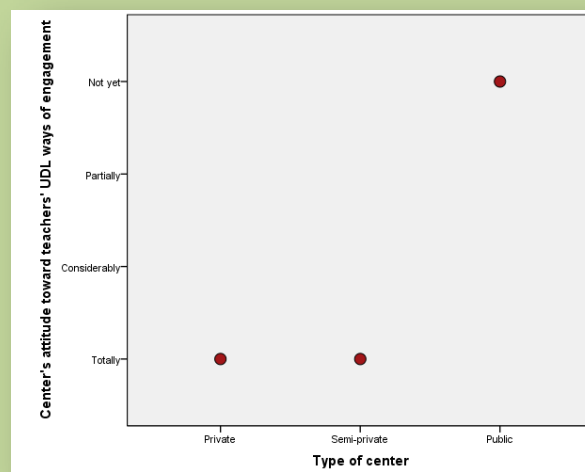
Figure 4.1.1.18 illustrates once again a dramatic contrast between the Public center's normative on the one hand, and the Private's and Semi-private's on the other. The Public center does not consider in its normative the possibility that teachers of English use a varied range of strategies to get SNS engaged in the dynamics of the classroom, and thus, supporting more complex thinking. Instead, the Public center waters down the curriculum and reduces the contents to make it easier for SNS. On the other hand, the Private and Semi-private centers' normative totally supports the so-called UDL ways of engagement for all students.
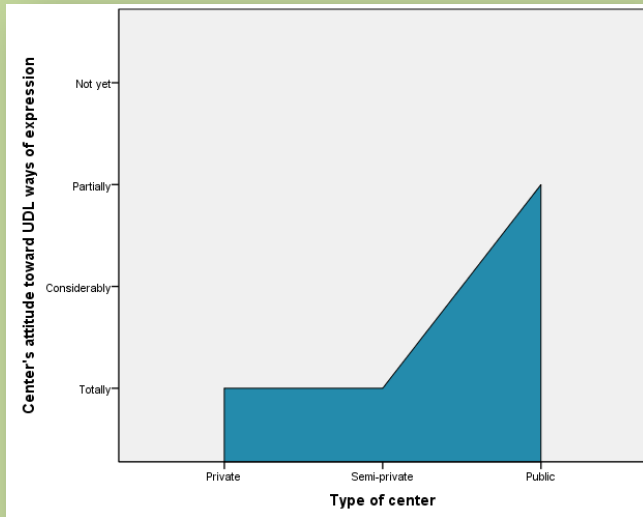
Figure 4.1.1.19. Centers' attitude towards UDL ways of expression [Source: Own preparation]

Figure 4.1.1.19 shows up that the Private and Semi-private centers' normative totally upholds that teachers of English should apply a variety of methods to collect data about students' progress in their curriculum, even if it has been adapted, rather than relying on just tests and exams. On the contrary, the Public center's normative partially agrees on that idea.

Figure 4.1.1.20. Centers' attitude towards families regarding diversity awareness [Source: Own preparation]
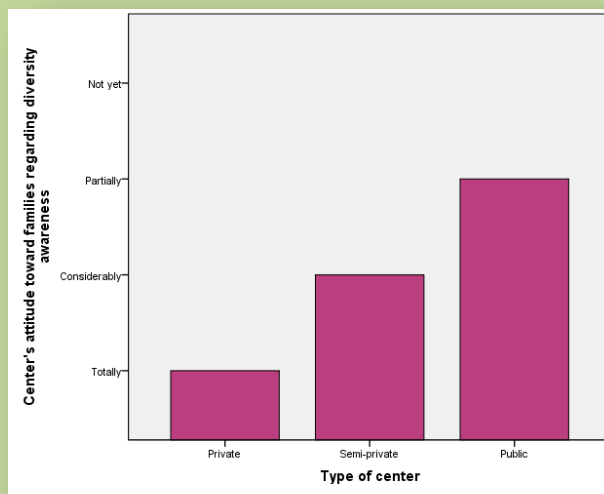
Figure 4.1.1.20 illustrates that the Private center's normative totally upholds that families should be involved into disability and diversity awareness training together with the center's staff and students. On the other hand, the Semi-private center's normative considerably agrees on that issue; whereas the Public center's normative partially accepts it.
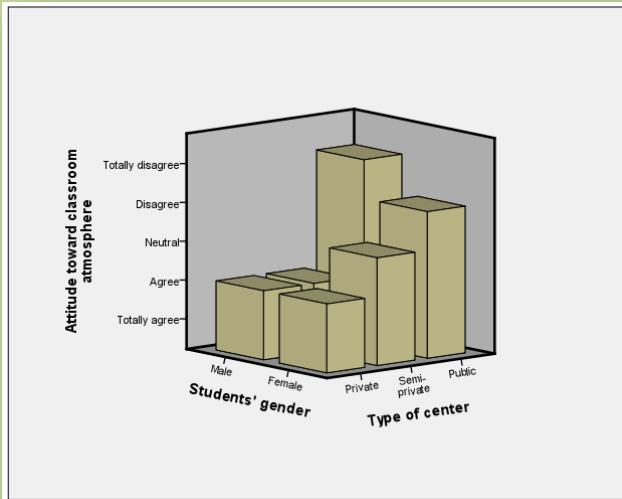
Figure 4.1.1.21. Students' attitude towards classroom atmosphere [Source: Own preparation]

Figure 4.1.1.21 illustrates that Private center's students feel that their English classroom atmosphere is good. Semi-private center's students also have a positive attitude towards their classroom environment, although female students are more neutral in this respect than male learners. Finally, Public center's students, in comparison to the others, have the more negative attitude towards classroom atmosphere.
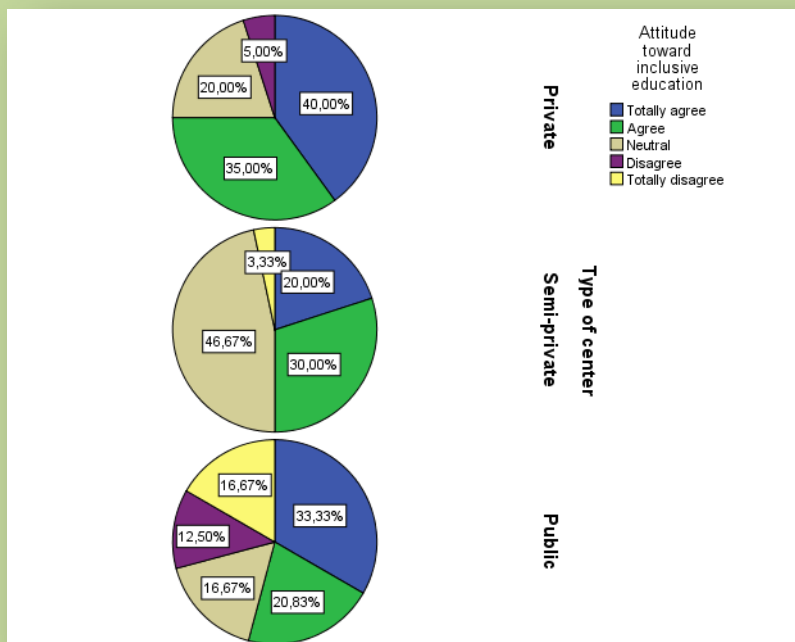
Figure 4.1.1.22. Students' attitude towards inclusive education [Source: Own preparation]

Figure 4.1.1.22 shows up the discrepancy of opinions of students. Most Private and Public centers' students agree that an inclusion setting is the best option for their process of learning the L2. On the contrary, most Semi-private center's students are neutral or slightly agree on that. Finally, the higher percentage of students totally against inclusive education for their own benefit comes from the Public center.
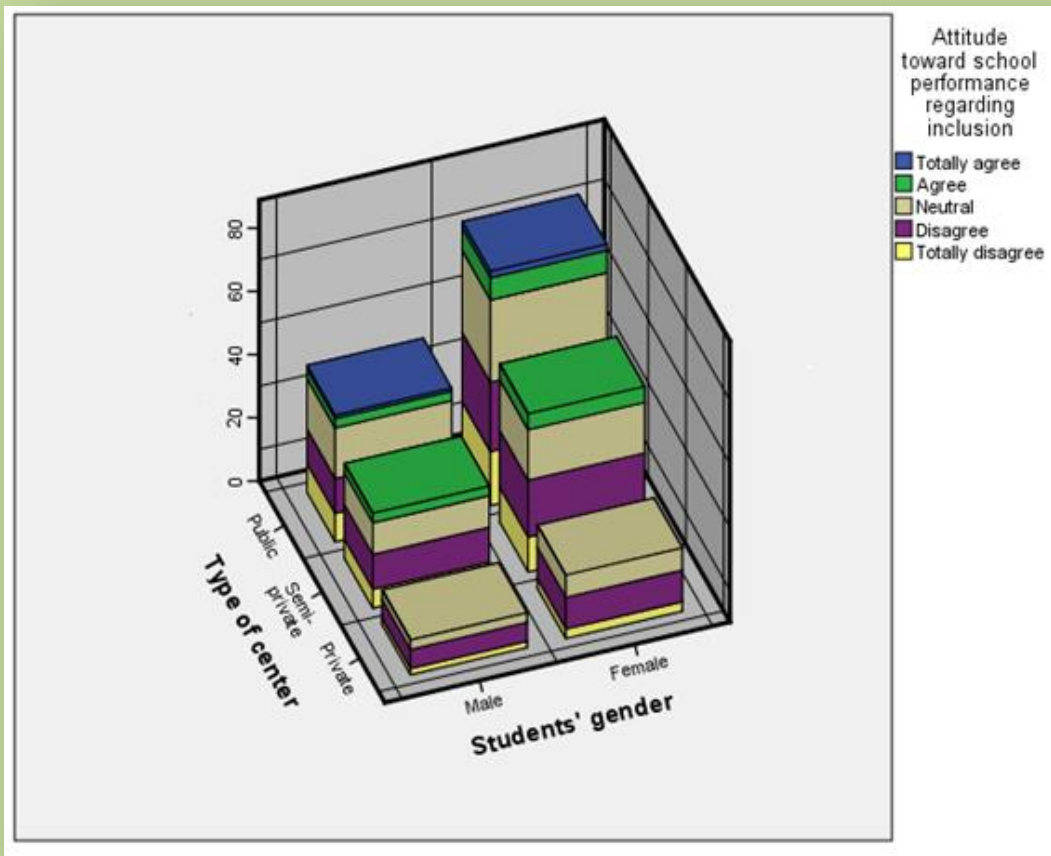
Figure 4.1.1.23. Students' attitude towards school performance regarding inclusion [Source: Own preparation]

Figure 4.1.1.23 demonstrates that just in the Public center, some students strongly feel that they are learning less English than they should and will not develop all the potential they could because they are involved in an inclusive program. This negative feeling is also visible in the Semi-private center, but not so strong. However, most students from the three centers have a neutral and sometimes encouraging opinion towards that issue.
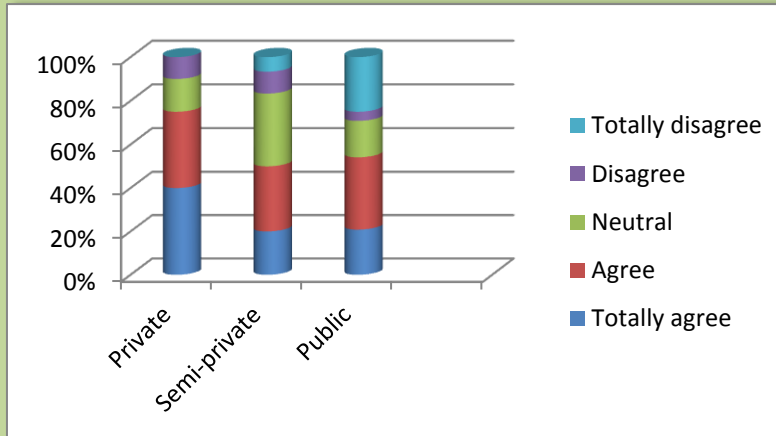
Figure 4.1.1.24. Students' attitude towards participation and motivation [Source: Own preparation]

Figure 4.1.1.24 illustrates that most students from the Private and Semi-private centers have a positive attitude towards participation and motivation for the English class. Although the majority of students from the Public center also have this same encouraging attitude, it is the only group in which there is a considerable amount of students having a negative attitude towards that issue.

	Totally agree	Agree	Neutral	Disagree	Totally disagree
Private	40,00%	35,00%	15,00%	10,00%	0,00%
Semi-private	20,00%	30,00%	33,33%	10,00%	6,67%
Public	20,83%	33,33%	16,67%	4,17%	25,00%

Table 4.1.1.1. Students' attitude towards participation and motivation [Source: Own preparation]

Table 4.1.1.1 examines the percentage of students with a negative attitude towards participation and motivation for the English class, making special emphasis on the Public center's learners.
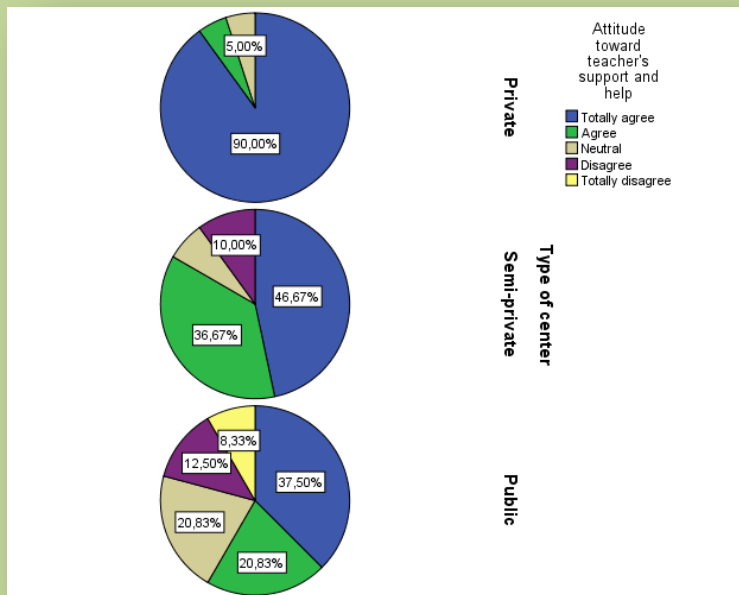
Figure 4.1.1.25. Students' attitude towards teacher's support and help [Source: Own preparation]

Figure 4.1.1.25 illustrates that the vast majority of the students from the Private center feel that their teacher of English assist them when they have any problem in the class regarding English, and that if necessary, teachers use the L1 to help them. There is also a positive attitude from most students belonging to the Semi-private and Public centers, although not so convincing as in the Private center. In addition, there is a minority of students who think they totally disagree with that issue, and they come from the Public center.
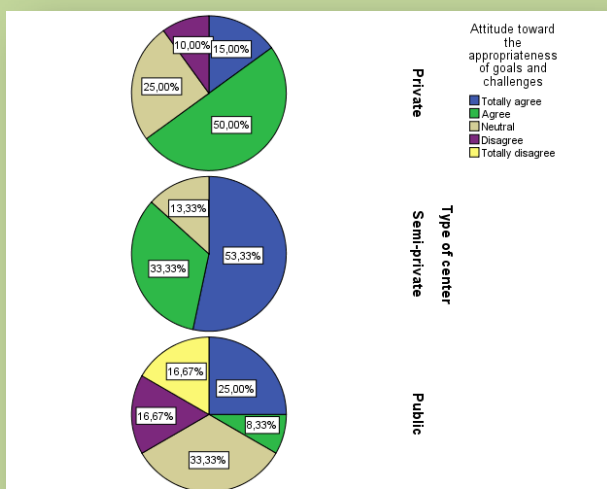
Figure 4.1.1.26. Students' attitude towards the appropriateness of goals and challenges [Source: Own preparation]

Figure 4.1.1.26 shows up that from the point of view of most students from the three centers there seems to be an appropriate curriculum which fits the majority of students' goals and needs for challenge. However, an important amount of students from the Public center also declare that they cannot cope with the activities and tasks of the English classroom.
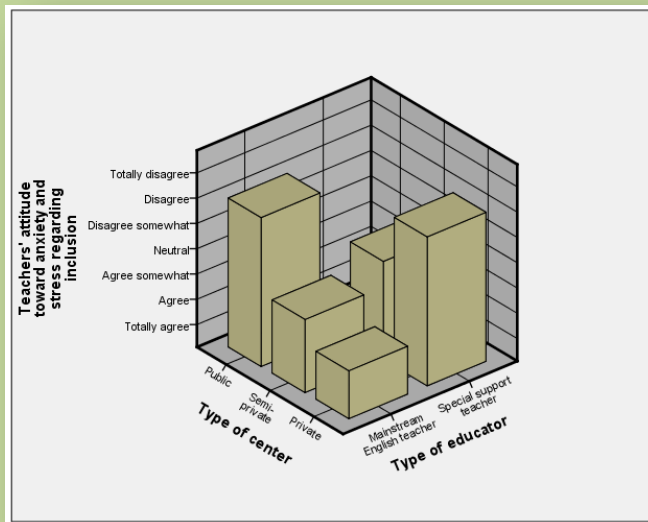

Figure 4.1.1.27. Teachers' attitude towards anxiety and stress regarding inclusion [Source: Own preparation]

Figure 4.1.1.27 illustrates that the mainstream teacher of English from the Public center and the special support teacher from the Private center think that inclusive education does not necessarily lead to stress and anxiety. Regarding this issue, the special support teacher from the Semi-private center maintains a neutral opinion; whereas the mainstream teachers of English from the Private and Semi-private centers seem to appreciate inclusion as an emotionally problematic concept.

Figure 4.1.1.28. Teachers' attitude towards their management with the heterogeneous classroom [Source: Own preparation]
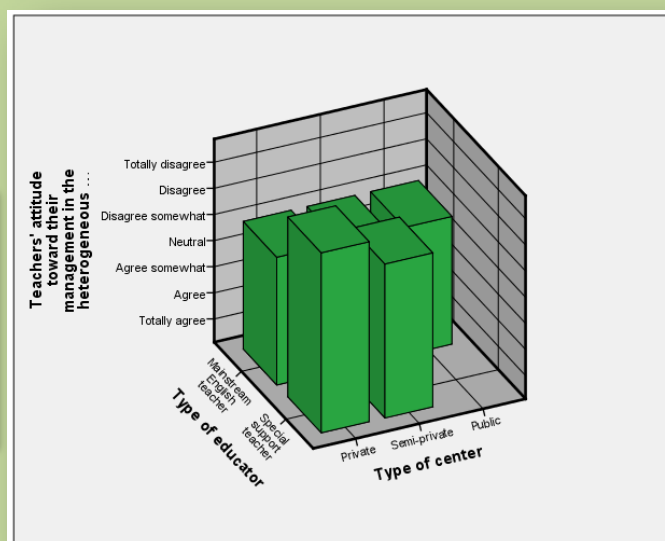
Figure 4.1.1.28 shows up that the five teachers, mainstream and special support ones, consider that they are able to manage with a neurodiverse group of students to a certain extend. Special support teachers from the Private and Semi-private centers support the strongest opinions about that issue. However, when comparing this figure with the next one, there is no congruence in the results:

Figure 4.1.1.29. Teachers' attitude towards their abilities and knowledge regarding SNS [Source: Own preparation]
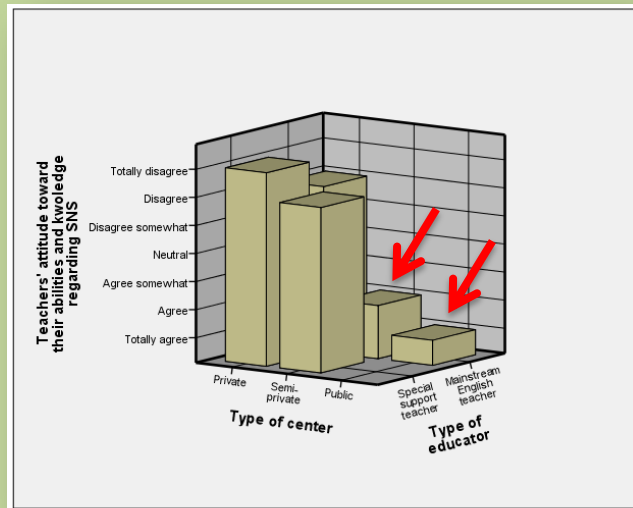
Figure 4.1.1.29 demonstrates that mainstream teachers of English from the Public and Semi-private centers do not have the sufficient knowledge and abilities to teach SNS. The rest of educators in this figure do more or less maintain their opinions in comparison to the previous figure about their abilities to manage with the heterogeneous classroom.

Figure 4.1.1.30. Teachers' attitude towards the use of brain-compatible strategies [Source: Own preparation]
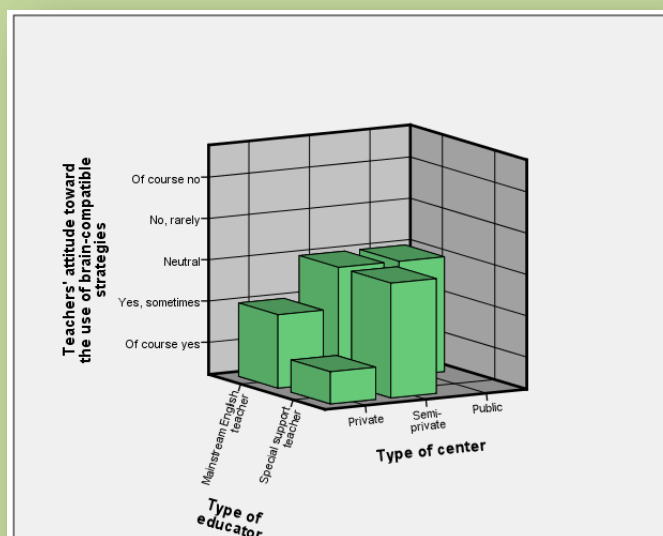
Figure 4.1.1.30 illustrates that only the special support teacher from the Private center considers essential the use of brain-compatible strategies to cover the different learning styles and diverse types of intelligences of students. The mainstream teacher of English from the Private center also gives importance to that issue and has a positive attitude towards it. However, the rest of educators show a neutral opinion regarding this topic.
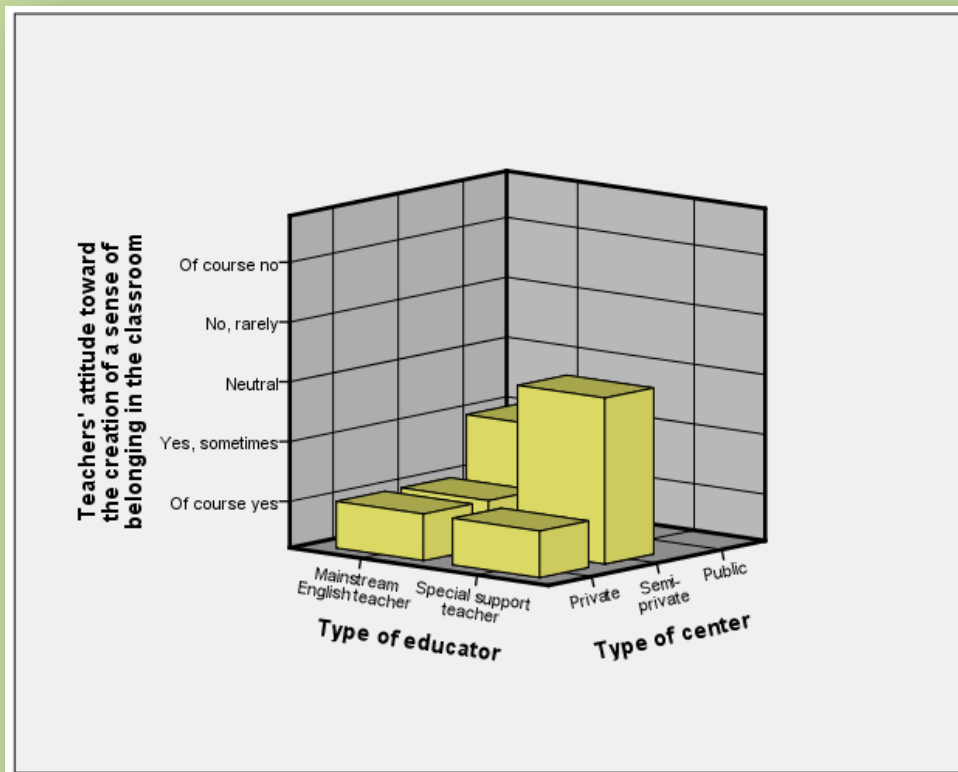

Figure 4.1.1.31. Teachers' attitude towards the creation of a sense of belonging in the classroom [Source: Own preparation]

Figure 4.1.1.31 shows up that the mainstream teacher of English form the Private and Semi-private centers and the special support teacher from the Private center think they have successfully created the most adequate classroom environment and have effectively built a sense of belonging to a community. In addition, the mainstream teacher of English from the Public center also reveals a positive attitude towards this topic, although not so radically encouraging as in the previous cases mentioned. And finally, the special support teacher from the Semi-private center shows up a neutral opinion regarding this idea.
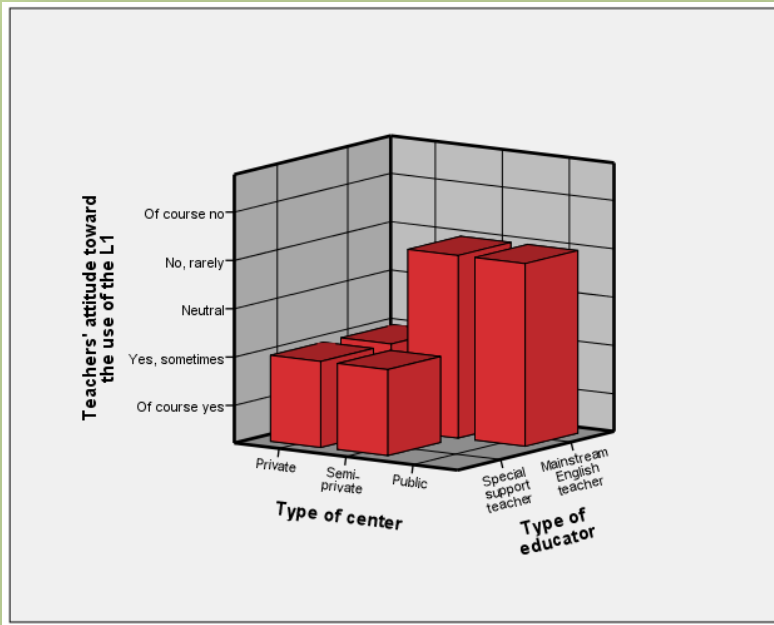
Figure 4.1.1.32. Teachers' attitude towards the use of the L1 [Source: Own preparation]

Figure 4.1.1.32 illustrates that the mainstream teacher of English from the Semi-private and Public centers have a negative view about the use of the L1 in the L2 classes. However, the rest of educators think there is nothing wrong with using the L1 at certain moments during the L2 class.
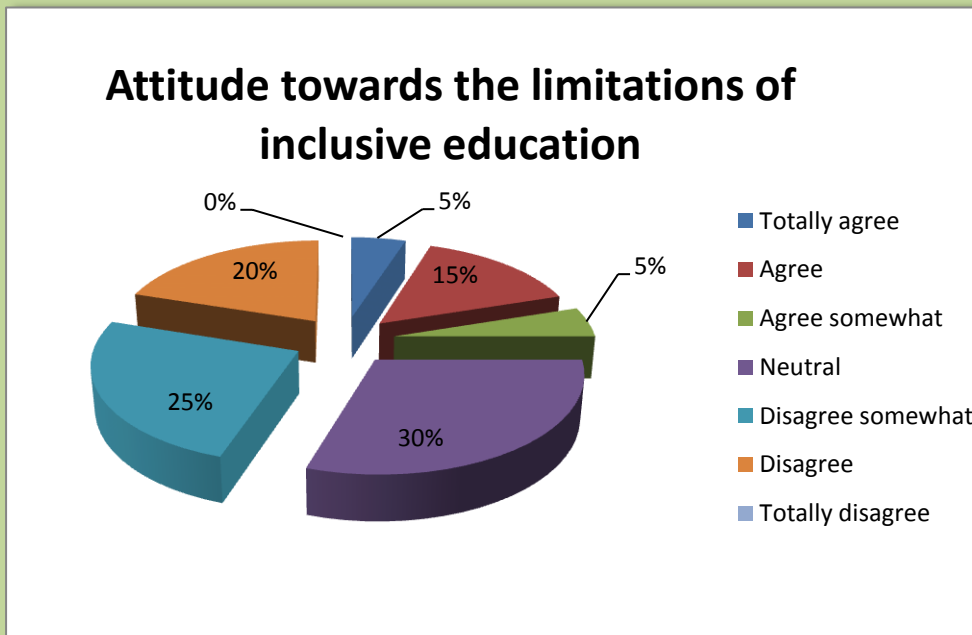

Figure 4.1.1.33. Parents' attitude towards the limitations of inclusive education [Source: Own preparation]

Figure 4.1.1.33 shows up that most parents think that inclusive education does not necessarily cause limitations that cannot be overcome. In addition, an important amount of parents express a neutral opinion in this respect. And finally, the minority of parents reveals a negative attitude towards inclusive education.

Attitude towards educators' management and students' scholar performance

- 15% Totally agree
- 60% Agree
- 5% Agree somewhat
- 15% Neutral
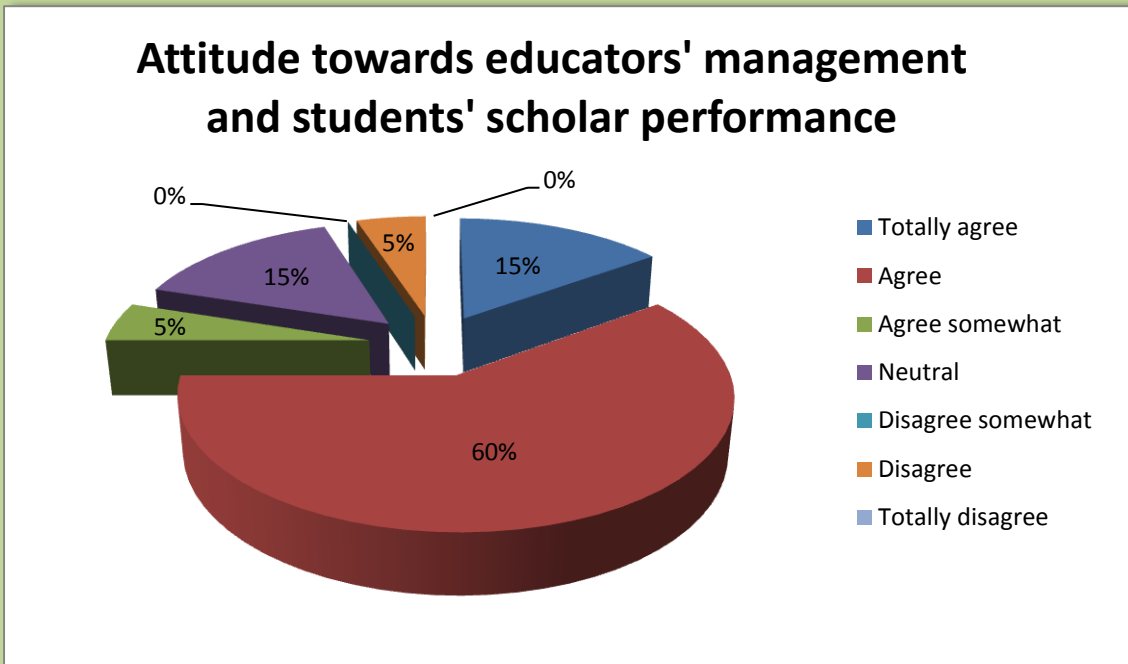- 0% Disagree somewhat
- 5% Disagree
- 0% Totally disagree

Figure 4.1.1.34. Parents' attitude towards educators' management and students' scholar performance [Source: Own preparation]

Figure 4.1.1.34 illustrates that the vast majority of parents think that their children's mainstream teachers of English and special support teachers can successfully cope with the management of the classes and consequently, their children can reach the stipulated goals in their curriculum.

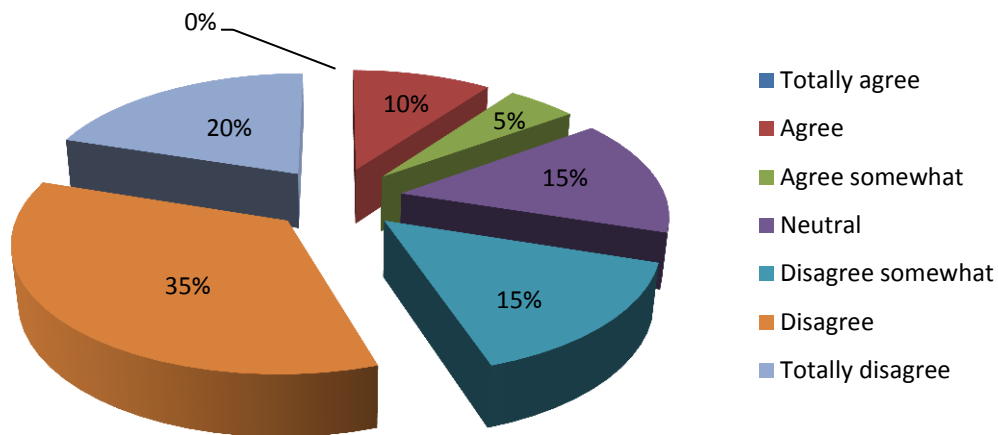## Attitude towards social and emotional development regarding inclusion

Figure 4.1.1.35. Parents' attitude towards social and emotional development regarding inclusion [Source: Own preparation]

Figure 4.1.1.35 illustrates that the minority of parents think that inclusive education may provoke a negative and unsuccessful development in emotional and social terms in their children. However, most parents understand that inclusion only leads to a positive and enriched classroom atmosphere characterized by the creation of a sense of belonging to the same community.

4.2. DISCUSSION

The main objectives analyzed in this research project have been the following ones: examining the degree of effectiveness of inclusive education programs in private, semi-private and public centers for the neurodiverse L2 classroom; exploring students' perceptions and feelings about studying English in a heterogeneous classroom, together with the advantages and disadvantages of inclusive education; analyzing teachers' perceptions about inclusive education and their capacities to manage with a heterogeneous class; examining the degree of implication of educators with regards to inclusive education, and also the kind of methodologies and brain-compatible strategies that they use in the L2 class; and finally, exploring parents' opinions about the L2 inclusive classroom; what they think are the benefits or limitations of it; and what they expect from their respective children in terms of learning both academic and non-academic skills.

Regarding the idea of examining the degree of effectiveness of inclusive education programs in private, semi-private and public centers for the neurodiverse L2 classroom, we have to comment that the Private and Semi-private centers seem to have a more positive attitude towards the notion and also the practice of inclusive teaching in comparison to the Public center.

These two centers, the Private and Semi-private ones, allege that it is fundamental for their normative to foster the creation of an educational system for all students, independently from the fact that they have or not any kind of disability or specific learning needs. In this respect, these two centers, specially the Private one, confess they believe that every student is able to reach the stipulated goals for his or her curriculum, even if it has been adapted for whatever reason. Indeed, the three different centers elaborate individual curricular adaptations when necessary, but the Public center is not so focused as the other two centers are on making such adaptations on the basis of academic and functional abilities that promote the access to the general curriculum in the case of SNS.

In addition, the results of this study reveals that the Public center's normative does not really foster the creation of an environment celebrating difference and diversity as something positive for learning. Indeed, the Public center lacks a special support teacher to assist the mainstream teacher of English in the L2 class. This is irrevocably a sign for these two events: the first one is that it seems to be a preference for segregation or partial inclusion (that is to say,

just integration at certain moments) of SNS within the mainstream L2 classroom in the Public center; and the second one is that there seems to be less money available for Public education addressed to cover the necessities of SNS within the mainstream classroom, so a special support teachers are a luxury that not all public centers can benefit from.

This last idea is also reflected in the fact that the Public center's normative does not consider the possibility of supporting the implementation of Best Practices for teachers of English for the sake of promoting inclusive education environments. Consequently, only the Private and Semi-private centers' normative implement incentives fostering teachers to accept and celebrate neurodiversity in the L2 class.

On the contrary, the Private center's normative makes especial emphasis on the idea that not only school staff and students, but also families should be engaged with the notion of diversity awareness, so that a continuum between center and family is drawn and turned into the real process of learning. In this way, inclusive education is really successful for all students, including SNS.

Furthermore, understanding the real meaning of diversity awareness and offering equal opportunities for social interactions during academic activities for all students is something that really fosters the construction of successful inclusive settings, together with the creation of a sense of belonging to a community, thus resulting into students' satisfaction, active participation, and motivation. In this respect, the Semi-private center, followed by the Private one, pays special attention to that idea, and its normative reflects the importance of having SNS within the mainstream L2 classroom most time possible. In addition, the Private and Semi-private centers seem to promote the use of non-academic activities to foster the creation of emotionally and socially positive relationships among all students; whereas the Public center is not so convincing about this issue.

Regarding the three centers' normative and their acceptance of the Universal Design for Learning's principles, it happens that again the Private and Semi-private centers seem to follow such principles more radically than the Public center does. In other words, both the Private and Semi-private centers' normative consider that teachers of English should use a wide range of ways of presentation of information with the intention to cover the different learning styles, types of intelligences, necessities, interests, and abilities of all students. Furthermore, their normative fosters the use of diverse modes of expression for students, so that final marks do not only rely on exams and tests, but also on the progress they are making through the curriculum. And finally, their normative also contemplates the necessity of applying multiple means of engaging students in order to get them motivated for learning, provided that the

developmentally appropriate goals and challenges are reached. On the other hand, the Public center's normative is not so focused on following UDL principles to improve the process of learning for all students, especially in the case of SNS.

Now, regarding the objective of exploring students' perceptions and feelings about studying the L2 in an inclusive neurodiverse classroom, it is important to mention that students from the Private and the Semi-private centers have a more positive attitude towards their classroom atmospheres than the Public center's students have in general terms. The reason for this discrepancy of opinions could be also reflected in the fact that an important amount of Public center's students feel that their school performance is negatively influenced because of the inclusive setting in which they study the L2, and consequently, they will not develop all the potential they have to learn English.

In addition, Public center's students also have the most negative opinions about their participation and motivation for the English class. This result could be also connected to that previously mentioned by which it was stated that Public center's teachers were less likely to foster the creation of a sense of belonging to a community within the class.

In this respect, as it has been postulated that using the L1 at the appropriate moments can become one effective way for teachers to create such motivating, attention-getter, anxiety-lowering, and stress-out environment in the L2 class, it is once again the Private center the one with more students upholding that, when necessary, their teachers give them support and help by using their mother tongue. In that way, the use of the L1 becomes a perfectly valid brain-compatible strategy, especially in the case of SNS.

And finally, also in connection to the last idea mentioned, an important amount of students from the Public center have declared that sometimes they cannot cope with the activities and tasks proposed in the L2 class. The main reason could be that their curricula does not offer them the appropriate goals and challenges to progress in their process of learning the L2, or even because teachers of English may not use the appropriate brain-compatible strategies for them, such as the use of the L1 as support and help at certain moments, for instance, when homework is given or a new task is explained just in English and a re-explanation in Spanish is needed so that SNS or even the whole group understand more details in Spanish about the instructions already given.

Next, taking into account the objectives of examining teachers' perceptions about inclusive education and their capacities to manage with a heterogeneous class, together with the kind of methodologies and brain-compatible strategies they use in the L2 class, it is essential to

mention that there is lack of congruence between what certain educators think they are able to do and what they say they really do. In other words, this controversy can be explained in that way: every single educator being chosen for the study has assured that he or she is able to manage with a neurodiverse classroom. However, two out of the three mainstream teachers of English, the ones from the Public and Semi-private centers, have also stated that they do not have the sufficient knowledge and abilities to deal with SNS within the mainstream classroom. In fact, there is only one out of the five educators that points out at the importance of the use of brain-compatible strategies in the neurodiverse classroom. In this case, this person is the special support teacher from the Private center.

Regarding the issue about the creation of a sense of belonging to a community in order to foster motivation and lower anxiety, all educators seem to claim that, to a certain extent, they do it more or less in a successful manner, specially the three mainstream teachers of English.

Finally, mainstream teachers of English from the Semi-private and Public centers have shown a negative attitude towards the use of the L1 during the L2 class, and curiously, they are the same people that previously stated that they did not have the sufficient knowledge and abilities to manage with SNS within the mainstream class. This event leads to the idea that they may be unfamiliar with what brain-compatible strategies really are and why they are so fundamental for the neurodiverse classroom management. Indeed, they had previously expressed a neutral attitude for the use of brain-friendly methodological approaches.

To end with the discussion of the results, it is absolutely fundamental to examine parents' opinions about the L2 inclusive classroom. Most parents have declared a positive attitude towards the practice of inclusion and its benefits in terms of social and emotional development for their children. So, we could say that most parents understand the notion of inclusive education as an opportunity for their children to grow up in a community that respects diversity and difference, and a community that offers equal opportunities for all for the sake of learning the L2 with the assistance of the L1 when necessary, especially in the case of SNS.

CHAPTER V:

CONCLUSIONS

5.6. CONCLUSIONS OF THE STUDY

To conclude this study, I would like to sum up some of the most important ideas mentioned along the report. For example, though much of this research is not new, it takes on new meaning when viewed from a perspective that combines both fields, that of neurology and that of pedagogy. So, one of the fundamental ideas expressed all along the study is that teachers should learn more about neuroscience and brain-compatible strategies since they will inevitably face a heterogeneous classroom, and it is their responsibility to know how to manage with this wide range of students if they want that every learner is able to achieve real academic and social success.

According to the results obtained in this study, not every center's normative consider the use of really effective teaching practices based on brain-compatible strategies as an essential idea to design the curricula. Indeed, as it has been mentioned in previous sections of the report, some teachers of English have a negative view of using the mother tongue to assist and offer equal opportunities for all students.

Furthermore, in an L2 neurodiverse classroom where every student has a different mastery of both the L1 and the L2, the fact of following all these brain-compatible strategies based on the different students' learning styles and intelligences is even more crucial.

In fact, when learning a L2, especially in the case of LD students, it is totally indispensable to make use of the L1 too, because by doing that, these students will lower their affective filter and feelings of frustration and failure, and they will find the proper motivating drive for paying attention to what is being taught, because they will feel that they are involved in a inclusive community that accepts mistakes during the process of learning. Consequently,

little by little, the information will be stored in the long-term memory banks of the brain, and it will be more likely to become automated, allowing the learner to use the L2 with less effort.

In this respect, the best teaching approach for a neurodiverse L2 classroom would be one that takes into account these two notions: brain-compatible strategies, especially the use of the L1, and also the praxis of collaborative work, not only among students but also among the center's staff, particularly mainstream teachers of English and special support teachers.

In this sense, on the one hand, the role of the L1 will be the activation of the limbic system of all students in order to foster motivation and participation, apart from lowering anxiety and stress; and on the other hand, cooperative work will lead to the creation of an enriched environment where inclusion is a motto and a sense of belonging to a community is achieved. Consequently, students will benefit from this kind of teaching practices in both cognitive and social terms.

In this respect, it is vital that teachers try to change their methodologies and classroom strategies towards a truly inclusive education based on differences that turn into equality of opportunities for all, and in this way, learning the L2 will be really successful.

In Córdoba, the majority of Secondary Education centers participate in inclusive programs that try to offer an education of quality for every student. However, providing an education like that could sound more utopian than real, since there are lots of limitations coming from the human resources and material adaptations, methodologies, and personal attitudes towards inclusion, in fact.

The present study has detected more negative attitudes in the Public center towards the different aspects surrounding the practice of inclusion than in the Private and Semi-private centers. In this respect, it seems to be still a current feeling of reservations (sometimes hidden because of the policy frame) against inclusion and in favor of special education centers separated from the mainstream ones. This is the dichotomy inclusion – segregation. In other words, although state and regional laws support inclusive education and leaves segregation just when it is absolutely necessary, in the end, some centers do not promote real inclusive settings, but they just practice integration at certain moments. In this way, both segregation and integration are two manifestations of the same event: lack of equal opportunities for all at every moment during the process of learning an L2.

Although it is a reality that inclusion is the nowadays trend, still many educators feel that it is difficult to manage with a heterogeneous class, and many times they give up because

the situation is not controllable. Maybe it is a question of changing the mind of teachers. Maybe it is a matter of changing the mind of the entire community.

Therefore, it is essential to achieve a higher degree of engagement and effectiveness from teachers, resources, materials, parents and students, as this project has proved by means of the different instruments measuring the attitudes of the different agents involved towards inclusive education. In addition, such desired degree of engagement and effectiveness will consequently provide an improvement of our current educational system, especially regarding the possibility of offering an education of quality for all, independently from the fact that the L2 classroom has a neurodiverse nature.

So, according to the results of this study, inclusive education in Córdoba should improve because it has been tested that if well planned and with the use of brain-compatible strategies to enrich the classroom environment, inclusion is the best way to achieve an education for everyone, an education looking for the academic and social success of every learner. Although there are many things to change, there are also others that could be positively valued, and I think that with the proper arrangements, we could reach the dreamed educational system in the future.

One way to start would be, for instance, the implementation of a-learning programs for the sake of providing effective Universal Design for Learning strategies and a better accessibility to learning for everyone.

5.3. FUTURE LINES OF RESEARCH

The present study could serve as the basis for future lines of research dealing with the analysis of the influence and positive interference from the L1 into the process of learning of the L2 in the case of Special Needs students, especially Developmental Delay ones suffering from any kind of Learning Disability, together with other psycholinguistic, such as the so-called Brain Method Theory.

In this way, such influence from the L1 into the L2 would be analyzed from the perspective of the Brain Method Theory in order to discover if Developmental Delay students who had the opportunity to be exposed to the L2 sounds before the critical period for the phonological awareness stage finished in their brains have acquired a better ability to manage with the L2 than Developmental Delay students who did not have such opportunity during their early language acquisition period.

CHAPTER VI:

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CHAPTER VII:

APPENDIX

7.1. ANNEXES

a. **INSTRUMENT 1:** *Quality Indicators for Inclusive Education* questionnaire [Source: Own preparation]

Nombre del centro: _____

Curso: _____

TACHE LA CASILLA OPORTUNA USANDO ESTA ESCALA:

1	2	3	4
TOTALMENTE	CONSIDERABLEMENTE	PARCIALMENTE	NO AÚN

CUESTIONARIO	1	2	3	4
1. **Uno de los objetivos fundamentales del centro refleja la filosofía de que TODOS los estudiantes pueden alcanzar un determinado objetivo.**				
2. **La normativa del centro incluye a todas las entidades involucradas (familias, administración, profesores y estudiantes) para hacer que la inclusión funcione.**				
3. **La normativa del centro asegura que los profesores de inglés usan el currículo estándar como base para la instrucción de TODOS los estudiantes.**				
4. **El centro hace un balance de los resultados de los alumnos y del desarrollo profesional de los**				

profesores de inglés.			113	
5. **El centro ofrece incentivos para promover la práctica de la inclusión y su aceptación por parte de los profesores de inglés.**				
6. **Tanto el profesor de inglés como el de apoyo colaboran en el diseño e implementación del currículo, la enseñanza y la evaluación.**				
7. **Los profesores de inglés son evaluados en base a si ponen en práctica la evaluación continuada para identificar a los alumnos en riesgo de no superar los objetivos fijados y sobre si ajustan su enseñanza para TODOS los estudiantes.**				
8. **Los profesores de inglés son evaluados en base a la efectividad con que los alumnos con necesidades especiales se involucran en las actividades de clase junto al resto de estudiantes.**				
9. **Los profesores de inglés usan diversas estrategias de enseñanza para cubrir los múltiples estilos de aprendizaje, necesidades e intereses de los alumnos.**				
10. **La labor y responsabilidad del profesor de apoyo en la clase de inglés están claramente delimitados.**				
11. **El centro fomenta un clima de aceptación y apreciación de las diferencias y la diversidad.**				
12. **El centro promueve actividades académicas y no académicas para mejorar las relaciones entre TODOS los alumnos.**				
13. **El centro organiza al personal de apoyo de acuerdo con las necesidades específicas de los alumnos y la adaptación curricular cuando sea necesario dentro de la clase general de inglés.**				
14. **Los alumnos con necesidades especiales pasan la mayoría del tiempo en la clase general de inglés con compañeros de su misma edad.**				
15. **Los alumnos con necesidades especiales tienen las mismas oportunidades que el resto para socializarse durante las actividades no académicas.**				
16. **Los profesores de inglés incorporan materiales visuales y táctiles para cubrir las necesidades especiales de los alumnos.**				
17. **Los profesores de inglés y de apoyo realizan las adaptaciones curriculares de forma individualizada cuando es necesario, atendiendo a que éstas sean apropiadas a la edad y las necesidades específicas del alumno.**				
18. **Los profesores de inglés usan estrategias de enseñanza con los alumnos con necesidades especiales para fomentar el pensamiento complejo**				

en lugar de reducir los contenidos del currículo.				
19. La adaptación curricular de los alumnos con necesidades especiales refleja sus necesidades individuales y habilidades tanto académicas como funcionales necesarias para acceder al currículo general.				
20. El profesor de inglés, el de apoyo, y en caso necesario, el terapista físico o de la lengua, colaboran para conseguir determinados objetivos con los alumnos con necesidades especiales.				
21. En la clase de inglés se usan una variedad de métodos para recoger información sobre el progreso de los alumnos en su currículo, incluso cuando ha sido adaptado.				
22. Las estrategias de enseñanza determinadas para una adaptación curricular individualizada son implementadas y actualizadas de acuerdo con el progreso del alumno.				
23. El profesor de inglés consulta con el profesor de apoyo todo lo referente a los objetivos de las adaptaciones curriculares.				
24. Las familias son alentadas a participar en la toma de decisiones y las actividades de apoyo del centro.				
25. Las familias se involucran en la formación para la conciencia de las necesidades específicas tanto en personal del centro como en los estudiantes.				
26. Los profesores de inglés y los de apoyo consideran a las familias como un recurso útil para la planificación y la solución de problemas referidos a la inclusión educativa.				
27. La labor del profesor de inglés, el de apoyo, y demás personal cuando sea necesario, está claramente delimitada y refleja el compromiso y las habilidades necesarias para lidiar con TODOS los estudiantes.				
28. Tanto el profesor de inglés como el de apoyo comparten la responsabilidad de evaluar el aprendizaje de los alumnos.				
29. El centro fomenta las Buenas Prácticas para los programas de inclusión mediante la formación del personal en este respecto.				
30. El centro revisa anualmente o cada cierto tiempo su plan de Buenas Prácticas para los programas de inclusión.				

b. <u>INSTRUMENT 2</u>: Students' questionnaire [Source: Own preparation]

Nombre del Centro: _____

Curso: _____

Sexo:

☐ **Masculino**
☐ **Femenino**

TACHA LA CASILLA OPORTUNA SIGUIENDO ESTA ESCALA:

1	2	3	4	5
De acuerdo totalmente	De acuerdo	Neutral	En desacuerdo	En desacuerdo totalmente

CUESTIONARIO	1	2	3	4	5
1. Me siento bien con mis compañeros en la clase de inglés.					
2. Pienso que el ambiente de inclusión es la mejor opción para mí.					
3. Me gusta la colaboración entre el profesor de inglés y el de apoyo.					
4. El profesor de inglés siempre me ayuda cuando tengo un problema en mis clases de inglés, e incluso me habla en español si es necesario.					
5. Pienso que la labor del profesor de apoyo es realmente importante y útil para mis clases de inglés.					
6. Pienso que estoy sacando el máximo provecho de mis clases de inglés y que desarrollaré todo mi potencial aprendiendo inglés.					
7. Pienso que estoy aprendiendo menos inglés del que debería porque estoy en un aula inclusiva.					
8. Me gusta participar en la clase de inglés porque me siento cómodo con mis compañeros y profesores.					
9. Puedo hacer perfectamente todas mis actividades de la clase de inglés.					
10. Mis profesores me evalúan de la mejor forma.					

c. **INSTRUMENTO 3:** Attitudes Towards Inclusion in African Scale (ATIAS) questionnaire for EFL teachers and special support teachers [Source: Agbenyega, 2007]

MARCA UNA DE ESTAS OPCIONES:

Profesor de inglés ordinario ☐

Profesor de apoyo especial ☐

MARCA LA CASILLA OPORTUNA USANDO ESTA ESCALA:

1	2	3	4	5	6	7
De acuerdo totalmente	De acuerdo	Algo de acuerdo	Neutral	Algo en desacuerdo	En desacuerdo	En desacuerdo totalmente

CUESTIONARIO	1	2	3	4	5	6	7
1. Los alumnos con dificultad para seguir las normas escolares deberían estar en la clase general de inglés.							
2. Los alumnos que son verbalmente agresivos con sus compañeros deberían estar en la clase general de inglés.							
3. Los alumnos que son físicamente agresivos con sus compañeros deberían estar en la clase general de inglés.							
4. Los alumnos que tienen dificultad en controlar su comportamiento deberían estar en la clase general de inglés.							
5. Los alumnos que con frecuencia se ausentan de las clases deberían estar en la clase general de inglés.							
6. Los alumnos que necesitan ayuda para moverse deberían estar en la clase general de inglés.							
7. Los alumnos que necesitan lengua de signos como medio de comunicación deberían estar en la clase general de inglés.							
8. Los alumnos con problemas de expresión deberían estar en la clase general de inglés.							
9. Los alumnos con carencia en las habilidades funcionales que necesitan formación sobre cómo desenvolverse por sí mismos deberían estar en la clase general de inglés.							

10. Los alumnos que tienen una dificultad persistente al expresar sus pensamientos deberían estar en la clase general de inglés.							
11. Los alumnos que tienen dificultad en prestar atención en clase deberían estar en la clase general de inglés.							
12. Los alumnos cuya expresión sea difícil de comprender deberían estar en la clase general de inglés.							
13. Los alumnos que no puedan leer textos estándar y requieran Braille deberían estar en la clase general de inglés.							
14. Unas infraestructuras inapropiadas harán la inclusión imposible.							
15. La carencia de recursos apropiados y materiales especiales harán la inclusión difícil.							
16. El tamaño de las clases hará la inclusión difícil de operar.							
17. La inclusión conllevará estrés y ansiedad.							
18. No soy capaz de lidiar con alumnos con necesidades especiales.							
19. No tengo el conocimiento y las destrezas requeridas para enseñar a alumnos con necesidades especiales.							
20. Es complicado ofrecer una atención equitativa a todos los alumnos en la clase inclusiva.							

d. <u>INSTRUMENT 4:</u> Mainstream teachers of English and Special support teachers' questionnaire [Source: Own preparation]

MARCA UNA DE ESTAS OPCIONES:

Profesor de inglés ordinario ☐

Profesor de apoyo especial ☐

MARCA LA CASILLA OPORTUNA USANDO ESTA ESCALA:

1	2	3	4	5
Por supuesto que sí	Sí, a veces	Neutral	No, casi nunca	Por supuesto que no

CUESTIONARIO	1	2	3	4	5
1. ¿Tienes preocupaciones acerca de la práctica de la inclusión educativa en tu centro?					
2. ¿Crees que tu nivel y experiencia profesional son suficientes para lidiar con una clase heterogénea?					
3. ¿Conoces qué tipo de servicios de apoyo y recursos se proporcionan en tu centro para promover la educación inclusiva?					
4. ¿Dirías que ofreces las mismas oportunidades para el aprendizaje de cualquier alumno, independientemente de sus habilidades/discapacidades?					
5. ¿Realizas adaptaciones curriculares para los casos de alumnos con necesidades especiales?					
6. Si haces alguna, ¿sigues algún tipo de criterio para planear tales adaptaciones curriculares?					
7. ¿Utilizas alguna estrategia compatible con el funcionamiento del cerebro de los alumnos ("*brain-compatible strategies*") que cubra los distintos estilos de aprendizaje y diversos tipos de inteligencias?					
8. ¿Crees que has fomentado un clima de bienestar y sensación de comunidad en tu clase?					
9. ¿Usas la lengua española en tu clase de inglés?					
10. ¿Usas un método comunicativo y colaborativo en la clase de inglés?					

e.   **INSTRUMENT 5:** Families' questionnaire [Source: Own preparation]

MARCA UNA DE ESTAS OPCIONES:

Madre ☐

Padre ☐

Otro ☐

MARCA LA CASILLA OPORTUNA USANDO ESTA ESCALA:

1	2	3	4	5	6	7
De acuerdo totalmente	De acuerdo	Algo de acuerdo	Neutral	Algo en desacuerdo	En desacuerdo	En desacuerdo totalmente

CUESTIONARIO	1	2	3	4	5	6	7
1. Pienso que un programa de inclusión es la mejor opción para mi hijo.							
2. Pienso que las necesidades de mi hijo estarían mejor cubiertas en clases especiales separadas.							
3. Pienso que la inclusión fomenta la comprensión y la aceptación de las diferencias.							
4. Pienso que la inclusión causa limitaciones que no pueden ser resueltas.							
5. Pienso que hay un buen clima en la clase de mi hijo.							
6. La colaboración entre el profesor de inglés y el de apoyo beneficia el proceso de aprendizaje de mi hijo.							
7. Pienso que los profesores en la clase de inglés son capaces de lidiar con las necesidades de mi hijo para conseguir el máximo rendimiento.							
8. Es probable que la inclusión tenga un efecto negativo en el desarrollo académico de mi hijo.							
9. Es probable que la inclusión tenga un efecto negativo en el desarrollo social y emocional de mi hijo.							
10. Pienso que los procesos de valoración y evaluación en la clase de inglés son los mejores para las necesidades de mi hijo.							

f.   CONSENT DOCUMENT FOR THE CENTER [Source: Own preparation]

DOCUMENTO DE CONSENTIMIENTO INFORMADO PARA LOS CENTROS

Investigadora Principal: Macarena Palma Gutiérrez

Documento de Consentimiento Informado para el centro _____.

Soy Macarena Palma Gutiérrez, estudiante del Máster de Inglés para la Cualificación Profesional. Actualmente estoy investigando en mi Trabajo de Fin de Máster el papel del Sistema Límbico y su activación a través de la Lengua Española en alumnos con Necesidades Especiales en la clase de Inglés en centros de Educación Secundaria que fomentan los Programas de Inclusión en Córdoba.

Le invito a participar en dicha investigación dando su consentimiento para que pase una serie de encuestas cuantitativas y anónimas, dirigidas tanto al director/a del centro, los profesores de inglés y profesores de apoyo especial que asisten en la clase de inglés, como a los alumnos y sus familias.

Dichas encuestas tienen como objetivo medir la efectividad de los programas de inclusión de los que participa el centro, las actitudes de los profesores hacia la clase heterogénea, la metodología y dinámicas empleadas en la clase de inglés, las expectativas de los padres y, por último, la opinión y percepciones de los alumnos mismos.

En este centro se seleccionará como muestra para la investigación al director/a, un grupo de E.S.O., su profesor/a de inglés y el profesor/a de apoyo especial y los familiares de los alumnos que realicen las encuestas.

Las encuestas son breves y concisas, y pueden rellenarse en pocos minutos. Además, la información recogida en ellas será confidencial y anónima. Los datos que se obtengan de esta investigación se compartirán con usted antes de que se publiquen los resultados.

Esta propuesta ha sido revisada y aprobada por el Decano de la Facultad de Filosofía y Letras de Córdoba, Eulalio Fernández Sánchez, mi tutor de TFM, junto con

un grupo de diez expertos también procedentes de dicha facultad que han validado las encuestas.

Si tiene alguna pregunta puede hacerla ahora o más tarde, contactando conmigo:

Nombre: Macarena Palma Gutiérrez.

Correo electrónico: macarena_pg90@hotmail.com.

Teléfono: 676 911 668.

FORMULARIO DE CONSENTIMIENTO:

Yo, _____, director/a del centro_____, corroboro que he leído la información proporcionada o me ha sido leída, he tenido la oportunidad de preguntar sobre ella y se me ha contestado satisfactoriamente.

Consiento voluntariamente participar en esta investigación y apruebo que la investigadora Macarena Palma Gutiérrez pase las encuestas referidas anteriormente a los participantes oportunos.

Entiendo que tengo el derecho de retirarme de la investigación en cualquier momento.

Firma del director/a del centro:

Fecha (Día/Mes/Año):

Ha sido proporcionada al participante una copia de este documento de Consentimiento Informado _____ (Iniciales del investigador).

g. <u>**CONSENT DOCUMENT FOR FAMILIES**</u> **[Source: Own preparation]**

DOCUMENTO DE CONSENTIMIENTO INFORMADO PARA LAS FAMILIAS
(Padres, madres, o tutores legales)

Soy Macarena Palma Gutiérrez, estudiante del Máster de Inglés para la Cualificación Profesional. Actualmente estoy investigando en mi Trabajo de Fin de Máster el papel del Sistema Límbico y su activación a través de la Lengua Española en alumnos con Necesidades Especiales en la clase de Inglés en centros de Educación Secundaria que fomentan los Programas de Inclusión en Córdoba.

Le invito a participar en dicha investigación realizando una encuesta cuantitativa y anónima, que tiene como objetivo medir las expectativas y opiniones de las familias acerca del sistema de educación inclusiva en la que se encuentra su hijo/a.

La encuesta es breve y concisa, y pueden rellenarse en pocos minutos. Además, la información recogida en ellas será confidencial y anónima. Los datos que se obtengan de esta investigación se compartirán con el centro donde estudie su hijo/a antes de que se publiquen los resultados.

Esta propuesta ha sido revisada y aprobada por el Decano de la Facultad de Filosofía y Letras de Córdoba, Eulalio Fernández Sánchez, mi tutor de TFM, junto con un grupo de diez expertos también procedentes de dicha facultad que han validado las encuestas.

Si tiene alguna pregunta puede hacerla ahora o más tarde, contactando conmigo:

Nombre: Macarena Palma Gutiérrez.

Correo electrónico: macarena_pg90@hotmail.com.

Teléfono: 676 911 668.

FORMULARIO DE CONSENTIMIENTO:

Yo, _____,
padre/madre/tutor legal de un alumno/a del
centro_____, corroboro que he leído
la información proporcionada o me ha sido leída, he tenido la oportunidad de preguntar
sobre ella y se me ha contestado satisfactoriamente.

Consiento voluntariamente participar en esta investigación. También entiendo
que tengo el derecho de retirarme de la investigación en cualquier momento.

Firma del participante:

Fecha (Día/Mes/Año):

Ha sido proporcionada al participante una copia de este documento de
Consentimiento Informado _____ (Iniciales del investigador).

7.2. INDEX OF TABLES AND FIGURES