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An Analysis of Down Syndrome Children and the Importance of Their Cognitive and Communicative Development

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AN ANALYSIS OF DOWN SYNDROME CHILDREN AND THE IMPORTANCE OF THEIR COGNITIVE AND COMMUNICATIVE DEVELOPMENT

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ABSTRACT

This paper will look at the issues of cognitive and communication development in children with Down Syndrome. With recent advances in neuroscience, educators need to understand brain development in order to utilize methods in dealing with education problems that occur with this population. Therefore this paper will look at the Down Syndrome child in both a physiological and educational context, to better understand appropriate methods of intervention.

Moreover, brain development and learning involves not only genetic content specific to each individual, but also the many paths laid out by the family, environment, social and educational needs. As they move through the first months of life, which is the time when neurons grow and connect with each other under the impulse of stimuli comes streaming in through the sensory organs. Their brain grows less, there are fewer neurons in some parts, and neurons establish less synaptic connections because of the fewer alterations in dendrite spines and axonal extensions that take longer (Bullock, Bennett, Johnston, Josephson, Marder, Fields, 2005).

Although their neurons may have problems to develop and establish their connections, they may need to be surrounded by different stimuli, although we see that their development is slower. Early intervention in cognitive development provides strong stimuli, consistent, and appropriate to the needs of each child and is rich in content, well thought out and directed, because it involves the different stimuli and as well as the family to help to increase these children's' skill to succeed in life.

DEDICATION

This thesis is dedicated first and foremost to God for giving the strength, faith and for always helping me to believe in myself. To my beloved parents who are always by my side in good and bad times, especially to my mom who is my example in life. To my grandmother for being my inspiration and a good example to follow and for encourage me through this learning process.

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Introduction

According to recent statistics there are more than 400,000 individuals living with Down syndrome in the United States (Stumbo, 2010). Of a variety of birth defects, Down syndrome is perhaps the most frequent and complex. It affects approximately one in every 700-800 live births (Capone, 2001; Nadal & Estivil, 2001; Sinet, 2000).

Since John Langdon Haydon Down described it for the first time in 1866 this syndrome and in 1958 Jerome Lejeune's contribution that the origin of the disease was genetic in nature, discovering an extra chromosome in the karyotype of these individuals (Down syndrome Catalan Foundation, 1996), much has been achieved in all issues surrounding "any" person with Down Syndrome in any of the mental, physical and sensory issues that arise, as well as in the social, educational, medical, and psychological aspects.

The average life expectancy has increased from approximately 9 years in 1929 (Penrose, 1949) to 40 years in the eighties (Carter, 1983) to reach a half-life of 60-64 years in 1996 (Strauss & Eyman, 1996). In Down syndrome people during the first years of life when the death rate is higher, is mainly due to respiratory infections, leukemia or birth defects large enough to become an obstacle in their life (Fryers, 1986). Specifically, with respect to leukemia, the percentage chance of getting the disease in infants with DS is much higher than in other infants (Robinson & Neglia, 1987).The resulting phenotypic expression of genetic malformation of Down syndrome

possesses a large variability. In this regard, there are cases described in the literature with phenotypic representations including two phenotypic traits, the case of a person with Down syndrome with regular trisomy appearing only in the absence of brachycephaly, which is a cephalic disorder resulting in premature fusion of the coronal sutures and its fibrous joints which does not make possible the union between the frontal bone and the two parietal bones of the skull (Patterson, 1987); and nasal bridge (Avramopoulos et al., 1997). The Down syndrome phenotype shows a penetrant variable affecting many organs such as the brain, muscle, heart, skeletal structure and blood (Chrast et al., 2000). Of all the characteristics which often occur in people with Down syndrome it can be said that the condition in the brain, causing cognitive delays, is present in all cases with the neuropathological changes present, similar to Alzheimer's disease (Dierssen et al., 2003). It should be noted that in the spectrum of intellectual disability, the variability between subjects is enormous. This variability can be explained mainly due to internal factors. Although the chromosomal abnormality is the same in different individuals, neurobiological development processes are different in each person, and although there is some similarity between affected brain structures are no such structural and functional alterations are in 100% of the cases studied (Lynch, 2004).

The neuropsychological characteristics of people with Down syndrome who are treated as equal individuals in external conditions, and who attend school and can be subjected to very effective early childhood development programs, varies greatly from one individual to another (Welsh, Elliott, & Simon, 2003).. Neuropsychological profiles studied and compared between these subjects show large differences, and, a priori, there seem to be external-environmental conditions directly responsible for this variation, and appear responsible for actually improving different brain functions (Wishart, 2001).

The phenotypic characteristics are expressed in the face, hands, feet and limbs. There are very common cardiovascular disorders, impaired vision and hearing, affected muscle tone, cognitive development that affects all areas of intellect, and accelerated aging with a high percentage of people with clinical symptoms similar to Alzheimer's dementia at relatively early ages (50-55 years) (García-Alba & Portellano, 2004). The phenotype of trisomy 21 of Down syndrome has two clinical features present in almost all cases: (1) cognitive development delays (2) muscular hypotonia (Epstein, 2001).

The cause of the abnormality that leads to Down syndrome resides on chromosome 21, the smallest of the chromosomes that carry human cells and occupies 1.5% of the human genome (Sinet, 2000). All body cells in the nucleus carry 23 pairs of chromosomes (FCSD, 1996), therefore, 46 chromosomes. In Down syndrome the pair 21 of the 23 that exist, has three chromosomes instead of two, which is what causes the chromosomal (excess or deficiency of genetic material).

In addition to trisomy 21 there are also other less frequent trisomies, such as 13 and 18. In most cases these changes are incompatible with life and spontaneous abortions occur. For instance, in these chromosomes the genetic material in excess triggers major malformations or more serious disorders because the number of genes of these chromosomes is far greater than the carrying chromosome 21. Given these circumstances, the prevalence of these malformations is much lower (FCSD, 1996).

Significance of the Research Topic

Before the diagnosis of Down syndrome in the child, the parents' emotions are unclear emerging feelings of guilt, or denial attachment (Brazelton and Sparrow, 1999), which sometimes involves a rejection of the situation.

Instead of being a moment of joy, parents enter a state of high tension, a psychological crisis may occur. This is because no parent is prepared in advance to cope with the birth of a child with Down syndrome, resulting in an imbalance that may affect other household members. So this is a multidimensional phenomenon that affects physiological, medical, educational and social areas (Ortega, 1997).

Recent studies have shown that, due to its high incidence, many doctors, psychologists and education professionals have focused on Down syndrome in different dimensions. In addition, many parents of people diagnosed with Down syndrome have formed partnerships with different support social policy objectives in support of their children (Alvarez, 2003).

For this reason, the importance of addressing an issue in the child diagnosed with Down syndrome is the focus that one should take into account both the individuals' needs and the family and social issues that may occur. A healthy environment for any child, especially a child with special needs, is one that allows and encourages its development (Minuchin, 1986).

For the same reason it is vital to try to better understand what impact that the cognitive and communicative development in children with Down syndrome has, and how the educational strategies, can enrich cortical functions such as attention, memory, language, perception, memory (Seminario, 2003). One way to accommodate such needs for a person with Down syndrome was exposed by Taylor (1983) in the Theory of Cognitive Development. Mainly, it is

the Cognitive development of the individual that allows them to recover, adjust and develop mechanisms to resume their lives.

This study allows us to deepen our knowledge about interventions to improve cognitive and communicative development of these children. Furthermore, cognitive development among many things allows finding meaning in experience, gain control over their lives, and to restore self-esteem (Taylor, 1983).

Limitations of the Research Study

This study to determine what is specific about Down syndrome in relation to schooling and education therefore requires determining what is distinctive and different in these children. Similarly, there is a lack of studies that try to explain what the cognitive development from a neuroscience perspective is and what can be learned. The most studied methodologies concentrates is the interrelation of other syndromes compared with Down syndrome itself. (FEAPS, 2006). In fact, there are concerns among some specialists in the pursuit of these differentiating peculiarities (VI International Symposium, 2005, Rondal and Perera, 2006).

However, there are more similarities that children with Down syndrome share with other than children what distinguishes them. To determine what is specific about Down syndrome in the school environment is important to use an adaptation of the model that O'brien (1998) used to identify the educational needs presented by different students of a class. This author proposes differentiating in:

- What is common: referring to the common needs of all students.
- What is different: the characteristic of a particular group. In this case, the distinctive needs of people with Down syndrome. Represent what is specific about Down syndrome.

The individual: the needs of each student. Students with Down syndrome have common needs of all children and some other coincident with special educational needs and intellectual disabilities. They also have different needs, specific to Down syndrome, which are not similar to children without disabilities, nor consistent with other intellectual disabilities themselves (FEAPS, 2006). Finally, each child is a unique, unrepeatable, with biological characteristics and social and family environment itself, unlike all other children, with and without Down syndrome. Hence, their personal characteristics that they have, expresses their own individual needs.

Chapter II

Literature Review

The literature review in this research project, allows the reader to ascertain the reasons for developing cognitive and communicative learning skills in Down syndrome children. It should be noted that a Down syndrome child, as well as any other children with disabilities, should be taught on a basis that focuses their study on the mental activities and cognitive processes, and which tries to explain the thought processes that mediate the stimulus-response relationship and that gives a more detailed explanation of the learning process (Hoppenstead, Izhikevich, 1997). Moreover, Pozo (1989) believes that cognitive learning is a psychological theory which is constructed from an individual's approach that focuses on learning generated in a school context. It is also constructivist theory, since it is the individual himself who generates and builds learning. In addition, cognitive and verbal development in Down syndrome children is essential because it helps them to better comprehend information, organize ideas, analyze and synthesize data, apply knowledge, choose among alternatives in problem solving, and evaluate ideas or actions (Mager, 1999).

It should be noted that since Down Syndrome was one of the first symptom complexes associated with cognitive disability to be identified as a syndrome. Understanding cognitive development might help them since it is a powerful mechanism that provides the means of knowledge and skills by mental or cognitive processes (Kumin, 1996) and the procedures we have for manipulating information 'in our heads'.

Cognitive processes include creating mental representations of physical objects and events, and other forms of information processing. Furthermore, Gagne, Yekovich, & Yekovich (1993) claim that the importance of cognitive learning roots in the fact that the individual learns by listening, watching, touching, reading, or experiencing and then processing and remembering the information. Indeed, cognitive learning might seem to be passive learning, because there is no motor movement. However, the learner is quite active in processing and remembering newly incoming information (Omrod, 2006). Consequently, cognitive learning enables Down syndrome children to create and navigate through a complex culture that includes symbols, values, beliefs and norms (Singer, 1993).

Brain Differences between a Normal Child and a Down syndrome Child

The brain of individuals with Down syndrome, is the result of the imbalance caused by too much information in the genes present on chromosome 47 (the extra pair 21), presenting a series of changes both in its structure and its function (Buitink and Kemmes, 1986). It should be noted that these changes may be different from one person to another, both in intensity or degree due to its location within the brain. This explains the great variability in cognitive abilities of entry that may exist between a person with Down syndrome and without (Marrero, 1990).

Brain Structure and its Functions

The brain is the system in our body which has the essential function to receive information, process it and retrieve it (Bruer, 1999). Thanks to our brain we can maintain a relationship with what occurs in outside environment, and we see life around us. In turn, because

our brain constantly receives signals from our own inner world and respond to external and internal signals we can have a better perception of our environment (Caine & Caine, 1995).

Moreover, D'Arcangelo (1998) clarifies that human beings are endowed with qualities that any living organism lack, our unique nervous system is able to "manipulate" the information we receive, to make conscious, to work and rework, to codify, and create thought.We become aware of ourselves, we have the power to decide and doubt, we are able to innovate, to go with the flow or go against the tide, to shut in our own shell or open to others (Caine & Caine, 1995).

These functions listed allow us to have a better understanding on how the nervous system is the essential element of our nature and how, when that system is altered, it may deteriorate some of the functions that it serves (MacLean, 1990). The neuron cell is the key, thanks to its structure and function, it is specially trained to simultaneously receive a great deal of information, encode, interpret, process and, in turn, transmit information in fractions of a second (Slavkin, 2004).

According to Kandel, Schwartz, and Jessell (2000), we must remember that a neuron consists essentially of:

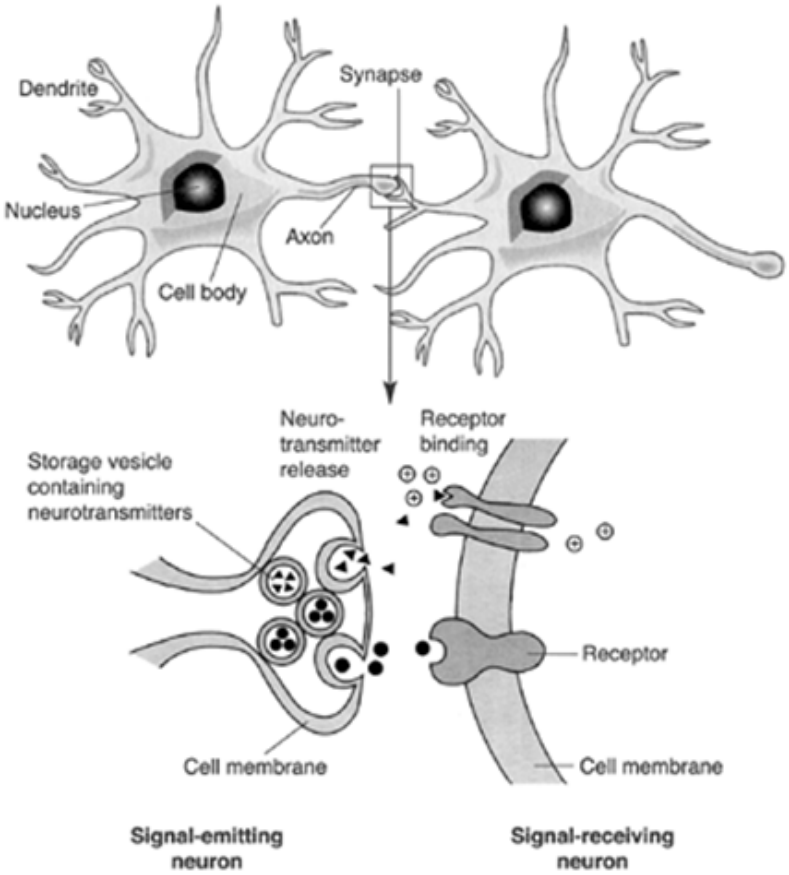
a) A body or soma within which is the nucleus that is the element that holds the chromosomes and therefore genes;

b) Composed of numerous branches that are called dendrites, which in turn, contain small projections referred to as "appendages" or "spines". Appendages increase receptive properties of dendrites to isolate signal specificity. Increased neural activity at spines increases their size and conduction which is thought to play a role in learning and

memory formation. There are approximately 200,000 spines per cell, each of which serves as a postsynaptic process for individual pre-synaptic axons.

c) An extension, long or short depending on the type of neuron called the axon. The soma and dendrites are the areas of the neuron ready to receive information from other neurons, whereas the axon is the element responsible for transmitting information to other neurons. The soma and dendrites of a single neuron receive hundreds or thousands of axon terminals from other neurons (principle of convergence), in turn, that neuron can connect with hundreds or thousands of other neurons through its axon branches (principle of divergence).

Figure 1. Illustration of Neuron's Structure and Synapses



A neuron does not fuse with each other when contacting with them, but retains its identity. The site of contact between the axon and the dendrites of another neuron with which to deliver information is called synapses (Yuh-Nung & Lily, 2010). The synapse, therefore, is the ultimate process of communication between neurons. In addition, according to Bullock, Bennett, Johnston, Josephson, Marder, Fields (2005), this communication is implemented through the issuance of chemical molecules by the neurons, which are called neurotransmitters, and have the power to activate other molecules located in the dendrites' spine of the receiving neuron. For this reason, they are called receptor molecules. That is when the neurotransmitter becomes a kind of messenger (Weiss, 2000).

Wolfe (2001) states that since a neuron receives numerous axon terminals that form synapses, and each of them can act with as a different neurotransmitter, which means that a neuron is constantly receiving information of a varied nature which sometimes might be excitatory and inhibitory and also may cause a certain response that can be reinforced or influenced. Thus, the neuron receives and integrates information giving rise to a response that can be immediate, delayed, or repeated, and so on. So, they form networks of neurons, or pathways, or circuits of size and activity which form the basis of brain activity (Alford, Frenguelli, Schofield, and Collingridge, 1993).

However, neurons possess a type of plasticity, which means that its structure and function are partly malleable. First, at the time of birth the neurons are not fully developed, they lack many of their arborizations and synaptic contacts, both from each other and are completed during the first months of life. This is the result of its own genetic program and partly according to the stimuli that neurons receive (Hart, B., & Risley, 1995). Conversely, an environment rich in stimuli facilitates the neural development and the full extent and quality of synaptic contacts.

Good stimuli reinforce and stabilize the function of synapses (Kandel, 1996). Unlike what happens in most of the brain, there is a small area in the hippocampus which reacts to emotional stimuli where neurons are born throughout life, and its production increases when there are good conditions for stimulation which can affect learning and memory (D'Arcangelo, 1998).

Brain disorders in Down syndrome people

In Down syndrome there are several changes in the brain that help explain the difficulties of certain neuronal groups to express themselves and can affect learning. These changes are due both to problems of development, and the presence of toxic factors that can injure neuronal life. As a result of a research Flórez (1999) observed the following:

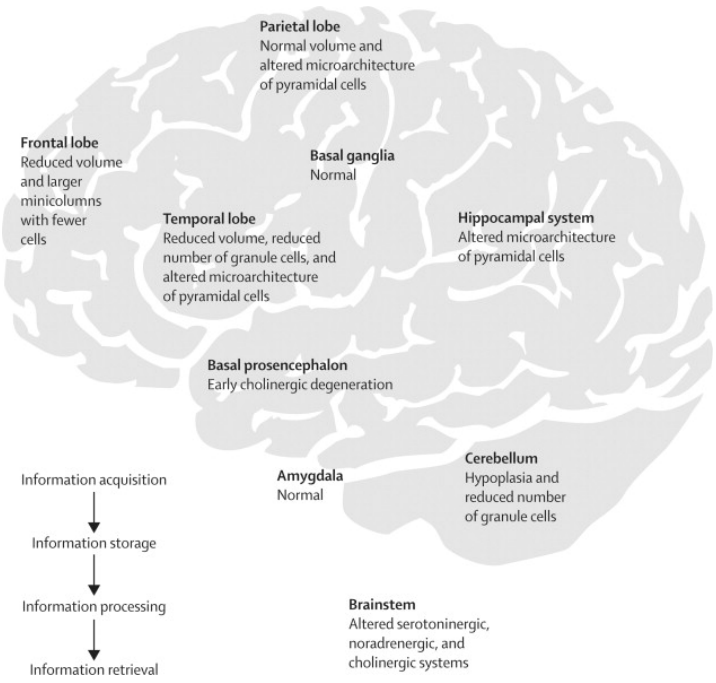
a) A decrease in certain types of neurons in the cerebral cortex. That is, neurons that best serves to link and integrate information.

b) A change in the structure and a decrease in the number of dendrites' spines that are part of the receiver of the neuron.

c) A reduction in the size of certain nuclei and brain areas, such as the hippocampus, the cerebellum and some areas of the prefrontal cortex.

d) Lower biochemical efficiency in the organization by which the neuron receives signals to cause an integrated response.

Figure 2. Illustration of Brain's Structure in a Down syndrome Individual



Some of these brain alterations have been seen in certain areas associated with the cerebral cortex, hippocampus and cerebellum, and therefore areas which are designed to store, summarize, integrate, and collect the information to organize memory, abstraction, deduction, and calculation. Consequently, orders received by the brain will be more slowly captured, processed slowly, slowly performed, and incompletely developed (Troncoso, Del Cerro, Ruiz, 1999).

Dierssen et al. (2001) mentions that there is a tremendous variability among people with Down syndrome in the number of brain functions affected and the intensity of this involvement. Logically, it is necessary to analyze what are the weakest points in a particular individual

develop other possible strengths. Early intervention may help them to compensate and overcome these limitations and may help them to take advantage of neural plasticity.

The Educational Needs of Down Syndrome People

Learning in a general sense is the process by which we acquired certain information and store it to use it when necessary. This use can be as a memory of an event, concept, data, but can also be instrumental in doing homework or any task. In any case, learning requires that information enters us through our senses where, it is processed and stored in our brain, and then can be evoked or remembered to be used whenever is needed (Saunders & Vawdrey, 2002). Moreover, Slavkin (2004) emphasizes that learning is a physiological process and technological progress has given us the chance to have a better knowledge about brain function, our thoughts as they occur, and to keep in mind how learning occurs. The brain, like other organs, has a natural function … learning. When we talk about 'learning', we talk about survival and the control human beings have about the outside world (Weiss, 2000).

The learning process of human beings

According to MacLean (1990) there are three steps that our brain does during the learning process:

1. Encodes information which is an active process where meaningful information is put in memory. Students encode information through stimulus, words, visual stimulation, and association, among others.

2. Storage where our brain constructs stimulus in short- term memory and meaningful information can be retained in long-term memory.

3. Retrieval where we construct new learning and we fill gaps and have a better understanding.

However, there is a set of theoretical data about Down syndrome and cognitive characteristics of these individuals. These data identified a number of problems and deficits in some specific processes in intellectual functioning of these people (Lambert and Rondal, 1982). In fact, these authors, point out two aspects that describe the cognitive development of people with Down syndrome: (1) Reduced speed of development. (2) Fixation in the lower stages of cognitive organization, which need to be taken into account when developing strategies for learning.

Reasoning and Cognitive Structure of the Person with Down Syndrome

If someone asks for the location of a street known or for the result of a mathematical operation, an individual may respond right away. If someone asks the same question to a person with Down syndrome, they make take some time to process information and respond. The message has come in, is interpreted, and may lose the cognitive structure of information presented in the synaptic discontinuity of its neuronal connections (Callner et al., 1978).

For instance, people living with Down syndrome have some deficits in terms of sensory discrimination, perceptual speed, etc. The great state of apathy and lack of attention according to Lambert and Rondal (1982) is due to two factors:

1. These individuals need more time to react to stimuli.

2. Their ability to answer, even after seeing all aspects of the stimulus, has a higher error rate and lower quality.

To Cuilleret (1985) the trisomic child theory has a kaleidoscopic spirit because he has an analytical mood that discourages his excessive capacity of synthesis. For example, when a car is shown to a person with Down syndrome, his visual-perceptual discrimination will stop at the wheels, the rear view mirror, and the steering wheel, etc. To analyze this he will not have many difficulties. However, he will struggle when he has to analyze and to know that that object is a car (capacity of synthesis). In this sense, Gliddon et al. (1975) have shown that there are some deficits in neurological processes regarding people with Down syndrome in their responses to visual stimuli. So, it is evident that the mode of reasoning that they possess has a different internal logic structure.

Remembering Piaget's theory to help understand the brain development of a Down's syndrome child may help (1969a, 1969b, 1970). From 0 to 7 years the child is in the egocentric stage where the child has an individual mind and the world revolves around him. It should be noted that this phase is formed by two sub-periods:

- 0 to 2 years. Sensor-motor intelligence where there is an external structure of language and the need for understanding empirical support, etc..
- 2 to 7 years. Preoperative intelligence where the child makes judgments based on perceptions, images and intuition.

Additionally, between 7 and 11 years the child enters the stage of concrete operations. Thus, the child organizes logical structures that can be handled in practice (Piaget, 1969a). Finally, from the 12 years the child enters the formal operational period where he already has capacity of abstraction (Piaget, 1970).

Referring to the theory of Piaget, Inhelder (2002) thinks that cognitively different people pass through the same stages as those considered "normal" but with the difference being that there is a slower development called "genetic viscosity". Because of this, the reasoning of people with Down syndrome is divided between the structures of thought of a higher stage and between the systems of thought that they have not left yet. This fragility can lead the child be able to overcome the stage or stay where he was.

If the child remains at the stage where he was, what happens is called " Penelope effect" (Guerrero Lopez, 1991) where it is observed that due to the different internal processes of maturity of the child, the action of the parents, or the intervention of teachers, the child with Down syndrome "unraveled" in no time what had been achieved with patience.

Often the physical developments of the Down syndrome children do not match their mental development. Zazzo (1970) calls it "development heterochromia" and believes that this mismatch between physical growth and mental growth causes weakness and, develops a peculiar cognitive style.

Lambert and Rondal (1982) have stressed that the mental growth of the child with Down syndrome is a greater up to 30-35 years, although this growth is very slow after the 15 years and they state:

> It is known that mental growth of individuals with Down syndrome is directly related to the level of mental decline: the more diminished the slower in his mental growth. Similarly, the more reduced the individual, the shorter the period of mental growth. (p. 34)

Cognitive Development of the Child with Down syndrome

When we refer to the term cognition, in general terms one can say that it is everything related to mental abilities to talk, think, reason and remember. Therefore, it is the process of knowledge that encompasses the processes of attention, perception, memory, reasoning, imagination, decision making, thinking and language (Candel and Carranza, 1999). In addition, cognitive development also takes place when the child learns to interact with the surrounding environment and as a result increases his understanding of it (Arraiz Perez, 1994). According to Sánchez Rodríguez (1996), children with Down syndrome have slow cognitive development. This is of particular concern to the parents of these individuals because it influences all aspects of understanding and control of daily life and determines the rate of acquisition of knowledge about the world surrounding the child. So when we talk about the difficulties or problems and characteristics of cognitive development in the child with Down syndrome, we are referring to the internal capacity which constrains the individual and the limitations of that social experience (Candel and Carranza, 1999).

It should be emphasized that the development of children with trisomy 21 has a structure similar to that of the general population. Children with Down syndrome can perform some tasks as children of the same mental age. However, Kumin (1997) state that children with trisomy 21 have a slower development in certain mental abilities which affects many aspects of their daily life, and therefore limits the knowledge they acquire from their environment.

Additionally, children with Down syndrome have a developmental delay compared to normal children which is visible early in the first year of life and there is also a progressive decrease in the rate of development during infancy Zazzo (1970).

According to Fernández de la Iglesia and Buceta Cancela (2003) state there are two fundamental difficulties that presents the child with Down syndrome:

1. The presence of cognitive delay in age when compared with their chronological age.
2. Slowness in cognitive ability, in their reactions, as well as in their mode of acquiring and processing information.

Likewise Fernández de la Iglesia and Buceta Cancela (2003) suggest that children with Down syndrome have problems associated with the development of the following processes:

- The mechanisms of attention, alertness and attitudes of initiative.
- The expression of their temperament, behavior and sociability.
- The memory processes in both the short and long term.
- Mechanisms for correlation, analysis, calculation and abstract thought.
- The processes of expressive language.

Furthermore, it is important to explain that most of the problems detected in children with Down syndrome are located in areas of the brain whose function is to store, summarize, integrate and consolidate the information so as to organize memory, deductions and abstraction (Ausubel, 1981).

The Intelligence of the Down Syndrome people

It should be noted that in the last decades there has been little research done on the intellectual development of individuals with Down syndrome. However in the generally used

categories of cognitive disability mild, moderate, severe and profound based on the IQ of the individual to label people with mental disabilities. Furthermore, within the educational field concepts for people with Down syndrome such trainable and educable subjects have been used. However, many such concepts should be reconsidered because the idea that children with Down syndrome can only acquire self-care skills is not accurate (Begley and Lewis, 1998).

Currently, Bernhardt (2008) specifies that there are studies that support the conclusion that the majority of students with Down syndrome work with a mild or moderate cognitive impairment. IQ can be re-evaluated especially after 10 years of life as the mental age of children with Down syndrome grows over time, but more slowly than chronological age. However, to clarify the intellectual disabilities characteristic of Down syndrome in modern terms from a psycho-neurological perspective is necessary to define those areas in which the individual shows the most special difficulties (Cunningham and Glenn, 2004).

There are also studies that talk about the anomalies that often occur in both the structure and function of the brain of people with Down syndrome (Cuskelly & de Jong, 1999). Troncoso and Del Cerro (1997) show functional data obtained from the brains, of people with trisomy 21, problems related to the development with the following processes:

- The mechanisms of attention, alertness, initiative attitudes.
- The expression of their temperament, and conduct of sociability.
- Memory processes in the short and long term.
- The mechanisms of correlation, analysis, calculation and abstract thought.
- Expressive language processes.

On the basis of the observed alterations in the brain system of the individual with Down syndrome, Flórez (1999) summarizes the following:

Table 1

Correlation between brain pathology and cognitive behavior of the individual with Down syndrome

Cognitive Behavior	**Structures affected in the nervous system**
I. Attention, initiative Tendency to distraction. Little differentiation between old and new stimuli. Difficulty maintaining attention and continue with a specific task. Decreased ability to self-inhibit. Low initiative to play.	Midbrain. Thalamus-cortical interactions. Frontal-parietal cortex interactions.
II. Short-term memory and information processing. Difficulty processing sensory information specific forms process and organize it as answers.	Sensory association areas (lobe parietal-temporal). Prefrontal cortex.
III. Long-term memory Decrease in the ability to consolidate and retrieve memory. Reduction in the types of declarative memory.	Hippocampus. Cortical-hippocampus interactions.
IV. Correlation and analysis Difficulty: integrating and interpreting information, organizing a new sequential integration and deliberately make an internal conceptualization and programming, get sequential cognitive operations, develop abstract thinking and numerical operations.	Prefrontal cortex in bidirectional interaction with: - Other cortical and sub-cortical structures. - Hippocampus.

Table 1

In short, Kingsley and Levitz (1994) state that there are a number of common characteristics with other forms of cognitive disability:

- Learning is slow.
- It is necessary to teach them many more things that children without disabilities learn for themselves.
- We must go step by step through the learning process.

The perception process of people with Down syndrome

The complex process of perception is to collect and then interpret the information that comes through our senses. Therefore, it is an organization and analysis of data received from the internal environment or whether the external environment plays a role (Saunders & Vawdrey, 2002). To MacLean (1990) the process of perception also involves the integration of sensory stimuli on the objects, events or situations, making from it a useful experience.

Sánchez Rodríguez (1996), states that one can say that perception helps the child to lay the foundations of knowledge. For these authors, it is for this reason that the development of the senses must be considered the first step in the intellectual process as the perceptional development requires minimal attention and involves the operation of large cortical association areas in the brain. Goldstein (2009) explains that cerebral cortical association areas develop more slowly than the primary sensory areas. For this reason, the ability to discriminate and differentiate one stimulus from others or to relate them require the presence of neural networks to be more related to each other.

On the contrary, in children with Down syndrome there is a shortage in intercommunicative development of neural structures in the brain which will disrupt the association of cortical areas and therefore there will be a delay in the development of perceptual abilities (Van Dyke, and Mattheis, 1995). As explained Troncoso and Del Cerro (1997) discrimination is the ability to see similarities and differences and to respond differently to what is perceived. It is therefore necessary to understand discrimination learning in children's educational programs may impede children from academic learning.

However, Cohen, Nadel and Madnick (2002) specify that children with Down syndrome need more than other students from a specific teaching method which can reduce their learning difficulties. Thus, a good discrimination learning method provides students with trisomy 21 logical thinking, knowledge of shapes, sizes, textures, colors, and other properties of objects, numerical concepts and reading. In addition, for these authors, this will help the child in the acquisition of new learning in the social and natural area, as well as to an improvement in their language.

Fernandez Sampedro, Gonzalez Blasco and Martínez Hernández (1993) state that people with Down syndrome have higher deficits in relation to normal people in the following areas:

- Ability in visual and auditory discrimination (especially with respect to discrimination of light intensities).
- Tactile recognition in general and also of three-dimensional objects.
- Copies and reproduction of geometric figures.
- Perceptual speed (especially in reaction time tasks).

Children with Down syndrome when they have to face the tasks they have to learn do not have mental structures necessary to carry out a proper assimilation of the world to receive information through their senses (Kumin, 2001). One of the characteristics of cognitive development of children with trisomy 21 is that establishing eye contact with the mother is deficient. This occurs later and also (Kumin, 2003). Sánchez Rodríguez (1996) argues that the looks that the child with Down syndrome has with his mother are shorter and tardier causing alterations of communication and knowledge of the environment as well as attention problems due to mother-child interaction. Therefore, it can be said that in a normal child the maximum frequency of eye contact occurs over 4-5 months of age while in the child with Down syndrome this maximum frequency is around 6-7 months of age Candel (2001).

Candel (2001) states that eye contact is one of the first behaviors that reflect maturational delays that the child with Down syndrome presents and therefore the mandatory deficit that characterizes these children. Additionally Sánchez Rodríguez (1996) maintains that children with Down syndrome have a biological reduction of the number of neurons, dendrite spines, synaptic connections and the myelination of the cerebral cortex affecting primary sensory and associative areas which are responsible of perception processes.

Therefore, children with Down syndrome have more difficulties to processing auditory and visual information regarding the level of perception of the signals and the systems execution. However, these children also have greater difficulties in auditory perception than in the visual one (Greenspan and Weider, 1998). The execution of the tasks where they have to respond to verbal commands will be poorer than when they have to respond to the information presented visually.

Attention skills of the Down Syndrome Individual

When talking about term attention, this refers to the ability of humans to plan. In short, it helps to address any issues in a planned way. Flórez (1999) states that attention is a complex concept because it involves several aspects: the penetration of the stimuli, and the response to these stimuli as to the uptake and appraisal of information. Also the motivational and intellectual assessment, the decision to sustain attention in a particular direction (targeting) and to filter and reject material, and the execution of motored or mental tasks (such listening to the information, take notes, decision ...).

Concerning the child with Down syndrome, this has deficits regarding the possibility of creating habits of fixing, targeting and concentrating attention. This is partly due to the close relationship that attention has to other areas of development such as: the perception area (visual and auditory), psychomotor area and the language area (especially in relation to oral language) (Selikowitz, M, 1997).

Fernández Sampedro, González Blasco, and Hernández Martínez (1993) claimed that the performance of children with trisomy 21 was mediocre regarding their learning of discrimination because of:

- The time to create the habit of directing attention to what was wanted was longer and they had greater difficulty in mobilizing their attention from one aspect to another.
- Children with Down syndrome had more difficulty to inhibit or retain their own response as they need to take more time to examine in detail the most important aspects and delete abstract stimuli. Hence the lower quality of answers and higher frequency of error.

According Troncoso and Del Cerro (1997) children with trisomy 21, from an early age, have a difficulty or delay in the ability to set their eyes to a stimulus. For these authors, this is due to ligament laxity and low muscle tone.

The child with Down syndrome as stated by Sanchez Rodriguez (1996) has specificity for the attention and also about the organization of information that may cause difficulties to reorganize the demands of the social world and to provide a response. Other difficulties that these children have are to interact with other looks, or to sustain attention over a period of time. This is because of auditory memory problems (Lubec and Engidawork, 2002). Also Roizen and Patterson (2003) add that children with trisomy 21 have difficulty moving their focus from one object to another, and to carry out a joint attention from the toy and the mother for example. Furthermore, these children often struggle with perception and hearing discrimination that can lead to them to not pay attention because they often cannot hear.

However, Candel (2001) says that the child with trisomy 21 attention development is qualitatively different compared to the normal child development. For example, around 9-10 months of age children who function normally have more exploratory behavior that most children with Down syndrome, which focus their attention not on the toys but without exploring the surrounding environment.

Additionally Sanchez Rodriguez (1996), states that alterations in hippocampus areas and disturbances in the prefrontal cortex are involved in the processes of attention decisively and also in the type of behavior that the child with Down syndrome will follow. This means that many children with Down syndrome tend to present a distraction and difficulty maintaining attention and interest in the accomplishment of the tasks in the time needed to perform them (Sherman, Allen, Bean and Freeman, 2007). In addition, Selikowitz (2008) refers that children with Down

syndrome have a poor differentiation between new stimuli and old stimuli as well as reduced ability to auto inhibition and lower ability to focus attention and control behavior and self-control. Sanchez Rodriguez (1996) states that in a child with Down syndrome there is a deficit in the inhibition process which produces a higher level of neuronal habituation leading to hypo-responsiveness to the presentation of new stimuli.

To develop the attention in children with trisomy 21 it would be a very useful resource to gently hold the hands of the child while he is asked what the teachers wants him to do, so, the child receives the request, processes it, produces the response and manifests with the look or attitude that he will perform the request in the right way (Palmer, 2005). After the child is alert and the teacher begins to work with him, it is important to vary the visual and auditory stimuli (Kranowitz, 2003). MacDonald (2004) state that to work with the child with trisomy 21 verbal communication should be treated carefully in order to maintain their attention to learning to about what they see and do. Also, it is necessary to occasionally let the child choose what he wants to do. Care programs aimed at developing early attention in children with Down syndrome are a great resource because with them, these children are gaining more attention and for a longer period of time (Kumin, 2003).

Troncoso and Del Cerro (1997) explained, to try to alleviate these difficulties that children with trisomy 21 present, during the early stages of their life, professionals in the field must work primarily on visual attention therefore the child will be able to maintain an adequate visual monitoring and good eye contact. For these authors, this all works using sound stimuli such as rattles, music, bells and so on. However, the best stimulus for these children appears to be the face and the human voice. So, children with Down syndrome learn to sustain attention to

people, to listen to verbal instructions and to establish a more solid emotional bond with their neighbors (Miller, and Lewis, 1999).

The memory of Down Syndrome people

Memory is the process of storage and retrieval of information that occurs in the brain. This is a basic process in learning and thinking and is the result of proper discrimination and proper recognition of sensory stimuli (Bruer, 1999). Memory is responsible for the organization of data from perception and memory which allow the recognition of objects, situations, events, and its main function is to acquire information including various processes such as: classification, categorization, grouping and repetition (D'Arcangelo, 1998).

Florez (1999) clarifies that the memory is an important part of the learning process and that is a neurocognitive process that enables an individual to record, encode, consolidate, store, access and retrieve information. Learning requires that the information received is stored so that it can be accessed as required. For this paper, three types of memory will be looked at: short-term memory, long-term memory, and emotional memory.

The short-term memory allows individuals to maintain and manage the information for a maximum of approximate 30 seconds (Tobin, 1987). It is used to retain the information as it is received so that we can gradually understand what we see, hear, feel, and so be able to reason, solve problems, retrieve or express information stored as long-term memory. In addition, for Thomas and Johnson (2008), long-term memory is able to collect, store and allow the individual access to previous information. It is this memory that allows us to recall personal experiences, learn and retain what we learn, advance knowledge of concepts; acquire skills, habits, etc. Within this long-term memory there are two memory types: (1) Declarative memory which recalls the "what" previous experiences, objects, scenes, names, faces, etc. (2) Non-declarative memory

which has to do with the "how" acts that people do, what they like and dislike, , it is the key what learning is all about (Swanson, 2008).

On the other hand, the emotional memory is a type of memory in which emotional stimuli or events full of emotional components play an important role for learning. In this type of memory certain nuclei of the amygdala are involved. These are connected with sensory areas that collect information and various systems that are involved in the expression of emotional response (Schacter, 1996).

The world of emotions and affections is an advantageous field for people with Down syndrome. Regardless of the difficulty that in the first weeks of life the mother-child bond was developed, in general there is the impression that children with trisomy 21 fully develop their emotional world and express affection easily with others in an interactive and comfortable way (Skallerup, 2008). Children with Down syndrome readily recognize and appreciate the emotional traits, either positive or negative, that they observed in others (McGuire and Brian, 2006). The world of feelings is not only protected in Down syndrome children, but may be over expressed by the lack or need of inhibition in areas located in the frontal cortex, which usually inhibit more primitive brain nuclei involved in limbic emotional behavior (Kranowitz, 2003).

This is a fact that must be taken into account to understand the educational intervention required. The emotional relationship between teacher and student with Down syndrome will quickly determine the attitude and the student's response and, consequently, their learning activity in a positive or negative manner (Kumin, 2001). However, the situation is not easy because the individual may have problems with the perception of the facts and their interpretation may appear over responsive to events. Obviously, this may startle professionals

who have no experience and have not lived or studied the reactions of people with Down syndrome **(**Miller and Lewis, 1999**).**

The positive affective tone in instruction helps the acquisition of knowledge as to the perception of the Down syndrome person has on himself, as well as the learning area to be reinforced (Kumin, 2001). Like with any individual, situations of fear or rejection in speech block the mind of the person with Down syndrome. Unfortunately, these events occur too often and in unpredictable ways that often make the continuity of the educational process difficult (Kranowitz, 2003).

Additionally to this fact, Florez (1999) comments:

> The issue of emotional sensitivity and its influence on learning is important not only in the parent-child and teacher-student aspect. In addition, now there is the incorporation of the individual with trisomy 21 to the ordinary world of work, in relationships between managers and workers or the required relationships between peers. This relationship with the person with Down syndrome at work reaches a far greater importance than the strict execution of the tasks assigned to them. Therefore, these people must be addressed and supported by labor integration programs. (p. 43)

According to Fernandez Sampedro, Gonzalez Blasco and Martinez Hernandez (1993), in the process of memorization are three stages:

1. Acquisition: is the perception of data and facts.
2. Retention: is the period of storage of information.
3. Recognition/recall: the moment when the stored information is updated.

For these authors, in the degree of retention of information numerous factors can be included:

- The conditions under which the information is acquired (repetitions, number of data, etc.).
- Nature of the information (such as the complexity aspects, emotional aspects involved, etc.).
- Attention, motivation and interest of the individual.
- Time elapsed from the acquisition of information.

The evolution of infant memory development is characterized by the use of a type of memory that involves essentially a perceptual process. This refers to the recognition or recall of data in isolation (immediate memory). With the passage of time appears another type of memory that is related to the logical operations of thought which takes into account the sequential order of the data and is referred to as sequential memory (Trias, 1993).

Hassold and Patterson (1999) state that in terms of memory there are numerous studies that point out that the memory traces remain longer in the neural circuits of short-term memory of the general population than in those with Down syndrome. However, Stratford, and Gunn (1996) state that the basic mechanism of learning and memorization is the same in individuals with Down syndrome than in normal subjects, but the procedures used to spontaneously organize learning and memorization are different. They stated that the cause of learning and memorization problems that people with trisomy 21 have the difficulties of conceptual categorization and symbolic coding. This suggests that people with Down syndrome do not have a mechanism for assimilation of mental structures or tasks, but have to learn the tasks directly. In

short, thoughts are often governed by the concrete and not abstract concepts (Appleton, et al., 2002).

Fernandez Sampedro, Gonzalez Blasco and Martinez Hernandez (1993) claim that the person with Down syndrome has a specific deficit which affects verbal memory with the naming of objects or events that must be retained, as well as the organization of the material, and voluntary exclusion of items that are not considered appropriate. The individual's memory is good, however, is ineffective when active and spontaneous intervention is required to organize the material that needs to be memorized.

Sanchez Rodriguez (1996) states that in children with Down syndrome there is a lack of spontaneous use of strategies such as repetition storage and organization of information as well as a deficit in the process of linking new with existing information due to attention problems that these children possess.

In summary, children with Down syndrome do not use methods that quickly help them to retain information but show a deficit in short-term memory because the mechanisms which process information use cortical areas that are reduced in the prefrontal cortex of the brain (Sanchez Rodriguez, 1996). Additionally, Candel (2001) argues that it is important to intervene in this area as well as in all aspects of the memory of the person with Down syndrome because they are critical, and the author also warns that failure to work with these children in short-term memory aspects may add to a cognitive delay.

Communication and Language Development in Down Syndrome Children

Fernandez Sampedro, Gonzalez Blasco, and Martinez Fernandez (1993) argue that the development of the individual, their integration and their social and personal autonomy are

determined largely by the acquisition of language. Hence, there is the need to know the characteristics of communicative development in children with Down syndrome.

For this it is necessary first to distinguish between speech and language. Fernandez Sampedro, Gonzalez Blasco, Martinez Hernandez (1993) consider the following:

> Speech refers to the sounds and sound combinations that serve to form syllables, words and phrases. Language is the code or linguistic system that governs the combination of sounds, syllables, words and organization of the sentences so that they can communicate an idea. (p. 246)

The characteristics of language are referred to both disorders often present in the child with Down syndrome at the level of speech (breath, voice, rhythm, articulation, etc.) and at the level of language itself involving intellectual functions ranging from the structure of thought to the intention to communicate (Buckley, 2003).

Before talking about the development of communication and language in children with Down syndrome is necessary to clarify that language development has serious limitations according Candel and Carranza (1999) these are:

- Hearing problems.
- Difficulties in auditory information processing.
- Memory problems, especially hearing levels.
- Hypotonia of the muscles involved in articulation of words and mental retardation in neuromotor maturation.

Also, it is essential to know the difference between communication and language skills to understand the child with trisomy 21 and the main ways for them to learn and interact with others (DeutschSmith, 2006). For this reason, the following will detail more deeply these terms

so that there is a clear vision about the communication processes that usually occur in all individuals.

Kumin (1997) states the following concerning communication and language:

> Communication is the process by which a person formulates and sends a message to another, which receives it in words. Men and women do not communicate through words alone. We can also communicate through linguistic signs, facial expressions, gestures and even Morse code or smoke signals. When people communicate, usually uses a symbolic code. All structured symbolic code used for communication is known as language. Language is a structured system of symbols which lists the objects, relationships and events within a culture. The language is more specific since it is a communication code which has a meaning to everyone who belongs to the same linguistic community. The use of language involves both understand and receive messages and also formulate and send them. (p.17)

Normally the development of language is the area of greatest delay in children with trisomy 21. The average age for the production of the first word is 18 months. Therefore, there is a delay of 4 months compared with the normal child (Falvey, 2005). Babies are building a vocabulary of words and move forward to achieve the same level of two-word phrases and the same content of ideas that normal children possess. But beyond the stage of the two words, children with Down syndrome have an ongoing problem in the acquisition of grammatical rules and the construction of sentences (Leddy, 1999).

Perera (1995) emphasizes that children with Down syndrome understand much more than they say but often have trouble being understood. Furthermore, the author refers to a recent study

in which about 80% of young individuals were understood only by their parents and teachers and only 30% of this group could be understood by people outside their family.

During the time of initial acquisition of language there is a close relationship between cognitive and linguistic process of children with Down syndrome who are 20 months of age. This will reduce as they improve in the variety of cognitive abilities but not related to the progress of language proficiency, especially in their grammatical development (Falvey, 2005).

Prelinguistic development of children with trisomy 21 is very similar to normal children, but children with Down syndrome vocalize less. Phonological development and vocabulary is often slow and difficult: the first words with referential meaning not appearing until 24-30 months of age and the first sentences composed of two or three words not beginning to emerge until they are about four years old (Falvey, 2005). However, these children excel in their ability to use language pragmatics: they know to take turns in dialogue, properly maintain and share attention and relating one conversation with another (Bird and Buckley, 1999).

General Characteristics of Speech and Language

Rondal (2002) states that in people with Down syndrome there is a slower language development and sometimes it is incomplete. Moreover, in children with trisomy 21 there is a mismatch between the comprehensive and expressive level: These deficits are at an early age due to communication or poorer mother-child interactions as well as less eye contact which leads the child with Down syndrome to lose a great amount of information (Kumin, 2003).

Arraiz Perez (1994) argues that difference in auditory deficits, the degree of hypotonia, morphological alterations of the phonatory organs and respiratory influence phonetic and phonological development of people with Down syndrome, are closely related to cognitive development and language development.

Kumin (2001) notes that the child with Down syndrome has a delay in vocabulary development but acquires the meaning of words in a similar manner that normal children do. So for this author the problems presented in relation to the lexicon may be due to the following:

- Children with Down syndrome cannot understand the relationships between objects, people or events and words that symbolize these relationships.
- These children are not adequately able to retain this relationship.
- Children with trisomy 21 are not able to integrate the references in the spatial-temporal framework.

Regarding the basic semantic structure is worth noting that the acquisition in Down syndrome children is similar to that of normal children, but it is slower, and the use of sentences with different functions is also similar (Kumin, 2001). However, as stated by Arraiz Perez (1994) the morphosyntactic aspects are altered for individuals with Down syndrome who present greater difficulties in comprehension and utilization of grammatical morphemes. According to Fernández Sampedro,Gonzalez Blasco and Martinez Hernandez (1993), the lower reactivity and initiative shown by children with Down syndrome in the early stages of interaction of life is due to the lower reference of eye contact or decreased capacity to look towards the social partner or object referred to verbally. For these authors, this becomes difficult to set up mechanisms and knowledge of the object association and vocabulary which delays the development of understanding and verbal communication.

Sanchez Rodriguez (1996) points out that the difficulties that child with Down syndrome presented in language development is due to many factors such as cognitive impairment, hearing impairment, motor disorders, abnormalities in the glossopharyngeal nerve, repercussions of brain

organization, etc. The author highlights some specific problems occurring in children with trisomy 21:

- Do not use the verb endings to mark the relationship or the correlation to the number.
- Have great difficulties in matching of gender and numbers of pronouns.
- Present difficulty when distinguishing between determined and undetermined article.
- Use smaller number of complex syntactical structures.

Fernandez de la Iglesia and Buceta Cancela (2003) notes that the main problems of language in these individuals are:

- In articulation of sounds and auditory distinction: difficulties of articulation and coarticulation where there is also a slow maturing and even sometimes incomplete regarding the phonemic distinction.
- In semantics: they have a bad organization of the mental lexicon, both in terms of pre-grammar. Furthermore, we can say that what defines the child with Down syndrome is his small lexicon.
- In morphosyntax: the child with Down syndrome showed less formal length and complexity of sentences, in addition to issues with inflectional morphology and when it comes to develop and understanding subordinate clauses and compound sentences.
- In pragmatic: the trisomic child has a slow development in pragmatic skills such as providing topics of conversation, interpersonal demands, and under-developed discursive macrostructures.

The Comprehensive Language in Down Syndrome Children

Regarding the comprehensive language it should be noted that the child with Down syndrome has difficulty performing a mental operation which requires abstraction, so they have

difficulties throughout synthesis operation, which according to Fernandez Sampedro Gonzalez Blasco, and Martinez Hernandez (1993) is specified in the acquisition of thoughts and phrase organization. Children with Down syndrome have less difficulty understanding speech because they show a better understanding of vocabulary than grammar (Kumin, 2003). So the domain of grammar is often slow and incomplete, and it shows a worse understanding with grammatical constructions.

Fernandez de la Iglesia y Buceta Cancela (2003), state that the understanding of messages in children with Down syndrome is within the context and also by the difficulties encountered in the area of grammar. For this reason, they tend to misunderstand complex sentences. For these authors, another difficulty in understanding the negation of long sentences or complex structure so it is important to contextualize statements when it comes to talking to a child with Down syndrome. It should be noted that the quality of comprehensive language can be used to improve a better understanding of expressive language so a family does not need to try to over-simplify language when it comes to talking to the child with Down syndrome (Rondal, 2002).

Buckley and Perera (2003), show that children with Down syndrome from birth begin to understand the spoken word when they are talked to or when people are speaking about them. Since these words often refer to the infant-related items: what he is seeing, hearing or doing. For these authors, when the baby repeatedly hears the same words day after day in the same context the child begins to understand them and give them meaning.

The Influence of Reading in Speech and Language in the child with Down Syndrome

As stated by Bucley and Perera (2005) learning to read helps the growth of vocabulary, particularly supporting the learning of grammar and sentence structure. Also, for these authors,

the teaching of reading also supports the practice of speech and language is able to improve articulation.

For Buckley (2003) reading is a driver for spoken language in children with trisomy 21 due to the following:

- New words learned soon begin to be used in the language of the child.
- Practice with sets of 2 or 3 words accelerates its use in the language of the child.
- Practice with appropriate sentences leads to the use of functional words and language employed in grammar and syntax.
- Children who read early by following this method achieved higher levels of ability and language skills than so far expected in children with Down syndrome.

In turn, Troncoso and Del Cerro (1997), proposed a reading method which is characterized by the following steps:

- The method of reading is based on the idea that the work is individualized and must adapt and adjust to the conditions of each student. The educator needs to suit the individual conditions of each person and support for creativity, imagination, perseverance and patience of the child with Down syndrome. The teacher should reconsider that is managing a very important tool and should get the child with trisomy 21 to take advantage of this technique to the fullest.
- The teacher should stimulate the cognitive development of the child with Down syndrome, aspects such as: the pursuit of long-term and short-term memory, personal autonomy in the acquisition of the aspects and the ability of correlation. Educators can submit written words that fit quickly to short sentences, but are full of content, this means

subjecting the brain to an experience in which intelligence is related to emotional development.

- Finally, the reading should facilitate the development of expressive language. This should be an exceptional enrichment support within the verbal and conversational aspects of language.

The development of written language ability influences the spoken language as new structures and functions are learned (Buckley, 2003). On the other hand, Kumin (2001, 2003) provides some specific learning difficulties that delay language development in children with Down syndrome:

- Hearing loss: In recent years there has been a high incidence of significant hearing loss in young children with trisomy 21, which may affect up to 80% of babies. These hearing losses affect the child's language learning.
- Preverbal communicative skills: Children with trisomy 21 do not use eye contact as a way to encourage their mother to talk to them about what they did or watched which may cause a delay in the lexicon development.
- The effect of the modality specified: Children perform better when tasks are presented visually rather than aurally, and when the answer may be manually or choose to point out, rather than using words. This may explain the alterations in the auditory processing of hearing loss, poor auditory discrimination and auditory memory limitation, as well as alterations in the complex mechanism of production in the language of these children.
- Auditory short-term memory: The short-term auditory memory is incomplete in relation to cognitive development throughout childhood. Therefore, the processing of sentences

and the learning of grammar and syntax are difficult for the child, which means that most of these children speak using immature sentences even when they reach adolescence.

- Visual memory: Visual memory of children with Down syndrome may be more effective than auditory. For this reason, they may learn at a faster rate by using a computer.

Unfortunately, even today many people still believe that it is impossible for a person with Down syndrome to develop adequate language and reading skills. Their lack of maturity, and their specific difficulties related to language development effects their ability to read and write by not understanding the meaning of what they want to express (Troncoso y Del Cerro, 1997).

To conclude this chapter it is vital to consider the importance of education and psycho educational intervention for the child with Down syndrome to promote the cognitive development as well as language development. For Fernandez Sampedro, Gonzalez and Martinez Hernandez Blasco (1993) it is necessary to develope an intervention plan which is preceded by detailed information of the child. Thus, teachers have a greater role to become a support for such children and are the same educators who will help them adjust to life aided by professional concepts that are based on the teaching-learning processes (Bandera Rivas, 1988).

Chapter III

The main purpose of this chapter is to highlight the importance of pedagogical, professional and family support in the life of children with Down syndrome with the purpose to have a better chance of efficacy in the early stages of cognitive development. It should be noted that the way people act around individuals with Down Syndrome during this period is critical. Systematic introduction of elements, shapes and motivating actions is a key part in the trisomic child's cognitive development. The proper application of methodologies will have a decisive influence on the interest of the child for the issues and events and will help them to develop the motivation necessary to learn and function in the world that surrounds him.

Educational and Psycho-pedagogical Intervention

From the perspective of improvement, knowing in depth the context of children with Down syndrome broadens with the focus on assessment (Sabiron, 2002). It is necessary to understand the teaching processes that occur in the classroom and certain organizational variables of the school institution.

As previously established in Chapter II, to foster cognitive and language development it is necessary to develop an intervention plan. Thus for Fernandez Sampedro, Gonzalez Blasco, and Martinez Hernandez (1993) the intervention plan should come by detailed information about the child. For these authors, this information may be collected in the form of a report which must contain the following:

- Medical report: relevant diseases suffered, presence or absence of heart diseases, vision or hearing problems, breathing difficulties, associated disorders, etc…
- Psycho-educational report: data on the development, personality and cognitive aspects of the child. It is important to know if the child has been subjected to early intervention programs or early stimulation, or has otherwise not received any type of specialized care.
- Social and family report: socio-cultural level and the family environment, attitudes and implications of various family members.

Pedagogical Aspects:

The purpose of educating the exceptional child is the same as education in general: to provide the maximum opportunity and support in the development of their cognitive and social skills to the highest effective degree possible (Speck, 1978).

The children with Down syndrome have a need for action and pedagogical efforts must be designed to adapt the need for action possibilities for each child. This should not be seen as trying to convert the child but providing identical opportunities as most children in the educational and social setting, allowing children with Down syndrome to evolve personally and individually (Smith and Berg, 1998).

The adaptation ability of the child with Down syndrome to reach their potential is manifested by a structured relationship with the world of people and things. Piaget (1985) calls this adaptation and defines it as the balance between the organism and the environment in biological and mental aspects. So, according to this, there is a strong possibility of an increased intellectual education of the child with Down Syndrome.

Stimulation and Early Education

The pedagogical assistance to children with trisomy 21 has a better chance of efficacy in the early stages of child development. For Beckman and Beckman (1993) the pedagogy during this stage can take as its starting point the following premises:

1. Learning depends largely on the direct or indirect stimulation the child receives from its environment.
2. The most favorable stage for the effectiveness of environmental stimuli is the phase of life that has a greater psychophysical development speed, generally the early years of childhood.
3. Learning offerings received by the child at this time require higher teacher effort considerably higher efficiency which is often lower or almost zero.

Therefore, in the case of children affected with Down syndrome early stimulation and education should begin as soon as possible since to Ruiz (2001) this helps to enhance the overall development. Parents and educators will have as their main tasks of education: motor skills, perception, interaction, and the cultivation of emotion and language.

For Hines and Bennett (1997) a second step in the life of the child with Down syndrome will come with admission to kindergarten at four or five years old which will help him to prepare for future entrance to school. For these authors the main tasks and activities to achieve greater maturity during this stage are:

- Stimulation and promotion of motivation and affective-based activity.

  Education of motor skills and senses.
- Exercises focused on self-care and hygiene.
- Music education and education in quiet environments.

- Development of social interaction.
- Deconditioning of bad habits acquired earlier.
- Elementary verbal education and understanding of language as a basis for communication.

Teaching and Learning of Down Syndrome Children

The child affected with Down syndrome is generally characterized as an immature individual and has many limiting behaviors (Kumin, 2001). For this reason, intervening in their education will mean implementing some functional behaviors that will allow him to meet the demands of the environment in which this child should develop.

The education should foster the ability of individuals to have an individual life and dignity in which the person with Down syndrome may be able to live in suitable conditions like any human being. According to this, Zulueta (1991) presents nine areas on which education should be based for the person with trisomy 21:

1. Education of sociability.
2. Education independence.
3. Education of the skill.
4. Education perceptual capacity.
5. Education domain of the body.
6. Education of mental representation capacity.
7. Language Education.
8. Orientation to mental activity.
9. Education regarding the affective component.

The education must address the whole human being and what the child learns, to Falvey (2005) that education should be based should be observable and verifiable always considering the capabilities of each subject and must possess the following characteristics:

- Flexible: must adapt to the peculiarities of the child, but also must be an open program in which they can be corrected by integrating new elements, deleting some of them depending on the evolution of the child, and even that is open to the search of new teaching strategies.
- Global: to intervene to develop a program divided into areas, the teacher must not forget that the main objective is the integral development of the child.
- Realistic: when proposing goals and both material and social levels it is important to keep in mind what are the elements that are in place to bring each project into practice. In turn, educators must take into account the objectives that can be achieved by the child and access them as a reference to the real goals that the student can attain.
- Compatible: If it is a school, the intervention program should try to allow a proper harmony between the general dynamics of the classroom and the dynamics with the specialist, since the ultimate goal is that the child is integrated into the classroom.

Children with Down syndrome receive an education differential which begins within the household and it is often related to the attitude of the parents (Falvey, 2005). The child must perceive the affection that is provided by household members, in a climate of adaptation and affection, as their first experiences in a learning environment.

In relation to psychosocial education of child with Down syndrome, this is relatively easy and fruitful, and though their instruction is slow, many of the children with trisomy 21 learn to read, write and add and subtract satisfactorily (Gartner and Lipsky, 2002). Advances can be

produced by not pushing the child during the learning process because education should be focused on specific, systematic and immediate processes.

Intervention to Improve Cognitive Development

Abarca (2003), states that to intervene in the cognitive development of the child with Down syndrome, the child should react first to the surrounding environment. For example, first look for a rattle, to have in his hand, or a family member or educator should show a small object with the purpose of forming eye-hand coordination and bring objects to his mouth again and again.

Educators, families and specialists must also work on the permanence of the object. The child with trisomy 21 sees that the object disappears and searches with your eye gaze. Also an object can be placed under various cloths overlaid so the child seeks for it. Another example of spatial relationship is developed working with small balls and the child has to put them in a tube, and causality is worked with a mechanical toy where the child is able to discover how winding the toy makes it work (Piaget & Inhelder, 2002).

Overall Motos and Candel (1999) considered that the benefits of early stimulation are seen both in qualitative and quantitative outcomes; also prevent severe mental deficiencies making it necessary to intervene at very early ages in the following aspects of the cognitive area:

- Object permanence.
- Cause and effect reactions.
- Understanding of spatial relationships.
- Skills sensory perceptual discrimination.
- Elaboration of objectives to achieve goals.

- Behavior of control over the social and physical environment.
- Exploration.
- Attention.
- Report.
- Problem-solving skills.
- Development of schemes.
- Formation of concepts.
- Related behaviors related to fine motor skills such as eye-hand coordination and spatial integration.

Intelligence Intervention in Down Syndrome Children

Currently, studies are conducted on the IQ of children with Down syndrome and their decline, which are aimed at the prevention of trisomy 21. As affirmed Fernandez de la Iglesia and Buceta Cancela (2003), IQ in children with Down syndrome may decrease over time, so it should be noted the mental age of the individuals that provides true information regarding their progress and which may increases at a slower pace.

From the educational aspect, Tapia (1997) consider that educators must encourage the design of appropriate educational programs which deal with the deterioration of the child's intellectual capacity. Professionals must start as early as possible and this sort of education must continue throughout the life of the child with Down Syndrome.

Therefore, for Ainscow, Hopkins, Southworth, and West (2001) education must be guided to the individual as a whole and what the child with Down syndrome learns should be observable and verifiable.

For these authors the teaching process must be guided by the principles of:

- Principle of activation: the child must be placed in an active relationship with the things to learn.
- Principle of structure: The instruction, teaching must be directed to split into small steps to make advances and help the child reaching the objectives.
- Transfer principle: what is learned about a certain aspect or a particular situation has to be applied, transferred to objects or similar situations.
- Language associated with the action: it is useful for language development and supports cognitive development.
- Motivation in social learning: The child with Down syndrome, due to his deficiency in his structural develop of life, needs positive learning conditions in terms of social and emotional nature.

In order to help the intellectual development of children with Down syndrome an open educational system should be advocated where the individual is an active member of it. Thus, this model can allow highlighting the differences of each individual to accommodate each subject to appropriate teaching according to their individual characteristics (Buendia, 1997).

Since the student is considered a total person, Colas (2002) highlights that the important idea is not going to be the effectiveness and the results translated into a finished product, but to improve the teaching-learning process and, therefore, to refine the personal development learning for each individual.

Down Syndrome Children Perception

For Fernandez de la Iglesia and Buceta Cancela (2003) spontaneous natural situations in which the child develops their discriminative ability is essential for learning, but not enough to lay the foundation for future school learning. For this reason, children with Down syndrome must participate in a structured, systematic and progressive education, where through different activities he can develop small and discriminative perceptual abilities (Gomez, 1998). For Fernandez de la Iglesia and Buceta Cancela (2003) it is essential to work on different aspects so to help these children in their cognitive development:

> The perception and discrimination, the ability to perceive similarities and differences to select and relate objects to each other and sort them by a property are essential steps for the acquisition of various concepts. Furthermore, the fact of working in both auditory and visual discrimination will favor the child with Down syndrome to present a logical thinking and it will help him to facilitate reading, knowledge of shapes, sizes, textures, colors, the object properties and numerical concepts. This area is very important, particularly in aspects of discrimination, since these are the basis for learning in areas such as social and language. (p.32)

Ruiz (2003) points out the importance of a good proposal for intervention in the perceptual aspect that favors the development of perceptual-discriminative abilities of individuals with trisomy 21 by the practice of varied activities that include the following:

- Association: it implies that students perceive and discriminate objects.
- Selection: consists in that the child has to choose the object or picture that is named.
- Rating: Requires that the child choose and put together objects that share certain qualities.

- Generalization: it is learning to use a context different from the teaching situation presenting to the child various opportunities in the practical aspect.

Association Process Intervention in Children with Down Syndrome

Association allows the student to observe and discriminate visual and mental objects and draws understanding that should put them together because they are equal. Later, when the child advances in knowledge of abstraction he will perform other associations of different objects that have a common property because its use or function is the same or belong to the same category (Ruiz, 2007).

Children can begin to associate this type of material from very early ages. With a , simple, clear, specific and modeling verbal explanation provided by the teacher in order to make the student understand for example putting together the circles, squares or triangles (Tapia, 1997).

Ruiz (2008) considers being effective is to practice with a variety of material to fully understand the concept of association and one to one correspondence, which is applicable to many things. This author states that children with trisomy 21 will soon learn that an object or picture may correspond to several associations simultaneously. Thus, the association work with paper and pencil begins when the student acquires manual dexterity and visual motor coordination enough to hold the pencil and draw some lines.

Buendia (1997) specifies that first it will be sufficient for the child to know how to draw horizontal lines that allow him to trace a line from one drawing to another. To this author, with this method, the task is reinforced as well as associative the prewriting process.

The Selection Process Intervention in Down Syndrome Children:

The selection process means that the child with Down syndrome will choose by pointing, grabbing, branding, or through any other procedure, the object or picture that is named (Begley and Lewis, 1998). First, the object is named and according to the child's progress will go to the next stage where he is able to discover the quality and subject-stimulus properties.

Selection activities must also be performed from very early ages, both in special sessions as natural and ordinary circumstances of life and child's play and he must always be attentive and listen to instructions (Bird and Buckley, 1999). He should also exercise memory and names evoked by the teacher in order to relate or associate with objects or pictures that represent them (Colas, 2000).

To work in this process, a teacher should start with a pair of objects known by the child and slowly tell him the name of each one of them and then the child will be asked to point or take the previously named object (DeutschSmith, 2006). If the child is directed to the object that does not match, the teacher must gently avoid that the child grasp it calling his attention to put the proper attention on the object (Gomez, 1998).

The Classification Process Intervention in Down Syndrome Children

Classification activities are those activities of selection, association and grouping of several objects belonging to the same category or that have a quality or property common to them all, and from a large set of objects it is necessary to choose and put together all those with one or more shared qualities (Dierssen, 1994).

Kranowitz (2003) points out tha**t** it may happen that the child has not yet learned the names of all the things sorted, but he knows and has captured the concept of which objects

belong to the same group. These activities facilitate generalization because it makes possible to connect the same name to different objects which belong to the same group.

For the activities of classification, several groups of objects are used, each one from determined "family". For this reason, whenever it is possible the child will have objects in two sizes and several colors so he can understand and group together different qualities or properties (Slavkin, 2004).

The Generalization Process Intervention in Down Syndrome Children

Learning is useful only when it is established; and not forgotten and can be done by using the different contexts of the teaching situation (Mager, 1999). In this case, generalization is supposed to help the pupil with Down syndrome apply their classroom knowledge to their natural environment throughout the processes of, associate, selection, classification, and even explaining the similarities and differences of things (Omrod, 2006).

Florez (1999) states that parents should take advantage of ordinary household situations, like trips and shopping to make the child notice certain stimuli, so in accordance with the objectives previously selected, he will be able to point out or act in the right way when he sees one of these signals. The child must realize that to associate two identical cars in the class is the same type of task as putting the two equal cans of tomatoes one beside the other.

Fernandez Sampedro, Gonzalez Blasco and Martinez Hernandez (1993) summarize some of the strategies to work in the perceptual aspects:

- Any perceptual learning must be made through the largest possible number of sensory pathways.
- The end of the intervention should be that the child select, recognize and use relevant the stimuli accurately at all times.

- The activities should be motivating, systematic and sequenced.
- It is very important that the child verbalize about the activity being performed.
- The goal is not that the child masters a particular activity, but creates a valid perceptual system for the development of learning processes.

Attention Intervention in Down Syndrome Children

Children with Down syndrome often give motor responses before processing the information received and giving the correct answer. This can be offset if the teacher gives him more time and teaches how to inhibit and to realize the need for self-control and can take time to reflect before answering (Bruer, 1999). The educator can prevent the child's precipitated motor response, for example, by gripping the hands of the child until he shows with his attitude and by looking to the teacher letting him know that he will run the task in an orderly manner as he processes and produces the answer (Mager, 1999).

Roizen and Patterson (2003) suggest that to improve attention difficulties the child with trisomy 21 has to develop activities that lead to this purpose, and keep in mind the specific characteristics of each child. Attention is essential with children with Down syndrome, especially since little can be done if the child does not maintain eye contact with the teacher or does not listen or understand his directions about certain task.

In addition, Fernandez de la Iglesia and Buceta Cancela (1993) argue that once the goal is achieved and the child is able to establish and maintain attention, the teacher can work in various learning situations, behavioral and relationship aspects. For these authors, in schools in order to maintain the attention of the child efforts should be made not only that the child stay seated properly in the chair, but in other aspects of attention such as visual attention. During the first

months of life of the child, as it was mentioned before, are the basis for the attainment of good eye contact and visual tracking, and therefore an improvement in communication with other people around their environment will progress if nurtured.

It is worth mentioning that it should not be attempted to teach the child with Down syndrome new information, especially if they are not aware of what they are learning. Sanchez Rodriguez (1996) states, that due to attention problems presented by the trisomic child they require truly meaningful learning that has a meaning in their lives, so the teacher needs to focus on their thinking and their action and thus to enter into motivational processes. Therefore, for this author, the teacher must teach strategies of attention through interesting activities which are meaningful in the real world that surrounds the child, encouraging the child to cope continuous interruptions and common distractions.

Another aspect that is important to work says Sanchez Rodriguez (1996) is metacognition that can be worked through the meta-memory, trying to make the child aware of strategies for remembering information that he can use, so that progressively and as the child grows, he will be transferring these strategies to similar concepts.

Intervention to Improve Communication and Language

Certainly, language is one of the key functions involved in the individual's cognitive development because language is the foundation of thought. (Buckley, 2003). In addition, language in the individual with Down syndrome is at the central core of the social difficulties which limit their possibilities of communication and hence the learning deficits in this area (Kumin, 1996).

The intervention in the area of communication and language must also be carried out from school, according to Kumin (2003) there should be collaboration between the speech and hearing specialist and the tutor, but both should remember that they have at their disposal many resources and they can and must appeal to other specialists in the field to carry out an effective intervention.

Additionally, family intervention is important because it represents a fundamental role in the life of the child with Down syndrome. Parents need to know the objectives they are working with for the child as well as the exercises teachers as well as specialists are working on. Thus, to be able to work with the same content at home (Falvey, 2005).

It should be clarified that the intervention, especially in areas such as phonatory and articulated education must be carried out by qualified personnel (Kumin, 2001). This intervention will be held through re-education techniques of language such as orofacial motor exercises, breathing exercises as well as articulatory, perceptual aspects, spatial aspects sensory-motor aspects, rhythmic aspects etc (Miller, Mark and Lewis, 1999**)**.

MacDonald (2004) argues that a good intervention of the area of language and communication must have the following characteristics:

- It has an early start and continuous in time with a regular rhythm.
- It involves the family of the child with Down syndrome.
- Uses and takes into account available data on language development in normal children.

The early intervention in the area of language and communication is important as the child must be aware of sound and voice that will help him in his vocalizations **(**Miller, Mark and Lewis, 1999**).** Children with trisomy 21 receive less communicative stimuli and hence less

motivation from their family and the environment, together with disinterest in language can lead to communication that does not occur spontaneously (Kumin, 2001).

From there, comes the importance of intervention in the first months of the child's life. To work on pre-linguistic education techniques that can be used more specifically of his experiences (Schwartz, 2004). For this reason, techniques such as semantic level should be adopted. For example, the teacher may work at the semantic aspects such as the notions of objects and actions and verbalizing the material to the child (Kumin, 1996).

Also the educator may be working with and handling discrimination exercises either by mime, drawing or a game. It is important to respect the compensation mechanisms so typical in children with Down syndrome, such as gestures or mime, since it helps him to understand (MacDonald, 2004) and furthermore, at all times teachers must work on words through exercises of classification, categorization and generalization.

Kumin (2003) states that at the syntactic level can be worked in many ways but always with a single goal: to facilitate the combinatorial language of the child. For this author, in order to do this, teachers should follow the strategy to provide exercises to motivate the child to be interested in relationships with other people and relations with the surrounding environment. Then the educators may work with the messages of two words in an expression to explain the observed semantic relationships. This aspect can be expanded as the child progresses.

To summarize, there is no doubt that when the support of education is appropriate to the specific needs of the child with Down syndrome they benefit tremendously from their time at school. Some children progress to levels that previously would have been considered unattainable. But, most of these children, to get daily social and academic skills is still a very difficult task, even though they are receiving diverse teaching strategies. This does not mean that

the child does not progress but he does so thanks to a high personal, family and educational effort.

Knowing the reality in the life of children with Down syndrome helps the teacher to make use of various strategies at the cognitive level. The teacher knows when those kinds of educational strategies must be taken into account in order to achieve the educational goals set for the student. As educators, it is important that they become aware of the learning process of the child with Down syndrome in order to maintain a bond of trust and be alert to the different types of behavior and the difficulties that arise during learning.

Understanding the neurophysiology of the brain is the key in our understanding the issues facing the child with Down's syndrome. If educators can understand the key concepts, then new approaches to teaching can more easily be developed.

Finally, as human beings and as educators we must take into account that what differentiates these children from others is that they have one chromosome more than we do. However, as educators, it is in our hands the responsibility to help them reach their potential and to ensure they reach their own success.

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Maria Elisa Campaña

Objective To obtain a permanent position where I can use my education and extensive work experience to help.

Education

The University of Mississippi University, MS
Education Specialist Degree in Curriculum & Instruction May 2012
Emphasis: Special Education
Overall GPA: 3.93

The University of Mississippi University, MS
Master Degree in Curriculum & Instruction May 2010
Emphasis: Special Education
Overall GPA: 3.88

Universidad San Francisco de Quito Quito, Ecuador
Bachelor of Arts in Journalism May 2008
Overall GPA: 3.87

Honors

- StudyMississippi International Student of the Year (12 finalists)
- Award as an Outstanding Master's Degree Student in Special Education

Teaching Experience

Colegio Becquerel Quito, Ecuador
Teacher Assistant May 2011-June 2011

- Assist the Second Grade Teacher developing lesson plans.
- Create diverse activities which enhance students' skills.
- Collaborate in a school final project at the end of the year which took into consideration multiple intelligences, differentiated instruction and Depth of Knowledge.
- Responsible to help 7^{th} through 10^{th} grade students to improve their writing skills.
- Develop creative writing activities to enhance learning and master knowledge.

The Writing Letter Project School of Education
Volunteer March 2011.

- Lead with this project where professors, students and graduate assistant wrote a letter to prospective students narrating their experiences at the university.

The Reading Institute
Presenter November 2011

- Teach educators in Grenada, MS to implement technology in their classrooms, educational centers.
- Teach them the importance to be aware of diversity to improve literacy, differentiate instruction, and enhance teaching quality.
- Help teachers to develop create activities to increase parental involvement during their children's learning process.

The University of Mississippi Intensive English Program
Volunteer January 2010-May 2010

- Tutor children ages 3-12 while their parents were studying English.
- Develop activities for the children as well to them to improve literacy skills while they enjoyed about each other's culture.

POPE School Pope, MS
Volunteer January 2010-Present

- Assist Miss. Jennifer Wilkie (NBCT) in her resource classroom.
- Help her students to master knowledge by using diverse activities, differentiated instruction which helps them to decode storage and retrieve information according to their specific IEP.

"Casa del Sol" Quito, Ecuador
Volunteer January 2008-May 2008

- Pre-K volunteer teacher for students who came from rural zones and families with low-income.
- Create activities which help them to develop their fine and motor skills.
- Nurture those children and teach them anything requested by the Principal with care and work ethic.

"SOLCA" Quito, Ecuador
Volunteer March 2007-December-2007

- Help with the kindergarten within the hospital.
- Create fun activities for children who have different types of cancer in order to help them to cope with their disease through humor and fun.
- Motivate children, play games with them before they went to chemotherapy or radiation.
- Support students and do anything on my behalf to help them to not be afraid (read books, draw, paint, play with play-dough, do puzzles with them, etc.)

Other Experience

School of Education Curriculum and Instruction Department University, MS
Graduate Assistant August 2011-May 2012

- Create innovative and creative Power Points.
- Research related to the Brain, Traumatic Brain Injuries as well as different disabilities.

School of Education University, MS
Recruiter August 2011-May 2012

- Recruit students who are eager to become teachers.
- Provide them with information and examples towards teaching and learning strategies.
- Talk to their parents as well as the student about the benefits of becoming a teacher and study at this university.
- Answer any questions they might have regarding any program we offer.

School of Education Curriculum and Instruction Department University, MS
Graduate Assistant August 2010-May 2011

- Assist the Chair of the Department of Curriculum and Instruction in any activity she might need or believe is convenient.
- Help the Chair doing some research, typing some letters, making some calls, etc.
- Being in charge to assign books to the system as well as to help the department checking from any errors in the school year schedule.

School of Education University, MS
Technology Assistant January 2009-May 2010

- Assist professors and students with technology issues, organize and schedule technological resources used by professors during the semester, software updates from various computer labs.

Languages

- Spanish as a native Language
-English as a Second Language
-French.