CHAPTER 1

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Several international and Indian landmark conventions and programs devoted to child rights codify the right of a disabled child to equal and enhanced opportunity with a view to ensuring a dignified life that is integrated with the community. Article 21A of the Indian Constitution, ‘The Right of Children to Free and Compulsory Education Act’ or Right to Education Act (RTE), 2009, describes the modalities of the importance of free and compulsory education for children between 6 and 14 years. India was one of the first countries to ratify the UN Convention on Rights of Persons with Disabilities, in October 2007, which states: “State parties shall ensure that persons with disability are not excluded from the general education system on the basis of disability and that children with disabilities are not excluded from free and compulsory primary or from secondary education on the basis of disability.”

Government of India has attempted to align the Sarva Shiksha Abhiyan (SSA) norms with the provisions of RTE Act, 2009. SSA aims to adopt a ‘zero rejection’ policy so that no child is left out of the education system. The thrust of SSA is on providing integrated and inclusive education to all children with special needs in general schools. It also aims to support a wide range of approaches, options and strategies for the education of children with special needs. According to the SSA, parents of children with disabilities should receive counseling and training on how to raise their children and teach them basic survival skills. The SSA encourages research in all areas of education for children with special needs.

The SSA’s goals are imperative and recommendations commendable. However, the initiatives advocated are challenging to execute in a country like India with a population of 1.21 billion (Census 2011). Based on the United Nations estimate that 10% of the population has a disability, there are about 120 million people with disabilities in India (Universal Periodic Review–India, 2011). This huge disability demographic compels the need for scientific interventions that are inexpensive, home based and easily administered by family/community members. Problems of access to
conventional interventions are particularly acute for the 833 million people who live in rural India (Population Census 2011).

The National Trust for Welfare of Persons with Autism, Cerebral Palsy, Mental Retardation and Multiple Disability Act, 1999, included autism as a disability after a proposed amendment of the Persons With Disability Act (PWD), 1995 (India Disability Legislation, 2009). The National Trust Act 1999 defines “autism” as a condition of uneven skill development, primarily affecting the communication and social abilities of a person, marked by repetitive and ritualistic behavior.

In current terminology, the subtypes and levels of severity of the condition of autism are grouped together under the term Autism Spectrum Disorders (ASD). Specific major diagnostic groups within the spectrum include Autistic Disorder, Childhood Disintegrative Disorder, Rett’s Disorder, Asperger’s Syndrome and Pervasive Developmental Disorders-Not Otherwise Specified (PDD-NOS), or atypical autism.

With autism acquiring ‘disability status’ only 13 years ago in India, access to intervention appears to have improved mainly in larger towns and cities, leaving large swathes of the country’s ASD population outside the net of available therapies. Most children with ASD in India therefore continue to have little or no access to interventions directed at addressing their sensory processing deficits. Children with ASD deserve to access therapies designed to develop their neuro-developmental deficits and help them lead a normal life to the extent possible. Ninety-five percent of children with ASD demonstrate some degree of sensory processing dysfunction (Tomchek, Dunn, 2007). Very few special or inclusive schools cater to such sensory deficits. This is still an emerging field in India; moreover, interventions addressing sensory needs for individuals with ASD are limited and not well researched.

Apart from children with ASD, vast numbers of the population with different disabilities stand to benefit from sensory intervention. The current rate of disability in India suggests a vast gap between the population with sensory deficits and the availability of sensory intervention programs catering to their needs. Given the present scenario in India, where population and poverty are big constraints in development, it is essential to constructively integrate the disabled into society to the
extent possible by providing scientific intervention programs which are easily adaptable, accessible and effective.

Holistic Approach to NeuroDevelopment & Learning Efficiency (HANDLE), like Sensory Integration Therapy (SIT), is based on a neurodevelopmental approach. HANDLE intervention program does not require any specialized equipment or space. HANDLE consists of activities and exercises that are simple enough to be carried out by parents and caregivers (Bluestone, 2005). HANDLE intervention program has the potential for extensive application across urban and rural India. It presents an India-appropriate intervention program given its low input requirements. However, this researcher found no research on HANDLE on the Indian ASD population.

Perceptual Cognitive and behavior difficulties are the outcome of sensory processing deficits and cannot be treated in isolation. A holistic approach has to be taken into account as all sensory systems are interrelated and are responsible for the learning deficits (Wagner, 2008). HANDLE follows a holistic approach, respecting the child and his behaviors.

This researcher hopes that this study will, with the help of home-based supplementary intervention by parents, help bridge the gap between the demand and supply of sensory intervention for children with ASD in India. It is with the aim of researching the efficacy of the HANDLE intervention program on children with ASD in India that the present research study was conducted.

1.1 Statement of the problem

1.2 Significance of the Problem
Data released from the Center for Disease Control and Prevention (CDC, 2012) placed the prevalence of autism in the U.S. at approximately 1 in 88 children. No data is available from India to provide an India-specific estimate of the prevalence (Barua & Daley, 2012). Das (India Currents, 2010) states that there are about 1.7 million individuals with autism in India. The Autism Society of America (Brasic, 2005)
maintains that the incidence of ASD is rising 10 to 17 percent per year all over the world. Given the dearth of access to intervention by India's population with ASD and the estimates of rising incidence, the need for an India-appropriate model of sensory intervention has never been more critical.

Bluestone (2005) emphasizes that the implementation of HANDLE is made easy by its non-reliance on infrastructure and aids. Baranek (2002) points out that Sensory Integration equipment though relatively low-tech, can be moderately expensive. These include anything from large bins of rice that a child can climb into, to an indoor swing set. SIT requires a therapy room with Sensory Integration equipment and a therapist to train the child with ASD. A variety of equipment, such as swings, crash pads, mats, trampoline, ball pool, and scooters are needed to enhance the child's ability to interpret sensory input accurately and make adaptive responses with their bodies. SIT is a long-term requirement for individuals with ASD, and hence becomes all the more difficult to pursue. For a vast number of rural/poor Indian children with ASD, access to such aids and time can be difficult. SIT is expensive (Zane, Davis, & Rosswurm, 2008) and time consuming (treatment sometimes lasting several years) (Baranek, 2002).

HANDLE program could be suitable as there is an acute shortage of therapists trained in SIT in India. Also, high costs restrict access to SIT for a majority of the population. HANDLE activities and exercises are simple to follow and carry out by parents and caregivers and at times by children too. Professionals and parents could become HANDLE Practitioners after receiving training in HANDLE.

HANDLE is gaining popularity in the west and claims to benefit the sensory difficulties seen in children with ASD (Bluestone, 2005). Positive outcomes of different case studies suggest the same, however, there is little research examining the efficacy of HANDLE. Only a few therapists are practicing HANDLE in India, probably because of the lack of studies conducted on the Indian population.

This researcher used the HANDLE program on children with ASD after being trained under Judith Bluestone, originator of the HANDLE Program. The positive outcome in these subjects motivated her to take up this study. HANDLE could ensure long-term,
sustainable models of intervention for addressing sensory processing difficulties for Indian children with ASD.

This study was undertaken to establish the effectiveness of HANDLE on children with ASD who are known to have sensory processing dysfunction.

1.3 Theoretical Framework
Training children with ASD is a challenging task for professionals and parents. The sensory deficits they display need a thorough study in order to appreciate their difficulties and make meaning of their behaviors. The principles of neurodevelopment need to be understood to place in context the difficulties faced by these children. The theoretical frameworks used in this study are discussed in detail in the following section.

A detailed account of ASD and its characteristics, Sensory Integration, the nature of sensory processing dysfunctions in children with ASD, Sensory Integration Therapy and the significance of the HANDLE intervention program for these children is presented. The discussion highlights the HANDLE approach and its feasibility in the Indian context.

1.3.1 Autism Spectrum Disorders (ASD)
Persons diagnosed with ASD (commonly known as autism) as defined by DSM-IV-TR are “characterized by severe and pervasive impairment in several areas of development: reciprocal social interactions skills, communication skills, or the presence of stereotyped behavior, interest and activities.”

The term ‘Autism’ was first used by Kanner (1943) to describe children who display marked solitariness and an inability to relate to others, an obsessive desire for sameness and an insistence upon repetitive activities, and poor language development.

Autism is a complex developmental disability that typically appears during the first three years of life. It is four times more prevalent in boys than girls and knows no racial, ethnic, or social boundaries. Family income, lifestyle, and educational levels do not affect the chance of autism’s occurrence (Autism Society of America, 2004).
Autism is characterized by three types of deficits:

- Difficulty with social relationships, with an appearance of aloofness or indifference and with inappropriate or repetitive styles of approach if contact is initiated.
- Limited verbal and non-verbal communication with a lack of two-way conversational skills, a failure to understand the emotions, gestures or ideas of others, and over-literalness in interpreting what is said.
- Rigidity of thought and behavior, and limited imagination orimaginative play where the individual may carry out ritualistic actions, or focus upon minor details rather than the whole (Connor, 1999).

Autism is a neurodevelopmental disorder characterized by qualitative impairments in social interaction and communication skill, along with a restricted, repetitive and stereotyped pattern of behavior and a variety of aberrant responses to sensory stimuli (American Psychiatric Association, 2000; Klin, Volkmar, & Sparrow, 2000; Simpson & Myles, 1998). Researchers have reported that children and adolescents with ASD respond to sensory experiences differently from peers without disabilities. These sensory processing disorders are well documented in basic science literature (Yeung-Courchesne & Courchesne, 1997), clinical literature (Watling, Deitz, & White, 2001), and first-person accounts of persons living with autism (Cesaroni & Garber, 1991; Grandin, 1995). The initial appearance of these sensory processing findings often predates diagnosis (Baranek, 1999).

**Characteristics of Autism**

**Social Impairment**

People with autism have social impairments and often lack intuition about others. Unusual social development becomes apparent early in childhood. Infants with autism show less attention to social stimuli, smile and look at others less often, and respond less to their own name. Toddlers with autism differ more strikingly from social norms; for example, they have less eye contact and turn taking, and do not have the ability to use simple movements to express themselves, such as the deficiency to point at things (Volkmar et al., 2005). Three- to five-year-old children with autism are less likely to exhibit social understanding, approach others spontaneously, imitate and respond to emotions, communicate nonverbally, and take turns with others. However,
they do form attachments to their primary caregivers (Sigman et al., 2004). Most children with autism display moderately less attachment than non-autistic children.

**Communication Difficulties**

About a third to a half of individuals with autism do not develop adequate natural speech to meet their daily communication needs (Noens et al., 2006). Differences in communication may be present from the first year of life, and may include delayed onset of babbling, unusual gestures, diminished responsiveness, and vocal patterns that are not synchronized with the caregiver. In the second and third years, children with autism have less frequent and less diverse babbling, consonants, words, and word combinations; their gestures are less often integrated with words. Children with autism are less likely to make requests or share experiences, and are more likely to simply repeat others' words (echolalia) (Landa, 2007) or reverse pronouns (Kanner, 1968). Joint attention deficits are observed in functional speech (Johnson & Myers, 2007), for example, they may look at a pointing hand instead of the pointed-at object (Tager-Flusberg & Caronna, 2007). Children with autism may have difficulty with imaginative play and with developing symbols into language. Dysprosody is seen in children with autism where their tone is flat, atonal and sometimes high pitched and unmodulated. They have the capacity to speak but do so very rarely (selective mutism). They lack the pragmatic aspect of language experiencing difficulty in both receptive and expressive communication (Lal & Bali, 2005).

**Perceptual Cognitive Difficulties**

“Perception is an active process of locating and extracting information from the environment and cognition is the manipulation of information to solve problems. The easier it is to extract information (perceive) the easier our thinking process becomes.” (Forgus, 1995).

The cognitive strengths and weaknesses typically exhibited by people with ASD include difficulties predicting others' behavior based on their thoughts and feelings (called theory of mind) and problems regulating and controlling their behavior (termed executive function), combined with an aptitude for detecting parts of objects or small details (called weak central coherence) Frith & Happe (1994). Executive functions (EF) are a broad class of cognitive abilities which involve functions
strategic in the regulation of thought and action. This class of higher cognitive abilities supports planning, impulse control, working memory, organization of mean-end behaviors, and flexibility in thought and action. This Executive Function deficit is experienced by individuals with autism (Smith & Jonides, 1999).

Individuals with autism experience sensory stimuli in an unusual way and the bizarre perceptual experiences actually cause the 'abnormal' reactions. This has led to the idea that, when severe, such perceptual problems contribute to social withdrawal, communication and cognitive problems, stress and obsessive-compulsive behaviors (Waterhouse, 1998).

Much of the confusion about the relationship between sensory symptoms and core features of autism has centered on the diagnostic category of restricted, repetitive behaviors and interests. Repetitive behaviors are defined by their repetition, inappropriateness, topographical similarity across contexts, and an overarching behavioral rigidity (Boyd, McBee, Holtzclaw, Baranek, & Bodfish, 2009). The category of repetitive behaviors has included such behaviors as motor stereotypies (e.g., hand-flapping) and self-injury, which are presumed to provide intrinsic sensory stimulation to individuals with autism (Lovaas, Newsome, & Hickman, 1987).

Studies demonstrated that sensory symptoms and repetitive behaviors often co-occurred in autism. Significant associations were found between the hyper responsive sensory construct and the presence of repetitive behaviors in children with autism. Higher hyper responsive scores were related to a variety of repetitive behaviors. There is significant association found between sensory seeking and ritualistic/sameness behaviors (Brian et al., 2010).

Individuals with autism experience sensitivities in the different senses. Sensory abnormalities are found in over 90% of those with autism, and are considered core features by some (Geschwind, 2009). Differences are greater for under-responsivity (for example, walking into things) than for over-responsivity (for example, distress from loud noises) or for sensation seeking (for example, rhythmic movements) (Ben-Sasson et al., 2009). An estimated 60%–80% of people with autism have motor signs that include poor muscle tone, poor motor planning, and toe walking (Geschwind,
Deficits in motor coordination are pervasive across ASD and are greater in autistic disorder (Fournier et al., 2010).

**Visual Perception**

Visual information processing refers to the visual cognitive skills that allow us to process and interpret meaning from the visual information that we gain through our eye sight. Visual perceptual deficits may lead to difficulties in recognizing, association, discrimination, coordination and learning. This gives rise to difficulties in remembering letters and words, learning basic mathematical concepts of size, magnitude, and position, confusing likeness and minor differences, mistaking words with similar beginnings, distinguishing the main idea from insignificant details, and poor handwriting. (Pediatric Vision Development Center of Gwinnett, 2012)

Visual perceptual processing is subdivided into the following.

**i) Visual discrimination** is the ability of the child to be aware of the distinctive features of forms including shape, orientation, size, and color. Visual discrimination, figure ground, and closure problems may result in a person confusing words with similar beginnings or endings and even entire words.

**ii) Visual motor coordination** is the ability to coordinate the eye with a motor activity. It is also called eye-hand coordination. Dysfunction in this area creates a problem with simple tasks like stringing beads, fixing pegs, etc.

**iii) Visual figure ground** is the ability to distinguish an object from its background information.

**iv) Visual closure** is the ability to recognize a complete feature from fragmented information.

**v) Visual memory/sequential memory** is the ability to recall dominant features of one stimulus item or to remember the sequence of several items as originally seen. Obtaining maximum information in the shortest possible time provides for optimal performance and is essential for reading, comprehension and spelling. Dysfunctions in visual memory may cause prolonged time in copying assignments, difficulty
recognizing the same word on the next page, and difficulty retaining what is seen or heard.

**vi) Visual form constancy** is the ability to recognize objects as they change size, shape, or orientation.

**vii) Visual spatial skills** refer to the ability to understand directional concepts that organize external visual space. These skills allow an individual to develop spatial concepts, such as right and left, front and back, and up and down as they relate to their body and to objects in space. A visual spatial deficit may contribute to poor athletic performance, difficulties with rhythmic activities, lack of coordination and balance, clumsiness, reversals of forms and letters, such as ‘b’ and ‘d’ and words such as ‘on’ and ‘no’, and a tendency to work with one side of body while the other side does not participate.

**Auditory Perception**

Many people with autism have difficulty processing auditory information. These problems can leave the child unable to concentrate as extraneous sounds constantly impinge upon him. Thus, when listening to others the child may hear a single word or two or even a simple sentence but longer sentences may be 'broken up' by intruding background noises and the meaning lost (Waterhouse, 1998). Such problems can lead him to avoid, run away from, or block out the noises he dislikes. Blocking out many important sounds could hinder the process of learning and communication.

The four levels of auditory perception given by Davis (2000) are:


i) **Auditory Awareness**: A child needs to know that a sound is present and that it has meaning to him. Many children with autism have learned to tune out (or shut off) sound because it is too confusing to them. Others will respond to sound some of the time but not all of the time because of the situation they are in. Children need to learn to listen, attend, and respond to sound. This may seem very simple but for some children with autism, this skill does not exist or is very weak.
**ii) Auditory Localization:** This is the ability to know where sound is coming from and how to use the information. Many children are not sure if they hear a sound on their right or left side, in front or behind them. If the child does not know where to locate a sound, by the time he has tuned in, he could have missed the initial part of the message.

**iii) Auditory Discrimination:** This includes gross and fine sound discrimination. Gross sound discrimination includes hearing and identifying differences between very different sounds such as a dog’s bark and a cow’s moo. Fine sound discrimination includes sounds that are very similar sounding such as two speech sounds like fa/va. Fine sound discrimination also includes hearing differences such as high/low, fast/slow, near/far contrasts. Many children with autism can identify sounds but have difficulty contrasting them. Others can discriminate gross sound differences but not fine sound differences. Still others can discriminate some sounds on command but not freely in the regular listening world.

**iv) Auditory Comprehension:** This includes utilizing all the smaller pieces of auditory information in order to make sense of what was heard. This means speech sounds, which are important, and there are many other subtle sounds that most people take for granted, such as sounds for safety (ambulance sirens, cars approaching while walking down the street, a fast approaching object like a ball thrown inappropriately).

**Behavioral difficulties**

Individuals with autism display many forms of repetitive or restricted behavior, Bergeson (2010) categorizes them thus:

**Irregular and Stereotyped Behavior**

Children with autism often display irregular or stereotyped body movements. They may be completely unaware of these movements and may engage in them when nervous or upset. Repetitive movements may act as a calming mechanism for some children with autism even though the behaviors can create additional social stigma. Donnellan (2010) listed several common irregular and stereotyped behaviors commonly found in children with autism. These include tapping, rocking, shrugging, hand flapping and wringing, uncontrollable dancing gestures, spasms, toe walking,
hopping and skipping. Some of these behaviors may become apparent as early as age 3, while other behaviors may not manifest until puberty.

**Obsessive Compulsive Behavior**

Children with autism often become obsessed with themes, objects and subjective areas of interest. These obsessions often affect behavior and may result in compulsive actions. Compulsive behavior is intended and appears to follow rules, such as in arranging objects in stacks or lines. Children may become fixated on certain objects and how they work, taking them apart over and over again. The DSM-IV-TR states that an essential criterion for autism is encompassing with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus. This intensity or focus on an object or theme may come to an end, resulting in the formation of a new theme or object of obsession.

**Ritualistic and Routine Behavior**

The diagnostic criteria also call for apparently inflexible adherence to specific, nonfunctional routines and rituals. Children with autism may have a specific playground ritual that involves mastering a specific skill or toy. Children with autism often engage in obsessions and rituals as a way to feel comfortable within their environment. This may suggest why children with autism often become very upset when an object of obsession is taken away or a daily routine is interrupted. Ritualistic behavior involves an unvarying pattern of daily activities, such as an unchanging menu or a dressing ritual.

**Self Injurious Behavior**

Self-injury includes movements that injure or can injure the person, such as eye poking, skin picking, hand biting, and head banging (Mesibov, 1997). A 2007 study reported that self-injury at some point affected about 30% of children with ASD (Piven, 1998). No single repetitive or self-injurious behavior seems to be specific to autism, but only autism appears to display an elevated pattern of occurrence and severity of these behaviors.
Temper Tantrums
Children with autism commonly display temper tantrums and engage in violent or destructive behavior. Children may injure themselves or others or may become physically uncontrollable and start shaking violently.

Oppositional Behavior
A child or teen may also start screaming loudly and pose significant difficulty when parents try to remove him from the environment. Children with autism may become oppositional when entering an environment or situation that is unfamiliar to them. This may result in extreme fear, anxiety or anger. Parents who experience this problem often may coach their child ahead of time about new experiences and locations.

While dealing with challenging behavior in autism, the underlying causes of the behavior need to be understood and an approach based on prevention rather than symptoms need to be developed. Challenging behaviors are caused by problems in communication, social interaction and sensory deficits (Bogdeshina, 2004).

Types of Autism Spectrum Disorders
1) Autistic Disorder
The term autistic disorder or classic autism applies to individuals who have social interaction impairment, communication impairment, and repetitive, stereotypic, and restricted interests and activities prior to 36 months of age. Most children diagnosed as having autistic disorder are moderately to severely impaired, having IQs that fall in the range of moderate to severe mental retardation (Simpson, 2008).

Social impairments are marked by poor use of nonverbal communication, difficulty in peer relations, lack of social-emotional reciprocity, and lack of shared enjoyment. Communication deficits may include failure to develop speech, use of stereotyped or delayed echolalia, and difficulties maintaining conversations. Social and communication impairments may also cause a lack of symbolic or imaginative play. Restricted and repetitive behaviors may include unusual preoccupations with narrow interests, inflexibility to nonfunctional routines, stereotyped and repetitive mannerisms, and preoccupations with parts of objects (Simpson, 2008).
2) *Asperger’s Syndrome*

Asperger’s syndrome, also known as Asperger’s disorder, is an Autism Spectrum Disorder (ASD) that is characterized by significant difficulties in social interaction, alongside restricted and repetitive patterns of behavior and interests. Asperger’s syndrome can be distinguished from other Autism Spectrum Disorder by the lack of delay or deviance in early language development (DSM-IV-TR, 2000). Additionally, individuals with Asperger’s syndrome do not have significant cognitive delays.

The syndrome is named after the Austrian pediatrician Hans Asperger who, in 1944, studied and described children in his practice who lacked nonverbal communication skills, demonstrated limited empathy with their peers, and were physically clumsy. (National Institute of Neurological Disorders and Stroke, 2012). The modern conception of Asperger’s syndrome came into existence in 1981 and went through a period of popularization (Rutter, 2000) becoming standardized as a diagnosis in the early 1990s.

An individual with Asperger’s syndrome typically demonstrates obsessive interest in a single topic or activity. Other symptoms include repetitive routines or rituals, peculiarities in speech and language, inappropriate affect or social behavior, problems with non-verbal communication, and clumsy or uncoordinated motor movements. No variation in tone (Dyprosody), extreme literalness, lack of Theory of Mind and Mind Blindness and obsessive and rigid behavior are common difficulties individuals with Asperger’s syndrome face. Because of these difficulties, they often have trouble interacting with others.

3) *Childhood Disintegrative Disorder (CDD)*

Children identified having Childhood Disintegrative Disorder have behavior patterns similar to those of children with autistic disorder. The distinction between children with CDD and those with autistic disorder relates to the age of the disability onset. It is characterized by at least two years of normal development, followed by loss of language, social skills, and motor skills before the age of ten (Simpson, 2008). Children diagnosed as having CDD display a clinical significant loss of previously acquired social skills or adaptive behavior, bowel and bladder control, play or motor
skills (APA, 2000). Childhood Disintegrative Disorder is also called Heller’s syndrome, dementia infantilis, and disintegrative psychosis.

4) Rett’s Disorder
Rett’s Disorder is a relatively rare condition that occurs almost exclusively in females. Onset of the disability typically occurs between the age of 1 and 2 and is characterized by head growth deceleration, loss of previously acquired hand movements and other motor skills, stereotypic hand wringing or hand washing movements, various motor impairments and social and communicative impairments. Loss of previously acquired skills tends to be progressive and permanent and prognosis for individuals with Rett’s disorder is poor. Rett’s disorder was originally described by Dr. Andreas Rett of Austria in 1966, but was relatively unknown until the mid 1980s (Simpson, 2008).

5) Pervasive Developmental Disorder - Not Otherwise Specified (PDD-NOS)
Pervasive Developmental Disorder, Not Otherwise Specified (PDD-NOS) is a 'subthreshold' condition in which some features of autism are identified. PDD-NOS is also referred to as “atypical autism” (The Center for Human Development Research, 2003). It is included in DSM-IV to encompass cases where there is marked impairment of social interaction, communication, and/or stereotyped behavior patterns or interest, but when full features for autism or another explicitly defined PDD are not met. While deficits in peer relations and unusual sensitivities are typically noted, social skills are less impaired than in autistic disorder. Children with PDD-NOS probably come to professional attention rather later than is the case with autistic children, and that intellectual deficits are less common (Mesibov, 1997).

Comorbidity with autism spectrum disorders
Autism spectrum disorders tend to be highly comorbid with other disorders. Distinguishing between ASDs and other diagnoses can be challenging because the traits of ASDs often overlap with symptoms of other disorders and the characteristics of ASDs make traditional diagnostic procedures difficult (Underwood et al., 2010). In spite of these difficulties, comorbid disorders are readily identified and tend to fall into six categories: medical conditions, intellectual disabilities, anxiety disorders, mood disorders, behavior-related disorders, and sensory processing disorders.
Medical conditions

A variety of medical conditions commonly occur in individuals with ASDs. The most common is seizure disorder or epilepsy, which occurs in 11-39% of individuals with ASD (Ballaban-Gil & Tuchman 2000). Typically, the onset of epilepsy occurs before age five or during puberty. Tic disorder is another common medical condition seen in individuals with ASDs. While only about 6.5% of individuals with an ASD have full blown Tourette syndrome, nearly 30% show some form of tics (Baron-Cohen, 1999). Tuberous sclerosis, a medical condition in which non-malignant tumors grow in the brain and on other vital organs, occurs in 1-4% of individuals with ASDs (Wiznitzer, M, 2004). Sleep disorders are also commonly reported by parents of children with ASDs, including late sleep onset, early morning awakening, and poor sleep maintenance (Canitano, 2007).

Intellectual disabilities

Intellectual disabilities are some of the most common comorbid disorders with ASDs. Recent estimates suggest that 40-69% of individuals with ASD have some degree of mental retardation (Mash & Barkley, 2003), with females more likely to be in severe range of mental retardation. Learning disabilities are also highly comorbid in individuals with an ASD. Approximately 25-75% of individuals with an ASD also have some degree of learning disability, although the types of learning disability vary depending on the specific strengths and weaknesses of the individual (O'Brien & Pearson, 2004).

Anxiety disorders

A variety of anxiety disorders tend to co-occur with autism spectrum disorders, with overall comorbidity rates of 7-84% (Mash & Barkley, 2003). Specific phobia is the most common comorbid condition over the lifetime for those with ASD, with comorbidity rates of 38-63% (Joshi et al., 2010). Common phobias for children with ASD include the fear of certain places or situations, the fear of medically related people, places, or things, and the fear of loud noises (Leyfer et al., 2006). Obsessive-compulsive disorder (OCD) occurs in 11-35% of individuals with ASD, with 16-81% showing features of the disorder without a full diagnosis (Joshi et al., 2010). While individuals with ASD exhibit rigid thinking and compulsions, similar to OCD, the repetitive behaviors displayed in ASD (i.e., flapping, spinning, repeating phrases) are...
distinct and serve alternate functions than the repetitive behaviors displayed in OCD (i.e., checking, cleaning, counting). Social Phobia or Social Anxiety Disorder is seen in approximately 7.4% of individuals with ASD, but is more common in higher-functioning individuals who have a desire for social interactions, but are also aware of their social deficits (Joshi et al., 2010).

**Mood disorders**
Rates of comorbid depression in individuals with an ASD range from 4–58% (Lainhart, 1999). The presentation of depression in ASDs can depend on the level of cognitive functioning, with lower functioning children displaying more behavior issues and higher functioning children displaying more traditional depressive symptoms (Matson & Sturmey, 2011). Depression is thought to develop and occur more in high-functioning individuals during adolescence, when they develop greater insight into their differences from others (Mash & Barkley, 2003). Bipolar disorder may also be comorbid with an ASD, although it is far less common than many other disorders. Rates of comorbidity vary greatly, but tend to be around 2-8% (Leyfer et al., 2006).

**Behavior-related disorders**
Deficits in ASD are often linked to behavior problems, such as difficulties following directions, being cooperative, and doing things on other people's terms (Tsakanikos et al., 2007). These behavior problems are also characteristic of Oppositional Defiant Disorder (ODD) and Conduct Disorder (CD), but the reasons for the behaviors often differ (Leyfer et al., 2006). For this reason, comorbidity rates of ODD and CD range from 7% to 73% (Joshi et al., 2010). Attention Deficit Hyperactivity Disorder (ADHD) has ASD comorbidity rates of 30-80%; however, current diagnostic guidelines prevent diagnosing ADHD along with ASD. Rather, ADHD-like symptoms are seen to be part of the ASD diagnosis (Rommelse et al., 2010).

**Sensory processing disorders**
Sensory processing disorder is also comorbid with ASD, with comorbidity rates of 42-88% (Baranek, 2002). Three patterns of sensory processing difficulties are commonly seen, hyperresponsiveness (behavioral over-reactivity to sensory stimuli), hyporesponsiveness (behavioral under-reactivity to sensory stimuli), and sensory-
seeking (craving or fascination with certain stimuli). These patterns of processing difficulties may be present with auditory, visual, or tactile stimuli (Boyd et al., 2010). Sensory features in autism often have co-occurred with the behavioral presentation of the established core symptoms. Sensory symptoms are considered secondary or associated features of the disorder because they have not been universally found in individuals with autism. Still there has been some discussion as to whether sensory symptoms in autism should be considered primary impairments that have resulted in problems relating to and interacting with others, particularly because for the developing child most of the world is explored and experienced via sensory input (Baranek, Parham, & Bodfish, 2005; Iarocci & McDonald, 2006; Rogers & Ozonoff, 2005).

1.3.2 Sensory Integration

Dr. Alma Jean Ayres Baker (1968), an occupational therapist, coined the term Sensory Integration to explain relationship between behavior, neural functioning and sensory processing. Ayres defined Sensory Integration as “the interaction and coordination of two or more functions or processes in a manner which enhances the adaptiveness of the brain’s response.” We are constantly receiving sensory information both externally from the environment and internally from our bodies. The nervous system then has to organize and interpret this information and decide how it will respond to the input and how the input can be used for skill development.

Sensory Integration is the organization of sensory information for ongoing use. It is the ability to receive and process information from all the senses (touch, movement, smell, taste, vision, and hearing), organize or integrate that information within the brain, and then respond in a meaningful way. More than 80% of the activities of the nervous system involve processing and organizing sensory information. Sensory Integration provides the necessary foundation for more complex learning and behavior, including motor planning ability, attention, adaptive behavior, and academic learning.
Williamson and Anzalone (1996) have identified five interrelated components that help understand how Sensory Integration occurs. These are:

1. Sensory registration
2. Orientation
3. Interpretation
4. Organization of a response
5. Execution of a response

1. Sensory Registration
Sensory Registration occurs when one first become aware of a sensory event. An individual may not be aware of certain types of sensory input until it reaches a certain threshold or intensity. “Sensory threshold” varies throughout the day, depending on the previous sensory and emotional experiences. When one is highly aroused or anxious, the sensory threshold is lower and one may register sensory inputs that go ignored any other time.

2. Orientation
Sensory Orientation allows one to pay attention to new sensory information being received. An individual is able to determine what sensory information needs his attention and what information can be ignored. This happens through sensory modulation and the functions of inhibition and facilitation. The brain is programmed to modulate or balance incoming sensory information to function efficiently. All sensory stimuli cannot be attended to in our environments. If all sensory input has equal importance, one could not select the relevant stimuli for the specific situation. Sensory modulation is necessary to regulate the brain’s activity level. Ayres (1979) compares the process of modulation to volume control. If the sensory information is “too loud” or “too intense” or too insignificant, the brain can inhibit or “turn down” the flow of information. This neurological process of inhibition prevents one from attending to meaningless sensations. Sometimes help is needed to respond to meaningful sensations and this is when the neurological process of facilitation is activated. Sensory modulation occurs unconsciously and results when there is a difference between inhibition and facilitation.
3. Interpretation
The ability to interpret sensory information allows one to determine what to respond to and if it is threatening. New sensory experiences are compared with old ones. Language, memory and emotional centers are involved in the interpretation process. The nervous system’s “fright-flight-fight” response helps to protect the body from potential harm.

4. Organization of a Response
Difficulties in registration, orientation and or interpretation affect the ability to organize a response to sensory input. Appropriate response to sensory input cannot be organized if the nature and meaning of the input is unclear. For some, the response may be exaggerated if the input is interpreted as being harmful. The “fright-flight-fight” response may be activated. For others, there may be no input response because the input did not register.

5. Execution of a Response
The execution of the motor, cognitive or emotional response to the sensory message is the final stage of the sensory integration process. The ability to execute an appropriate response is dependent on the previous components and adequate motor planning abilities. Motor planning is the ability to perform purposeful activities.

Sensory Integration contributes to the development of self-regulation, comfort, motor planning, motor skills, attention and readiness to learn. Self regulation is the nervous system’s ability to attain, maintain and change levels of arousal or alertness (Williams & Shellenberger, 1994).

Sensory Integration focuses primarily on three basic senses–tactile, vestibular, and proprioceptive. Their interconnections start forming before birth and continue to develop as the person matures and interacts with his/her environment. The three senses are not only interconnected but are also connected with other systems in the brain. Although these three sensory systems are less familiar than vision and audition, they are critical to our basic survival. The inter-relationship among these three senses
is complex. They allow us to experience, interpret, and respond to different stimuli in our environment. (Yack, Sutton, & Aquilla, 1998)

The basic sensory systems are described below.

(i) The Vestibular System
The vestibular system monitors and maintains the body's balance against gravity. Both vestibular and proprioceptive systems are interoceptive (internal monitoring) processes receiving and transmitting to the brain sensory information derived in a variety of ways.

In order for the brain to understand the relationship of the body to space, vestibular sensation of gravity and movement must interact with proprioceptive sensations from muscles and joints, and visual verification to support what is sensed. This three way interaction enables the vestibular system to interpret the orientation of the head and body so that when the eyes are looking at an object, the brain will know if it is the object, the head, or the whole body that is upright, titled or prone, and whether it is the body or the external environment (or both) that are moving (Berger, 2002).

(ii) The Proprioceptive System
Proprioception is related very closely to the vestibular system. It monitors internal activities and works together with the rest of the brain to modulate movement activities. Sensation from muscles, joints and organs enable the brain to interpret vestibular input. Among proprioceptive sensations are joint and muscular contractions that send electric feedback to the brain, letting it know where the limbs are, what they are doing, where the body is in space, how much movement and body dynamics are required to execute a procedure functionally. Motor planning (praxis) relies directly on the interaction and integration of vestibular with proprioceptive input (Berger, 2002).

(iii) The Tactile System
Touch is one of the first sensations activated in the womb (along with hearing). The tactile system receives information about touch, pressure, vibration, temperature and pain from receptor cells in the skin. Feedback from the tactile system contributes to the development of body awareness and motor planning abilities. The brain processes
tactile sensations through two main channels; the protective system, and the
discriminative system. They must work together in order for the body to interact in a
functional, calm, and adaptive manner to ongoing touch sensations, including internal
and external responses to pressure and pain. The discriminatory tactile system
includes receptors on the skin, in the mouth and other areas of the body that transmit
information about where and how the body is touched and the external and internal
condition of the environment. It provides information about the quality of tactile
input. The protective system responds to any touch and is on high alert with those
sensed by the brain as potentially dangerous. The hypothalamus (where sensory
information converges) and the amygdala (which assesses emotions) in the limbic
system of the paleoencephalon are in constant interaction regarding incoming
information. According to Royeen and Lane, (1991) clinicians have long suspected
that anxiety resulting from stress can amplify tactile and sensory defensiveness. They
believe that anxiety resulting from stress may be associated with fear, as well as with
concentration difficulties, restlessness, and other symptoms in almost any system of
the body. A hypersensitive tactile system creates the condition of tactile
defensiveness, which is prominent in children with ASD (Berger, 2002).

It is postulated that manifestations of stress and anxiety are associated with limbic
system and at the higher levels, the neo-cortex. The fear response is further
exacerbated by the release into the system of catecholamines, neurotransmitters and
chemicals such as norepinephrine, epinephrine (adrenaline) and others. Tactile
information interacts with the vestibular, proprioceptive and visual sensory input, thus
the reduction of tactile defensiveness becomes important (Berger, 2002).

(iv) Visual System
Visual system operates at neo-cortical level. It supports the vestibular and
proprioceptive systems. Binocular vision uses both eyes simultaneously, each
performing specific tasks (location, distance, form, etc) that combine to unify image
attributes into one whole, unified picture.

(v) Auditory system
Audition, the act of hearing, is predominantly a passive sub-cortical process. Sound
energy and vibrations are found everywhere in the environment and are unavoidable.
Sound perception, which is the interpretation of sound, is complex. This involves an active exchange of communication between the sub-cortical processes—instinct—and cortical processes. Auditory and vestibular systems both operate through the ear.

The appropriate integration of sound stimuli received by two ears simultaneously and their accurate interpretation in the auditory cortex, cannot be assumed to be functionally operative in persons with sensory problems.

Two ears on two different sides of the head receive and process auditory input differently and within fractions of a second of each other. Each ear submits auditory input for assessment of location, distance, quality, speed and other elements. The brain collates this information, scanning and ultimately integrating this into a whole, coordinated sound scape of the environment. Since each ear is located differently, each will detect sound differently in terms of distance and volume. This is true if stereophonic (binaural) hearing (both ears simultaneously) is intact. With sensory integration problems it is often not possible to determine what auditory process is intact, and what impression the auditory scanning process has produced (Berger, 2002).

(I) Sensory Processing Dysfunctions in Children with ASD

For most of us, effective sensory integration happens automatically, unconsciously, or without effort. For some of us, the process is inefficient, demanding effort and attention. This inability to adequately analyze, organize and integrate sensory information is called Sensory Integration Dysfunction (SID). Presently the term Sensory Processing Dysfunction (SPD) is being used as a global umbrella term that includes all forms of this disorder, including three primary diagnostic groups (Miller, et al., 2010).

- Type I - Sensory Modulation Disorder
- Type II - Sensory Based Motor Disorder
- Type III - Sensory Discrimination Disorder

Type I - Sensory Modulation Disorder (SMD) This implies over, or under responding to sensory stimuli or seeking sensory stimulation. This group may include a fearful
and/or anxious pattern, negative and/or stubborn behaviors, self-absorbed behaviors that are difficult to engage or creative or actively seeking sensation.

**Type II-Sensory Based Motor Disorder (SBMD)** Shows motor output that is disorganized as a result of incorrect processing of sensory information affecting postural control challenges and/or dyspraxia.

**Type III-Sensory Discrimination Disorder (SDD)** This implies sensory discrimination or incorrect processing of sensory information. Incorrect processing of visual or auditory input, for example, may be seen in inattentiveness, disorganization, and poor school performance.

Many individuals with ASD over-register or are hyper-responsive to sensory stimulation. Some report hearing whispers from another room or trains that are miles away. Others report that certain clothing textures feel like sandpaper. Some individuals with ASD may also under register sensory information. They may not notice someone calling them; they may not feel pain like other children and may not respond when sensory stimulation is exaggerated. Responses to sensory input may be highly inconsistent and vary on a daily basis. Some children who may appear unresponsive to sensory input may in fact be highly sensitive to sensory stimulation. This may be because their nervous system has “shut down” to protect them from incoming sensory stimulation (Yack, Sutton, Aquilla 1998).

Many children with ASD have poor sensory modulation. A typical sensory registration and orientation can interfere with the process of inhibition and facilitation. One child may not be able to follow verbal instructions or interact with others because he is attending to “meaningless” sensations of wind against his face or dust particles in the air. Another child may be overwhelmed by and uncomfortable with certain sensations, displaying fear and anxiety.

Atypical language, memory and emotional development in individuals with ASD may interfere with the ability to interpret sensory information. Individuals with ASD may also have problems with the stages of sensory registration and orientation, subsequently hampering the interpretation process. It is difficult to interpret sensory information if the input is distorted, inconsistent, too strong or too weak.
Sensations may constantly be interpreted as new or unfamiliar. Therefore, individuals with ASD may have difficulty with transition and may be obsessed with order and set routines. They more frequently report hypersensitivity to sensory input.

The term sensory defensiveness describes the tendency to react negatively or with alarm to sensations that are generally considered inoffensive (Wilbarger & Wilbarger, 1991). Children may be defensive to all types of sensory inputs or one specific sensation. Defensive responses may be highly variable and inconsistent. Children who are sensory defensive operate under high levels of anxiety as they are bombarded by sensations that they do not like and that may encourage ‘fright-flight-fight’ reactions. As they are often in the hyper-aroused state, they become hyper-vigilant and have lower sensory thresholds which make them even more responsive to sensory input. These children may avoid sensation to prevent negative reactions but may also seek out certain sensations as a coping strategy.

Atypical cognitive and emotional development in individuals with ASD further interferes with the ability to organize a response. Their emotional reactions may be exaggerated or minimized and they may experience problems maintaining attention, formulating and comparing choices and initiating plans of action.

Greenspan and Wieder (1998) in their review of 200 children diagnosed with ASD, reported that 100% of these children experienced some kind of motor planning problem. David Hill and Martha Leary (1993) suggested a strong association between certain behaviors and specific motor or movement disturbances. They suggested that movement disturbance relates to impaired motor planning and is reflected in difficulties with starting, executing, stopping, combining and switching motor acts. The child who engages in persevering self-stimulatory behavior may have difficulty starting, switching or stopping motor acts.

Berger (2002) describes the sensory integration dysfunctions commonly evinced in the sensory systems in children with ASD.

i) Dysfunction in the vestibular system

In ASD, the vestibular system may not be properly received, synchronized, accurately interpreted or modulated. Thus, the person might lack accurate spatial orientation. For
the autistic child with integrative dysfunction of the vestibular system, the world is very threatening. Besides inappropriate muscle tone, usually hypotonic (weak), the muscle fatigues easily, may seem clumsy, unpaced and prone to frequently falls. A properly functioning vestibular system keeps the arousal level of the nervous system balanced. Slow vestibular stimulation calms and stimulates utricle information; fast vestibular stimulation arouses and stimulates semicircular canal information.

With a poorly modulated vestibular system, the child may either be in a constant state of arousal, or perhaps even fluctuating between these two states. Vestibular system dysfunction or misinterpretation of stimuli also contributes to midline disorientation, directional spatial confusion and gravitational insecurity. This can trigger a sensory defensive response and activate the fright-flight-fight reaction. Inefficient vestibular information processing can also result in inadequate ocular-motor activity. This can further implicate the mental image retention capabilities needed to navigate space, and to learn to write letters and numbers. It can also impact upon sequential short-term memory, attention span, attention to details, and other cognitive functions.

**ii) Dysfunction in the proprioceptive system**

Some children do not adequately receive or process information from their muscles, joints, tendons, ligaments or connective tissues. This results in insufficient feedback about movement and body position. Vision must be used to compensate for the poor body awareness. Motor planning abilities can be compromised and fine and gross motor skills may be delayed. Proprioceptive dysfunction is usually accompanied by problems with the tactile or vestibular systems (Kranowitz, 1998). When the proprioceptive system is deficient, the child with ASD has difficulty remaining stable, complying with directives (walk, run, etc.), learning to write, manipulating items, and achieving other tasks involving motor planning.

Many ritualistic behaviors, requirements for sameness, communication deficits, fear of new things, lack of body scheme and spatial orientation, and other aspects of autism are attributed to proprioceptive-vestibular-visual sensory disorientation and sensory overload. In these cases, the system may always be survival mode stress.
iii) Dysfunction in the tactile system

Dysfunction in the tactile system can be seen in withdrawing when being touched, refusing to eat certain 'textured' foods and/or to wear certain types of clothing, complaining about having one's hair or face washed, avoiding getting one's hands dirty (i.e., glue, sand, mud, finger-paint), and using one's finger tips rather than whole hands to manipulate objects. A dysfunctional tactile system may lead to a misperception of touch and/or pain (hyper- or hyposensitive) and may lead to self-imposed isolation, general irritability, distractibility, and hyperactivity. Tactile defensiveness is a condition in which an individual is extremely sensitive to light touch. Theoretically, when the tactile system is immature and working improperly, abnormal neural signals are sent to the cortex in the brain which can interfere with other brain processes. This, in turn, causes the brain to be overly stimulated and may lead to excessive brain activity, which can neither be turned off nor organized. This type of over-stimulation in the brain can make it difficult for an individual to organize his behavior and concentrate and may lead to a negative emotional response to touch sensations.

Some children may excessively register and orient to touch input. They may have problems with sensory modulation and may be unable to inhibit or screen out touch sensations. In autism, Sensory Integration issues create problems with modulation at the primary reflexive accommodation level. This causes the system to remain in a threatening state for periods longer than usual, causing panic and fear attacks which increase the flow of adrenalin, cortisol further hindering the ability of the system to ‘calm down.’ Environmental changes, changes in routine and food, often affect autistic behaviors because of the requirement for extra time to make immediate accommodating adjustment. Odd behaviors, self stimulation, hand flapping, lack of eye contact, tactile defensiveness are all part of the system’s estimation of need.

iv) Dysfunction in the visual system

Persons with autism may be processing visual information through peripheral (survival vision). This is the vision mode that is in effect when the fight or flight response is activated. The peripheral vision includes unmodulated (unprioritized) visual input (everything at once) with the brain receiving a larger amount of visual information than necessary. Stress, anxiety, fear all contribute to entering the
peripheral, fight or flight vision mode. This ocular phenomenon is quite prominent in autism. Much erratic behavior results from the presence of peripheral vision, when too much information is provided that cannot be functionally adaptable. In individuals with autism this often translates to an inability to focus, provide extended eye contact or remain on task. The absence of visual figure ground is another variable in inaccurate visual sensory function. The inability to perceive figure ground means that the brain is receiving all visual information without priority or frame of reference for what is important to see and what can be ignored or dismissed.

Depth perception is contingent upon the brain’s ability to determine what and how wide the background is. Other ocular issues such as determination of size and shape of an object may also be implicated in figure ground deficiencies.

These visual problems are significant contributors to autistic behaviors. They contribute to attend visually for any length of time, distractibility, visual sequential tracking and visual memory.

Persons on the autistic spectrum have visual perception inaccuracies defining spatial characteristics. A walkway or surface that is absolutely leveled may be perceived as downhill. This ocular-vestibular-proprioceptive illusion directly implicates motor planning and movement behaviors. A sensory integration problem where the brain seemingly receives information about the position of head, but conflicting visual images do not support vestibular-proprioceptive transmissions. Toe walking observed in many children with autism is often an indicator of this problem. Visual perception problems perpetuate motor planning issues, balance problems, attention disorders and visual overload, often leading to exaggerated movements and generally chaotic behavioral anxieties.

v) Dysfunction in the auditory system
If binaural stereophonic hearing functions at a deficit, the possibility that auditory information will be appropriately integrated and perceived becomes highly doubtful. The brain could be receiving individual bits of information from one ear at a greater than ‘normal’ time gap, causing an inability for the brain functionality to coalesce the information into a complete auditory picture. There could be time discrepancies
between the ears, incomplete information from one ear, lack of distance calculation, dissimilar sound regulation between ears (one hears loud, the other soft), distortion of sound in one or both ears and many more subtle problems.

It is more likely that the auditory system of individuals with autism is operating predominantly on ambient (survival) hearing (all sounds at once). This means there is an intake of peripheral rather than focused sound, similar to eyes functioning on peripheral vision. Ambient auditory processes may place the nervous system on auditory overload because ambient (survival) hearing has no figure ground orientation. As in the case of visual systems, ambient hearing means the intake of all audible sounds, from everywhere in the environment received simultaneously and without discernment for what must be retained or may be discarded. Here again it could be that the auditory scanning process never actually rests on a particular sound long enough for ‘focus’ to take place.

(II) Sensory Integration Therapy (SIT)

During Ayres’s studies, she formulated the theory of Sensory Integration based on established knowledge and theories found within the neuroscience field (Fisher, Murray, Bundy, 1991). Her theory described normal sensory integrative abilities, defined sensory integrative dysfunction and guided intervention programs which use sensory integrative techniques (Fisher et al., 1991). This theory provided a framework for intervention with children and adults with a variety of special needs.

Problems in self regulation may contribute to many of the behaviors observed in individuals with ASD. These behaviors include, disregard or exaggerated responses to sensory stimulation, inconsistent ability to tasks, distractibility, poor impulse control, limited frustration tolerance and fluctuating emotional reactions (Yack, Sutton & Aquilla, 1998). SPD is suspected when the child exhibits one or more of these common symptoms with frequency, intensity, and duration. If a child is suspected of having SPD, an evaluation can be conducted by a qualified occupational therapist using both standardized testing and clinical observations of responses to sensory stimulation, posture, balance, coordination and eye movements. After carefully analyzing test results and other assessment data along with information from other professionals and parents, the therapist will make recommendations regarding
appropriate treatment. The main form of SIT is a type of occupational therapy that places a child in a room specifically designed to stimulate and challenge all of the senses. Activities designed to address the sensory needs include riding scooter boards, using swings, jumping on trampolines, and wrapping children in fabric. The children seek out sensory input to fulfill their needs (Simpson, 2008).

Treatment follows the child’s lead using activities that challenge his or her ability to respond appropriately to sensory input by making a successful, organized response. When the child actively engages in meaningful activities that provide the intensity, duration, and quality of sensation his or her central nervous system craves, integration occurs, adaptive behaviors improve, and learning improves. Treatment helps the child build a strong foundation for the demands of more complex learning and skill. Treatment also helps the child develop skills to interact successfully in social situations and develop a strong sense of self-esteem (Simpson, 2008). SIT benefits individuals of all ages; however, change in neurological patterns appears greatest in children under the age of 7 years (McClure & Holtz-Yotz, 1990).

According to Simpson (2008), the most important step in promoting sensory integration in children is to recognize that it exists and that it plays an important role in the development of a child. By learning more about sensory integration, parents, educators and caregivers can provide an enriched environment that will foster health, growth and maturation. SIT requires a trained occupational therapist with extensive training in Sensory Integration to be able to evaluate the sensory dysfunctions in a child prior to implementing any form of SIT. Risk may result from implementation of SIT by unqualified and inadequately trained individuals (Hamilton, 1995). Parents can implement a sensory diet which is closely monitored by an occupational therapist experienced in SIT.

Proponents of Sensory Integration report both benefits and disadvantages associated with use of SIT (Cook & Dunn, 1998). One advantage is SIT’s highly individualized programming, including the fact that activities are designed to meet each child’s unique developmental needs, and therapists use what motivates a child. In addition, this therapy resembles play. According to Simpson (2008), one disadvantage is that
implementing this method requires extensive training and understanding of how the neural and physiological systems work and coordinate. Very few special or inclusive schools practice SIT. The shortage of infrastructure and space, trained manpower, large student teacher ratio to a class inhibits possibility to SIT to a large extent. Also, there is a paucity of scientifically valid research related to the efficacy of this method (Simpson, 2008).

1.3.3 HANDLE Intervention Program
HANDLE is a non-drug treatment alternative for identifying and treating neurodevelopmental disorders like ASD. It includes principles and perspectives from medicine, rehabilitation, psychology, and education. It is founded on an interactive, developmental model of human functioning. The HANDLE Institute International offers clinical services, community information, and professional training programs.

Judith Bluestone, a neurodevelopmental therapist and a person with ASD herself designed the HANDLE intervention program, helping resolve issues caused by a wide array of neurodevelopmental disorders. Her condition enabled her to perceive ASD both externally and internally and led to the development of HANDLE.

*The HANDLE Approach* (Bluestone, 2002)

"Holistic" refers to viewing the numerous interdependent body-mind influences within each individual as their systems respond to the multi-faceted elements in the entire environment.

"Approach" means that HANDLE is paradigm, a set of guiding principles rather than a set of exercises or techniques that is unified by applied neuroscience deduced from developmental behavior, including the evidence that the body organizes the brain, not vice versa. The weak areas of neurological systems are gently enhanced and signs of stress honored, customizing programs for each individual.

"NeuroDevelopment" refers to an interactive hierarchy of nervous systems’ functions, with emphasis on the role of the cranial nerves and autonomic nervous system rather than isolated functions in particular sites in the brain. Development is a lifelong process that relies on neuroplasticity, the ability of the brain and the rest of the nervous system to reshape themselves according to the stimulation they receive.
“Learning” is the process of using sensory, motor, social and emotional input to realign output into behavior successfully. Both learning and brain structure continue to develop shortly after conception until the moment of death. Learning, as development, is cyclical. As spirals in normal development are experienced, spirals in the learning processes of people with special needs are a normal part of development. It means that the seemingly lost behavior was not well enough internalized to appear automatically, and the body-brain has another priority.

“Efficiency” refers to the brain expending the least amount of energy and experiencing minimum stress as it works to accomplish tasks. HANDLE addresses the root causes of maladaptive or unsuccessful behaviors. With Gentle Enhancement to encourage neurodevelopmental integration, the body, directs the individual to perform tasks optimally; efficiently, not just effectively.

The principle of Gentle Enhancement guides all HANDLE therapy. An individual with ASD must be respected for his perceptions, for his tolerance of stimulation, passive and active, internal and external. That is the essence of Gentle Enhancement, which is the key to resolving many issues of individuals with ASD (Bluestone, 2005). According to Suliteanu (2010), only the amount and nature of stimulation the individual’s systems will accept is allowed. Any state change – which may involve breathing, circulation, inattention, pain, or other signs, warns that the input occurring at the time is being rejected. Stressed systems do not get stronger; they shut down. Respecting the child’s response as self-descriptive rather than judging it as “stubbornness” or “defiance” achieves progress toward neurodevelopmental integration: the so-called defiance says that child is not ready for that stimulation at that time. Gentle Enhancement is based on the neuroscientific research indicating that overloaded systems shut down. This is the basic therapeutic modality of HANDLE.

All the systems are interrelated. The digestive system relies on the motor system for chewing food; the sense of smell conveys messages directly to the brain, exactly where the emotions register; eyes tell ears where to focus; fear depletes the resources our immune system needs. Neurodevelopmental integration requires smooth multidirectional communication, therefore HANDLE targets such communication between
each child’s interrelated systems. Behaviors convey our brain-body’s needs and capabilities, which the neurodevelopmental integration lacks (Suliteanu, 2010).

The HANDLE activities include gentle stimulation of cranial nerves (such as “Face Tapping” along the distribution of the Trigeminal Nerve), controlled rolling while cocooned in a natural-fiber blanket, to reinforce the vestibular system; climbing through a hula hoop without touching it, to develop an internal sense of boundaries and others; there are twenty-four possibilities. All are simple to do, and complicated neurologically. Since HANDLE program address neurodevelopmental integration, they affect all areas of function (Suliteanu, 2010).

Each HANDLE program includes several key elements, the combination of which is what causes its outcomes. That interactive dynamism, given the principle of Gentle Enhancement, accounts for and distinguishes the nature of functional change achieved by HANDLE program. Suliteanu (2010), explained the key elements: organized movement-based activities, sensory-motor integration, and the nonjudgmental attitude that respects each child’s behaviors as communication of needs and skills.

Fundamental to the HANDLE program is that the therapist be open to communication and interaction with the individual in whatever form he or she wishes or is able to use. This requires careful observation on the part of the therapist. By careful observation of the individual and creating a profile of interactive and interdependent functions, the therapist is then able to provide the individual with a customized program of simple organized movement activities for retraining the nervous system.

Distinctive Features of HANDLE Intervention Program:

- Views the person as a whole
- Looks beyond the labels for root causes of perplexing behaviors
- Strengthens systems without stress through Gentle Enhancement
- Considers the person in relationship to his or her environment
- Assists the brain to create efficient pathways through a "systems approach" (an understanding of the connections and interactions between components of a system)
- Works globally, affects specifically
- Provides a nonjudgmental observational evaluation
Parents are trained in follow-up programs. At each follow-up session, the family is asked to report any changes, and to share the observations and comments of teachers and other supervisory personnel.

Areas of progress include improved attention and focus, better sitting tolerance, and improved motivation. In areas of social interaction, improved communication skills, improved behavior, faster response time, happier, more relaxed disposition and better compliance with instructions are reported. In areas of independent skills, improved judgment of obstacles in path, better task completion, more organized, increase in appetite and range of foods, less bedwetting and improved impulse control are observed. Academic benefits like better reading, math, spelling also show significant progress (Bluestone & Suliteanu, 2001).

While HANDLE is an individualized approach, in some cases a group program may be developed using HANDLE activities designed to suit the group setting and the individual needs of the group's members.

There are countless interventions and treatments that purport to be suitable to the individuals with ASD, a number of which either have not been scientifically validated or have been determined to have little or no worth. It is clear that identifying scientifically validated methods is extremely important and timely. Scientific practices are defined as those that have significant and convincing empirical efficacy and support having undergone substantial amount of rigorous research. A promising practice refers to intervention and treatments that have (1) been widely used for several years without any or few adverse outcomes, and /or (2) undergone research that suggests children and youth with ASD respond favorably and display skill acquisition as a consequence of the intervention and (3) appears to have efficacy and utility with the individuals with ASD, even though the intervention requires additional scientific support to be considered scientifically based method (Simpson, 2008). HANDLE intervention program fits into the category of a promising practice.
1.4 Operational definitions of the key terms

**Perceptual-Cognitive Skills** consist of attentional priorities, visual and auditory discrimination, visual and auditory sequencing, visual motor coordination, figure ground perception, pattern recognition, problem solving, visual closure, form constancy, position in space, spatial relationship, decision making, concept formation and causal relationships as measured by Part A of the tool ‘Scale for Perceptual Cognitive and Behavioral Skills in children with ASD (SPCBS).

**Behavioral Skills** consist of Positive and Negative behaviors patterns. Positive behaviors such as a social smile, cooperating with others, waiting for a turn, sharing, seeking permission, offering help and expressing emotions. Negative behavior patterns which are categorized under stereotyped and repetitive behavior, violent behavior, self injurious behavior, disruptive behavior, and odd behaviors as measured by Part B (i) and Part B (ii) respectively of the Scale for Perceptual Cognitive and Behavioral Skills in children with ASD (SPCBS).

**Children with Autism Spectrum Disorders (ASD)** included male and female children between 5 and 13 years of age on the Autism Spectrum as per their school records.

**Effectiveness** is the measure of impact of HANDLE intervention program on perceptual cognitive and behavioral skills in children with ASD.

**HANDLE**

An intervention program that mainly includes Face Tapping, Skull Tapping, Two Finger Spinal Massage, Hug and Tug, Ear Muff, Buzz Snap, Rope Turning, Clapping Game, Accentuation Stomp, Jiggle Bridge and many more organized movement activities as per the guidelines given by Bluestone (2005).

**SI Intervention Techniques:** A sensory integration intervention program involves standard exercises which enhances sensory input through the ball pool, swing, textured mats, trampoline etc. as recommended by Ayres (1979), and commonly practiced in the Indian therapeutic setting. It is also called Sensory Integration Therapy (SIT).
**The Scale for Perceptual Cognitive and Behavioral Skills (SPCBS):** A tool developed by the researcher, to assess perceptual, cognitive and behavioral difficulties in children with ASD.

**Parent’s Observation Schedule (POS):** A tool developed by the researcher, to measure the parent’s observations of their child’s progress post intervention in the treatment group.

1.5 Research Questions

1. Would HANDLE intervention program significantly enhance perceptual cognitive skills in children with ASD?
2. Would HANDLE intervention program significantly improve positive behavioral skills in children with ASD?
3. Would HANDLE intervention program significantly reduce negative behaviors in children with ASD?
4. Would HANDLE intervention program show significant improvement in perceptual cognitive skills in comparison to those children with ASD who do not receive it?
5. Would HANDLE intervention program show significant improvement in positive behavior skills in comparison to those children with ASD who do not receive it?
6. Would HANDLE intervention program show significant reduction in negative behavior skills in comparison to those children with ASD who do not receive it?
7. Would the scores achieved by children on SPCBS have a positive correlation with the scores achieved on POS?

1.6 Objectives of the study

- To study the effect of HANDLE intervention program on the development of perceptual cognitive and behavioral skills in children with ASD.
- To compare the effect of HANDLE intervention program on perceptual cognitive and behavioral skills between the treatment group and control group.
- To correlate the mean gain scores of POS and SPCBS in children with ASD.
1.7 Scope of the study

Limitations
The study was conducted on randomly selected sample of children with ASD (N=50), of both sexes, receiving SIT and within the age group of 5 to 13 years from special schools or regular schools with inclusive setups in Mumbai.

Delimitations
Since the research was conducted on children with ASD within the age group of 5-13 years, the findings may be used for children with similar disability.