CHAPTER 5

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5.0 Introduction
This chapter deals with the discussion of the results obtained through the analysis of data. The data has been analyzed and the findings have been reported in the previous chapter. Based on the results and findings, the hypotheses stated were either rejected or retained. In this chapter, the results of the impact of the HANDLE intervention program on the perceptual cognitive and behavioral skills of children with ASD are presented under the three main hypotheses that were drawn for the study. The results are discussed in light of the literature available, observations made by the researcher and interpretations which can be made.

5.1 Hypothesis 1
HANDLE Intervention Program will significantly enhance the Perceptual Cognitive and Behavioral Skills in Children with ASD
Children with ASD have significant difficulties in sensory processing and sensorimotor integration. Children with ASD have difficulty registering or organizing and using the sensory information from their body and from the environment. Frequently, such children show motor impairment, including poor muscle contraction around joints, low muscle tone, and decreased balance and equilibrium. Children with sensorimotor dysfunction typically have problems in accurately producing a movement or controlling the execution of a movement. Sensory processing, motor planning and motor performance delays are seen in children with ASD.

The prevalence of sensory processing dysfunction among children with ASD is estimated between 42 and 88%. Approximately, 39% of children with ASD are under-responsive to sensory input, 20% are hypersensitive, and 36% show a mixed pattern of hypersensitivity and hyposensitivity (Barenek, 2002; Greenspan & Weider, 1997; Kientz and Dunn 1997; Watling, Deita, & White 2001).

When individuals have deficits in processing and integrating sensory input, problems in learning, movement, development or behavior may arise. Poor sensory processing can impact their ability to participate in social, school, and home activities. Children
with ASD often demonstrate an extreme aversion to sensory input (hyper-responsiveness) or excessive seeking out of sensory input (hypo-responsiveness) (O’Neill & Jones, 1997). The core symptoms of ASD are impaired social interactions, deficits in communication and repetitive or restricted behavioral patterns. Despite the fact that current diagnostic criteria do not consider sensory processing disturbance as a core deficit of an ASD diagnosis, a recent meta-analysis of the sensory modulation literature in autism found support for the universality of these symptoms across the diagnostic spectrum (Ben-Sasson et al., 2009).

In the present study, observations of deficits in sensory processing were observed in the subjects as they had difficulty with perceptual cognitive skills revealing poor visual and auditory perception abilities. These observations are similar to findings by Greenspan and Weider (1998), wherein 94% children with ASD exhibited unusual sensory processing resulting in perception dysfunction.

Children with limited communication skills and/or poor social development are particularly at risk for development of problem behaviors (Borthwick-Duffy, 1996; Koegel, Koegel, & Surratt, 1992). Problem behaviors such as physical aggression, self-injury, pica, stereotypy, tantrums, and disruption are major barriers to effective education and social development. (Horner, Diemer, & Brazeau, 1992). This researcher observed similar behavioral difficulties in the subjects during her study. During intervention, a correlation was observed between sensory processing deficits, social interaction and communication difficulties and behavioral deficits.

Post intervention, the children of this study showed significant improvement in attentional priorities, visual and auditory perception like visual motor coordination, pattern recognition, figure ground perception and form constancy as in a case study presented by Simon (2009), of a 14-year-old girl with a history of ADD, autism, and sensory processing disorder, diagnosed with central auditory processing disorder (CAPD). She benefited from the HANDLE program: her perceptual deficits improved, enhancing her social skills, organization skills and academic concerns.

Bluestone (2005) herself struggled with ASD all her life. She experienced many self stimulatory behaviors as a child. Some of the behaviors were jumping on a pogo stick,
chewing sleeves and collars of her clothes, picking bites and scabs, and wiggling her ankles violently. Having experienced these behavior difficulties, she was able to relate to the sensory dysfunctions in her body in her later years.

A six-year-old child with autism had difficulty with visual perception. He was comfortable using his peripheral vision and could not have an eye contact. Post the HANDLE intervention program, there was an improvement in his eye contact and also his visual perception, which enhanced his perceptual cognitive skills. (Bluestone, 2005).

As reported by a mother (Jones, 2002), her 6-year-old daughter with autism was diagnosed with having tactile hypersensitivities, vestibular irregularities, proprioceptive weakness, light sensitivities and difficulty with binocularity. These irregularities explained a lot of her behaviors and dysfunctions. Post intervention, a significant improvement was seen in her eye contact, her emotions were under control, words followed easily, she was able to wash her face, brush her teeth and dress herself. She was able to stay in her seat belt for long drives and consistently wrote her name in a correct manner. She would grab the therapist’s hand to ask for face tapping and she looked forward to the sessions. This is similar to this researcher’s experience with her subjects where many subjects would take her hand and gesture a request for Buzz Snap, Face Tapping Two Finger Spinal Massage and even Ear Muff. Refusal to leave after the session finished was a common issue. Parents who were a part of this study also reported improvements similar to these cases.

There are many more anecdotes reported by parents of individuals with different disabilities like Tourette’s syndrome, CHARGE syndrome, Down’s syndrome etc. Case studies of individuals with different disabilities like hearing impairment, learning disabilities, ASD, Behavior Disorders, Obsessive Compulsive behaviors, Cerebral Palsy, Acquired Brain Injury, Attention Disorders (ADD/ADHD) and other neurological disorders have been worked on using the HANDLE intervention program and marked improvement has been reported in areas of perception, social interaction, communication, behavior and academics. The behaviors finding their root causes in sensory dysfunctions have helped integrate sensory systems. (Brenner,
In the present study, marked improvement was observed in hyperactive and attention deficit behavior of the subjects with such associated conditions.

The primary concern of each being is survival. When we perceive a threat to our survival, we succumb to the program that shifts our body-brain-mind-spirit from the control of higher level cognitive functions and puts it into the fright/flight/fight mechanism of our Autonomous Nervous System (ANS) (Bluestone, 2005). The symptoms of fright/flight/fight may be associated with dangers other than those of which we are conscious. They may be the body’s response to sensory overload, sensory deprivation or sensory “scrambling” (Bluestone, 2005). Sudden exposure to unpredicted stress is dangerous to our systems; continuous production of stress hormones during period of overwhelming and unrelenting anxiety weakens immune system responses and floods the body with toxins (Bluestone, 2005). Bradstreet (2001) mentioned that autism should be renamed “toxic encephalopathy” while Greenspan prefers to call it a “multisystem developmental disorder” (Bluestone, 2005).

The fright responses in the body signals the brain to provide more cortisol and adrenaline to support a defensive posture which depletes the body's supply of amino acids needed to support the immune system and the production of neurotransmitters necessary for neural transmission (Bluestone, 2005). Therefore, the researcher took utmost care to follow Gentle Enhancement to avoid the child to get into the fright/flight/fight mode.

The significant improvement in perceptual cognitive skills reiterates the importance of intervention at sensory level to enhance perceptual cognitive skills. The initial goal of HANDLE intervention in this study was to identify the sensory issues affecting the children. This researcher used ‘Gentle Enhancement’ to address observed sensory dysfunctions. Mental rehearsals gradually allowed this researcher to approach the overloaded sensory systems of the children.

The HANDLE approach looks into the underlying neurological dysfunctions of ASD. In the HANDLE paradigm, individuals with ASD need to be protected from stress in order to avoid melt downs (Bluestone, 2005). One of the primary state changes that
HANDLE practitioners watch for is a change in breathing patterns. The ANS response of changed breathing patterns is indicative of stress, particularly if it occurs over an extended period. Other important state change signs are a sudden tensing of any muscles not actively involved in performing a particular activity, loss of visual focus, change in facial color, reddening of the ear or worsening of an activity once it is becoming integrated. This researcher was mindful of these state changes in her subjects, employing principles of ‘Gentle Enhancement’ so that the systems to be strengthened did not shut down. The results are indicative that the progress made by the subjects in the area of perceptual cognition was due to ‘Gentle Enhancement’, thus benefiting the subject’s learning processes.

The program is best suited for use at intervals during regular activity as demanded by the child. This enhances the meaningfulness and functionality of the program, thus enhancing learning. This approach seemed to have played a significant role in developing sensory integration of the children who participated in the study. Children with ASD having different sensory dysfunctions were introduced to different activities of the HANDLE intervention program depending on their sensory requirements. The intensity, frequency and duration of each activity varied from child to child keeping in mind the modality of ‘Gentle Enhancement’. This approach was successful in preventing the subjects from lapsing into fright/flight/fight mode.

The highlight of the HANDLE approach is child centeredness where behavior is viewed as communication without attempting to control or mask behaviors before understanding them, thus conveying a non-judgmental evaluation of neurodevelopmental functions and is guided by the underlying treatment modality of Gentle Enhancement (Wagner, 2008). Treatment with Gentle Enhancement, not just in the connotation of therapy, but in its full meaning of how to interact with one another is the fundamental of HANDLE intervention program (Bluestone, 2005). Positive and negative behaviors of the subjects showed significant improvement as is evident from the results of this study. This relates well to the findings that having individualized child centered sessions where all the behaviors are accepted as communication, provides a non threatening environment for the child. This researcher experienced this with her subjects and interrelated the sensory dysfunctions to the behavior pattern and worked accordingly on the stressed sensory systems.
The intervention program used in this study focused on the different sensory dysfunctions of the children and the interrelation between them. The labyrinth of the body-brain-mind, cannot achieve sustainable functional goals by treating one area. The whole being experience should be kept in mind (Bluestone, 2005). HANDLE intervention program is not aimed at the behaviors, but at the neurophysiological disorders finding expression in the deviant behavior (Bluestone, 2005). The behaviors that many people with ASD naturally engage in- turning off parts of the body-brain-mind while rocking, focusing on seeming nothingness and making white noises are like traditional ways to relieve stress (Bluestone, 2005). All the above mentioned behaviors and many other self stimulatory behaviors were observed in the subjects of this study indicating the need to release stress created by the sensory dysfunctions. Post-intervention improvement in the behavior patterns of the subjects was suggestive of improved Sensory Integration. Parents also reported similar positive changes in their children and their findings correlated significantly with this study.

The parasympathetic and sympathetic divisions of the ANS have a great deal of autonomy in the way they perform, with the Central Nervous System (CNS) exerting little control. Indirectly, the ANS is very much involved in our behavioral responses to emotions such as fear, anger, panic, pleasure. These emotions are triggered by the brain centers, primarily in the limbic system. Without mediation by our cerebral cortices-the areas in our brains where we engage rational thought-messages sent from the limbic system to the autonomic control centers dictate many of our bodily responses (Bluestone, 2005). These autonomically controlled responses then produce further sensory input, which contributes to a continuation of the emotional response. In fact more than 80% of the fibers of the vagus nerve (services most of the internal organs) process sensory information, and many of those relate to comfort and discomfort in the gut. Through cyclical interaction among various nerves, emotional responses escalate unless the higher brain centers are able to intervene (Bluestone, 2005). The parents of this study reported a positive change in their child’s emotional responses and understanding.

The thalamus central to attentional disorders is structurally located in a part of the brain called the diencephalons. Having many direct connections to the limbic system,
some neuroscientists include it among the structure of the limbic system. It acts as the relay station for all senses other than the sense of smell. After receiving the necessary information from the senses, the thalamus sends information forward to the cerebral cortices and to the hypothalamus. When the thalamus gets disparate information from various senses and cannot form a coherent energetic sense, it disregards the information. The higher cortical areas and the hypothalamus get erratic messages that defy interpretation (Bluestone, 2005). In the present study this relates to the varied behavior difficulties observed in children with ASD due to deficiencies in attentional priorities. Post intervention improvement observed in attentional priorities correlated with the reduction in behavior difficulties.

Many individuals with ASD appear to have difficulty with self regulation (Siegel, 1996). Problems in self-regulation may be contributing to many of the behaviors observed in persons with ASD. These behaviors include disregard or exaggerated response to sensory stimulation, inconsistent ability to attend to tasks, distractibility, poor impulse control, limited frustration tolerance and fluctuating emotional reactions. (Yack, Sutton, & Aquilla, 1998). Subjects of this study were able to self regulate their negative behaviors significantly post intervention as is evident from the results of the study.

In the HANDLE evaluation phase, the neurological profile traces presenting concerns back to their origins, through the paths of vision and audition, proprioception, kinesthesia and vestibular functioning, to the most foundational level to touch, taste and smell. It incorporates the processes of attention, differentiation, lateralization and integration as well. The root causes of perplexing behavior and poor learning patterns are brought to light, and a picture of the dynamic interaction of neurological functioning emerges (Bluestone, 2002). These dysfunctions were observed at pretest and post test findings revealed significant progress made in the subjects of the study.

HANDLE looks for the cause inside the body system, working on the deficit sensory areas through ‘Gentle Enhancement’. The varied HANDLE activities gradually work on the weak sensory systems, thus enhancing learning. By developing the weak sensory systems, the overall development in terms of muscle tone, integration of senses, communication, emotions, energy and behaviors, social interaction, sleep and
anxiety see marked improvement. This is because all the systems are interrelated (Wagner, 2008). The results of the individual analysis of selected subjects of this study also indicate similar areas of improvement in the subjects observed by the parents. This reiterates the fact that the sensory systems are interrelated and interdependent.

In the present study, the analysis of observations made on SPCBS pre and posttest reveals a significant change in the Perceptual Cognitive and Behavioral skills of the experimental group. As per the researcher’s observation, there is an increase in the mean score (293.40) at posttest from that of the pretest (228.52) and a significant t value (21.12, df 24, p< 0.001) which indicates that HANDLE intervention program is effective in enhancing perceptual cognitive and behavioral skills in children with ASD. Thus, the results indicate that Hypothesis 1 is retained.

The significant change observed in experimental group of children in perceptual cognitive, positive and negative behavior patterns indicates that HANDLE intervention program is beneficial in minimizing sensory processing difficulties affecting perceptual cognitive and behavioral skills thus facilitating learning. This finding reiterates previous evidence that the HANDLE intervention program is effective in supporting and organizing the neurodevelopmental systems resulting in improved learning efficiency (Bluestone, 2004).

5.2 Hypothesis 2

Children with ASD who receive HANDLE intervention program will improve significantly in Perceptual Cognitive and Behavioral skills in comparison to those who do not receive the intervention.

There is a significant difference seen in perceptual cognitive and behavioral skills between the children with ASD who received HANDLE intervention program in the experimental group to the ones who did not receive HANDLE intervention in the control group. The significant difference seen between the experimental and control group of children with ASD indicates that SIT was not sufficient to significantly develop the weak sensory systems. The marginal improvement in the control group is suggestive of it. A significant change in perceptual cognitive and behavioral skills in children of the control group was not observed. A significant difference in the mean
gain between the experimental and the control group of children shows that the HANDLE intervention program was more beneficial in the development of perceptual cognitive and behavioral skills in children with ASD.

‘Gentle Enhancement’ prevents the child from getting into the fright/flight/fight mode thus minimizing the stress on the sensory systems and avoiding sensory overload. This study indicates that a Holistic Approach to Neuro Developmental and Learning Efficiency (HANDLE) model used with the experimental group was more effective in enhancing perceptual cognitive and behavioral skills in children with ASD than in the control group as care was taken not to let the subjects get into sensory overload.

The sensory related behaviors exhibited by persons with autism are thought to assist them in coping with their sensory environments by either generating or avoiding sensory input (Erner & Dunn, 1998). In this study, the behaviors were seen as an indication of sensory dysfunction and correlation of behavior to particular sensory deficit were studied.

When children with sensory integrative dysfunction are given the opportunity to receive appropriate input within the context of meaningful activity, the ability of the CNS to process and integrate sensory input can often be improved - and learning, movement, and "behavior" have the opportunity to be enhanced (Ayres, 1972). This researcher included the HANDLE movement activities in a meaningful and contextual way enhancing the ability to integrate the HANDLE activities for the child in his daily routine. This also helped the parent observing the sessions for the home-based follow-up program.

Several therapies, including SIT, have been evolved to address the sensory processing deficits in children with ASD. Evidence is reviewed on the prevalence of sensory and motor abnormalities in autism and the effectiveness of SIT designed to address such abnormalities. Although sensory processing and motor abnormalities are neither universal nor specific to autism, the prevalence of such abnormalities in autism is relatively high. There is, however, little controlled research on the effectiveness of SIT designed to address these abnormalities. Outcome studies of SIT were identified as such small scale that no firm conclusions regarding efficacy could be made.
(Dawson, & Watling, 2000). After nearly 40 years of research and practice, SIT still lacks reliable scientific support for its efficacy in the treatment of any diagnostic group (Hyatt, Stephenson, & Carter, 2009). SIT is expensive (Zane, Davis, & Rosswo1m, 2008), time consuming (treatment sometimes lasting several years), (Baranek, 2002) and its appropriateness and efficacy have been strongly called into question by experts in pediatric care and research (Poleniick et al., 2012). The above researches give a realistic overview of SIT.

According to Severs (2002), despite receiving years of SIT her autistic son’s vestibular and proprioceptive systems were immature. One year of HANDLE intervention program showed a radical change. Initially, his inappropriate behaviors consisted of high pitched screams, aggression, public nudity, problems with toilet training, and teeth grinding. He had limited fine motor activities. After HANDLE program, he was completely toilet trained, had minimal bouts of aggression. High pitched screams were not observed and teeth grinding was occasional. He wore different textured t-shirts too.

In individuals with ASD, the central nervous system sensitivities are so many and their enteric nervous system and immune systems may be so weak that their autonomic nervous system is continuously stressed, just trying to brace against constant bombardment from a hostile environment. Sometimes, as they protect themselves, they close down to activities, and it may be the behaviors that they do not exhibit that provide us the biggest clues into the puzzle of their neurodevelopmental profile. Not the presence of rocking and hand flapping, but the absence of a full range of rocking or the ability to move one hand without the other. Not the biting and swallowing of Styrofoam cups and the gnawing of shirtsleeves, but the lack of chewing food. Not the tantrum over having their nails cut but the blocking of sensations on their faces or the seemingly high tolerance for pain in general. These are some of the clues one must uncover if we are to help unlock these children from the traps of their irregular systems (Bluestone, 2002). In this study, the researcher observed what the behaviors were indicating. Progress of the subjects in the experimental group could be attributed to correlating behavior deficits with the weak sensory systems prior to intervention.
According to Nathan, (2009), HANDLE intervention program for persons with neurological disorders aimed at working towards looking at identifying the core deficit areas in social interaction, language and communication and behavior. As these areas are interrelated and are affected by sensory dysfunction, it becomes very essential to address the behaviors at their source. Individual analysis of the subject’s sensory dysfunction enabled the researcher to understand what the behaviors were communicating thus enabling working on the weak systems of the subjects using the HANDLE intervention activities.

To begin with, the subjects who were randomly selected were pretested in the areas of perceptual cognition, positive and negative behaviors. All the subjects were receiving regular SIT before and during the intervention period. Additionally, they received special education in their respective schools. Initial observation prior to intervention showed marked deficits in sensory issues. This questioned the efficacy of SIT in dealing with the sensory issues of these children as they were on SIT for a minimum of 6 months prior to the HANDLE intervention. This also gave an opportunity to study the effectiveness of SIT in dealing with perceptual cognitive and behavior difficulties in children with ASD.

In the present study, the obtained t value (2.14, df 48) is significant. There is a significant difference between the mean score of the experimental group (293.40) and control group (261.40) at posttest in the area of Perceptual Cognitive and Behavioral skills. The mean gain in Perceptual Cognitive and Behavioral skills in the experimental group (64.88) was higher than the mean gain in the control group (13.52). The derived t value (13.53, df 48) was significant (p<0.001). Thus, the results indicate that children with ASD who received HANDLE intervention program improved significantly in perceptual cognitive and behavioral skills in comparison to those who did not receive the intervention. This indicates that HANDLE intervention program was more effective in minimizing the sensory difficulties affecting perceptual cognition and behavior in comparison to those who did not receive HANDLE intervention program.
5.3 Hypothesis 3
The mean gain score on POS will correlate positively to the mean gain score on SPCBS

Another salient feature of the intervention program was demonstrating the techniques to the parents after they observed the sessions. This facilitated spontaneous use of the HANDLE activities by the parents at home as and when required by the child. This helped establish confidence in the parents in implementing the program they had received. Adequate observation and practice of techniques helped the parents in registering, retaining and retrieving the skills learnt. Parent training has been shown to be a very effective method for promoting generalization and maintenance of skills in children with autism (Ingersoll, et al., 2012).

Research suggests that using naturalistic teaching paradigms leads to therapeutic gains in clinic settings for children with autism and related disorders. Studies are demonstrating that implementing these strategies within a parent training format may produce collateral effects in other areas of family life. The parent training paradigm resulted in the families showing positive interactions on all four scales, with the parent-child interactions rated as happier, the parents more interested in the interaction, the interaction less stressful, and the communication style as more positive (Koegel et al., 1996).

Families are increasingly involved in the implementation of behavior support interventions to promote positive behaviors of young children in everyday family settings. Contextual fit, described as congruence between the behavior support intervention and the values, skills, resources, and routines of those who will implement the intervention, has been associated with the effectiveness and sustainability of the intervention. Findings revealed that researchers generally reported information about collaborative partnerships with families (McLaughlin et al., 2012).

Randomised control trials (RCTs) of interventions for pre-school children with autism findings report RCT for a parent training intervention with a focus on the
development of joint attention skills and joint action routines made more progress in language development than the local services group (Drew, 2002).

The HANDLE paradigm applies neuroscience to bring about integrated mind-bodies, enabled to accept life’s challenges. And it promises empowered families and communities to find within themselves the tools to move from dysfunction to function (Bluestone, 2002). The parents in this study felt empowered when they observed the sessions and were trained to carry out the home program. They initially demonstrated the activities to the researcher and after developing confidence carried out the program at home. Individualized sessions with the parents where beneficial in child-specific home programs as the frequency and duration of each movement activity was to be adhered to so that the sensory systems did not get overloaded.

The brain-behavior connection is very strong. Because the child with SI Dysfunction has a disorganized brain, many aspects of his behavior are disorganized. His overall development is disorderly and his participation in childhood experiences is spotty, reluctant or inept. For the out-of-sync child, performing ordinary tasks and responding to everyday events can be enormously challenging (Kranowitz, 1998). The POS used in this study clearly indicates the different areas of daily living skills, communication and motor skills which have also shown improvement. This clearly indicates that there was additional learning in the above mentioned areas besides gain in perceptual cognitive and behavioral skills. This again reiterates that sensory systems are interrelated. “Sensory processing machine” demonstrates the crucial interrelationship of the central nervous system and the senses. It shows that all parts of the central nervous system must communicate in order to integrate senses. Sensory integration depends on a sensory processing machine that is in good working order (Kranowitz, 1998).

Use of Gentle Enhancement and modeling to encourage mental rehearsals helped monitor the intervention program at home and parents gave valuable feedback about their child’s changes and progress. The parents achieved fluency and confidence in following the intervention program as a home program. Gradual fading of support and cuing for higher functioning children helped the children to use the program
themselves as and when they required. As parents were equipped with the techniques, it increased the chances for maintenance and generalization.

Significant observation made in the POS and its correlation with SPCBS is a good indicator of the parents’ view of their child’s progress and their participation in the follow-up program. The biggest advantage of this program is the ease with which it can be continued as a home-based program, supplemented with regular follow-up with the practitioner.

As per this researcher’s observations, there is a significant correlation (0.515, p <0.004) between the mean gain scores on POS and SPCBS, which indicate that HANDLE intervention program was effective in enhancing perceptual cognitive and behavior skills of children with ASD. Hence, the hypothesis stated is retained.

**Summary**

The above discussions clearly identify a group of factors which have resulted in the successful outcomes for children with ASD in this study. The HANDLE intervention program has been successful in significantly enhancing the perceptual cognitive and behavioral skills in children with ASD. Furthermore, in comparison to the control group, the experimental group showed a significant gain in perceptual cognitive and behavioral skills. Post intervention parental feedback of the children’s progress correlated positively with the study results.