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Abstract

Objective: In keeping with client-centered practice in support of occupational performance, we examined the use of a multisensory environment (MSE) on engagement in preschool children with Autism Spectrum Disorders (ASD), comparing two different methods: an individualized approach and a protocol-driven approach.

Method: Fifteen children, ages four to seven years, participated. A randomized, counterbalanced design was used to measure engagement in the protocol-driven condition and the individualized condition. In the protocol-driven sessions, the equipment was turned on in a slow, sequential manner. In the individualized sessions, participants were free to play and engage the MSE as desired. Engagement was measured across four variables: 1) The number of requests/initiations, 2) the duration of engagement /play, 3) affect, and 4) desired and undesired behaviors identified by the parents. Sensory processing patterns were determined through the Sensory Profile (Dunn, 1997). Parents were asked for their opinion of the use of the MSE under the two conditions.

Results: Results were not significant in terms of increased engagement in an MSE in the individualized approach. However, most parents valued the use of the MSE with their children.

Conclusion: This study provides a picture of engagement within MSEs for preschool children with ASD. Given the results, occupational therapists should select between the individualized and protocol-driven approaches according to their own clinical judgment. Further research is needed to guide best practice use of MSEs.

Effect of Individualized Use of a Multisensory Environment on Engagement in Preschool Children with Autism Spectrum Disorders

Autism Spectrum Disorders

Autism is receiving more coverage by the media because it is the fastest growing severe developmental disability in the United States (Centers for Disease Control and Prevention [CDC], 2010). Ten years ago, one in 10,000 children born in the United States was diagnosed with autism; today that number is one in every 68 children (CDC, 2014). The term Autism is credited to Swiss psychiatrist Eugen Bleuler, who coined it in 1910 to describe a group of symptoms related to schizophrenia (Kanner, 1943; Kuhn & Cahn, 1910/2004). As a developmental disorder, it was first described by American psychiatrist Leo Kanner in 1943. The National Institute of Child Health and Human Development (NICHD) defines Autism as a multifaceted neurobiological disorder of development that spans the lifetime (NICHD, 2005). Autism, classified as a developmental disorder, is one of an array of conditions collectively known as Autism Spectrum Disorder (ASD). In 2013, the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders ([DSM-5] American Psychiatric Association, 2013) classified ASD to encompass these four disorders: autistic disorder, Asperger's disorder, childhood integrative disorder (CID), and pervasive developmental disorder, not otherwise specified (PDD-NOS). ASD typically emerges between the ages of 18 to 24 months of age, though signs and symptoms may not be apparent until the ages of 24 months and 6 years of age (Autism Society of America [ASA], 2004a).

It is estimated that four million children are born in the United States each year, and approximately 24,000 of those children will be diagnosed with ASD (CDC, 2009). ASD can occur in all racial, ethnic, socioeconomic and intellectual groups and, on average, are four to five

times more likely to occur in boys than in girls (CDC, 2010; Fombonne, 2003). The specific cause for ASD is unknown but studies suggest that genetic, environmental, and neurochemical factors influence brain functions and structures leading to abnormalities (ASA, 2004c). Medical conditions such as phenylketonuria, tuberous sclerosis, and Fragile X syndrome are frequently occurring conditions in persons with ASD (American Psychological Association, 2004). Other related conditions may include cognitive disability, seizures, chronic constipation and/or diarrhea, sleep problems, pica, low muscle tone, pain, allergies/suppressed immune system, hearing and visual impairments, and sensory processing difficulties (ASA, 2004b).

The characteristics of ASD in children include impairments in social interaction, communication, behavior, and sensory processing (CDC, 2010). Each of these is reviewed below. The American Academy of Child and Adolescent Psychiatry (2010) list disturbances in social interaction commonly seen in children with ASD as difficulty in making friends, limited eye contact, flat affect, lack of social engagement, lack of enjoyment in being held, dislike of physical contact, and loneliness. Notable communication disturbances, including verbal and nonverbal communication, vary in severity with the most severe including not speaking at all and echolalia. Case-Smith and O'Brien (2010) note additional language and speech deficits as "syntax problems, atonal and arrhythmic speech, pronoun reversals, and lack of inflection and emotion during communication" (p. 171). Behavioral disturbances include patterns of behavior described as stereotypical: Repetitive, obsessive, ritualistic and perseverative (CDC, 2010). A distraction or change in routine from these behavioral patterns can be met with violent outbursts and self-injurious behavior. Observable, stereotypical motor patterns include hand flapping and body rocking. Other visible movement patterns include banging and rolling the head, lunging, swaying, darting, toe walking, and showing a lack of coordinated movement (Baird, Cass, &

Slonims, 2003). It is also commonly noted that children with ASD have sensory processing difficulties in which they struggle to manage sensory stimulation through the visual, auditory, tactile, proprioceptive, kinesthetic, and olfactory senses (Baranek, et al., 2007; Dahlgren & Gillberg, 1989). In a sample of 287 children diagnosed with ASD, 95% had sensory processing difficulties (Tomcheck & Dunn, 2007). An estimated 30% of individuals with developmental disabilities have sensory processing difficulties, which includes people with ASD (Baranek, et al., 1997).

Sensory processing and perceptual disturbances occurring in children are described in the research literature (Ayres, 1979, Parham, 2002, Dunn, et al., 2002, Miller, et al., 2007). Coping with these disturbances in everyday life is difficult and often restricts children from participation in daily activities, including play. Children with sensory-processing challenges can be under-responsive or over-responsive to sensory stimuli, resulting in different behavioral outcomes (Baranek, 1999; Baranek, et al., 2007, Tomcheck & Dunn, 2007). Dr. Temple Grandin, who herself has ASD and is an advocate in the field, explained that the central nervous system (CNS) becomes overwhelmed with constant sensory input and with limited output, and the CNS is unable to regulate itself, resulting in discomfort (Grandin & Scariano, 1986). This conflict within the CNS is often referred to as sensory modulation disorder. Affleck and colleagues (1984) noted that “if the body does not find a way to regulate itself, a state of chronic stress results” (p. 20). The influx of sensory stimuli, coupled with emotional and environmental factors, stimulate a stress response, and “stress is perceived by the [body] systems as a threat to its existence and leads to the fight or flight response” (Affleck, et al., 1984, p. 19). The fight or flight response is regulated by the autonomic nervous system (ANS). The ANS is always working and is comprised of two main branches. In stressful situations like fight or flight, the sympathetic

nervous system (SNS) causes an increase in pulse, respiration, and heart rate as the blood flows to the lungs, heart, and muscles to ready the body for action. At the same time, the parasympathetic nervous system (PNS) is activated allowing the opposite actions in order to maintain homeostasis and a symbiotic relationship.

Dr. Herbert Benson, professor at Harvard Medical School and co-founder of the Benson-Henry Institute for Mind Body Medicine at Massachusetts General Hospital, asserted that one way to counter the state of fight or flight is through the Relaxation Response (RR). The RR is a physiological response characterized as generalized decreased SNS activity and possible increased PNS (Hess, 1957, as cited in Benson, 1982). Four basic elements are usually necessary to elicit the RR (Benson, 1974):

1. Sustained focus on a repetitive mental activity or stimuli,
2. A carefree, passive attitude,
3. Decreased muscle tone, and
4. A quiet environment.

According to Benson and colleagues (1974), the RR should be elicited in a calming environment and in conjunction with other therapeutic interventions. This might include multisensory interventions.

Occupational Therapy, Sensory Integration, and Occupational Engagement

According to the American Occupational Therapy Association ([AOTA], 2001; 2011), occupational therapy can provide many services to children with ASD and their families. Case-Smith and Arbesman (2008) reviewed 49 articles lending support to occupational therapy interventions for ASD. Sensory integration therapy was cited as one of the leading interventions. Occupational therapy using sensory integration as a primary intervention is one of the most

frequently-requested services by parents of children with ASD (Mandell et al., 2005, Green et al., 2006, Goin-Kochel et al., 2009, as cited in Schaaf, et al., 2013). A recent randomized trial by Schaaf and colleagues (2013) assessed the effectiveness of occupational therapy using sensory integration (OT/SI) for sensory difficulties in children with ASD ranging from ages 4-8 years (n = 32). The results indicate that children in the intervention group (n = 17), who participated in 30 OT/SI sessions, scored much higher on the Goal Attainment Scales ($p = 0.003$, $d = 1.2$), self-care as measured by caregiver assistance ($p = 0.008$ $d = 0.9$), and socialization ($p = 0.04$, $d = 0.7$), than the control group (n = 15). The study asserts high rigor and lends strong support for sensory integration interventions for children with ASD. Dr. A. Jean Ayres, a leading occupational therapist and developmental psychologist, dedicated her career to understanding the complexities of the way the CNS integrates sensory information, and the possible deficits thereof, so that people could live meaningful and purposeful lives. Over forty years ago, Dr. Ayres set the foundation for sensory integration theory that undergirds occupational therapy intervention for sensory processing deficits in children with disorders, including children with ASD (Ayres, 1971).

Since the sensory deficits that often accompany ASD affect a variety of areas of occupation, sensory deficits are often a focus of "interventions to help an individual respond to information coming through the senses" (AOTA, 2011, p. 7), in order to generate an adaptive response. An adaptive response is described as a person's interaction with and reaction to objects, stimuli, and even other people within the environment, which is productive and meaningful to that individual. Occupational therapists are called upon to maintain the professions' dedication to "supporting health and participation in life through engagement in occupation" (AOTA, 2008, p. 626). An article via *Autism Speaks* reported that parents belonging

to *MyAutismTeam.com,* a social network for over 28,000 parents of children with ASD, listed occupational therapy as the number one therapy as rated by over 9,300 parents (Peacock, 2012). Occupational therapists view occupational engagement as a change agent. Since play is the primary occupation of a child, this is a key focus of our work with children.

Finding client-centered methods to increase occupational engagement may be one of the challenges when working with children with ASD due to specific characteristics of the condition, such as limited communication and limited affective engagement with others (Wimpory et al., 2007). One strategy to increase occupational engagement is the provision of choice. Previous research has suggested that providing choice enhances engagement. Studies by Dunlap and colleagues (1994) and Kern and colleagues (2001) examined the effectiveness of choice interventions for children with a variety of emotional challenges. The findings suggest that choice conditions result in increased engagement and fewer disruptive behaviors. A recent study by Lough and colleagues (2012), examined the effect of choice on a coloring task in children with ASD. One major finding is that when given choice, children spent a longer duration coloring.

The benefits of occupational engagement may also include enhancing the physiological function of the central nervous system, including the ANS. Neuro-occupation, a term coined by Padilla and Peyton (1997, as cited in Walloch, 1998), refers to the evolving, active, and symbiotic connection between the central nervous system and occupational engagement. The concept of neuro-occupation asserts that through the act of doing or active occupational engagement, the central nervous system can shape and reorganize itself. Many years ago, Ayres described ways in which changes in the nervous system afforded the opportunity for occupational engagement (1979). Years later, occupational therapists continue to explore this

dynamic relationship between occupational engagement and the nervous system. Walloch (1998) explored how pain can lead to a lack of occupational engagement and how mindfulness meditation fits into the management of the affective and sensory aspects of chronic pain. Howell (1999) showed how sensory deprivation or sensory overload in intensive care units can lead to difficulty organizing information, decline in cognitive function, auditory, visual and perceptual hallucinations which interfere with occupational engagement. Howell suggests that practitioners can increase or reduce the sensory stimuli to lessen the "strain" on the reticular activating system, thus facilitating occupational engagement. Way (1999) suggests that there is a bidirectional relationship between play and the homeostatic functions of the ANS, suggesting that play can be used therapeutically to enhance physiological function.

Another benefit of occupational engagement may be neuroplasticity. Kleim and Jones (2008) describe neuroplasticity as the way the neurons of the brain change in structure and function as a result of the type and amount of incoming stimulation, including cognitive, behavioral, and sensory experiences (p. S226). According to Pagliano (2012), sensory stimulation is imperative to the process of neuroplasticity. Kleim and Jones (2008) identified ten principles of experience-dependent plasticity; several of these principles lend support to occupational engagement: age, repetition, intensity, time, specificity, and salience (or meaning, which is a core construct of occupational therapy). Parham and colleagues (2011) and Pagliano (2012) emphasize that sensory integration interventions should always be collaborative, non-prescriptive, and delivered by a caring individual with whom the child feels comfortable. Pediatric occupational therapists utilize an array of meaningful and purposeful play-based interventions (including multisensory mediums) to elicit occupational engagement.

Multisensory Environments

The environment in which the sensory stimuli are delivered is important in the therapeutic process (Slavik & Chew, 1990; Walker, 1991). Dr. Ayres delivered her sensory integration therapy in a playroom with specific characteristics, including the presence of an occupational therapist or trained professional, a calm and safe environment, and occupational forms that provided significant sensory opportunities utilizing a variety of modalities to engage the senses (Ayres, 1971; Ayres 1979 as cited in Parham et al., 2007), such as suspension equipment, therapy balls, ramps, and climbing structures. In contemporary practice, therapeutic interventions often take place in dedicated spaces called Multisensory Environments (MSEs). Although MSEs do not utilize all of the specific characteristics of sensory integration treatment spaces, the underlying sensory integration theory lends support to the use of MSEs to provide sensory input. MSEs are designed to create a comfortable, welcoming environment that promotes relaxation and offers opportunities for an adaptive response (Messbauer, 2012). Linda Messbauer, an occupational therapist, is credited for bringing the first MSE to the United States from Europe, where it has been widely utilized in therapy for some time. In 1979, occupational therapists Ad Verheul and Jan Hulsegge at The Hartenberg Institute in Holland produced the first MSEs for utilization in therapy with people with intellectual disabilities to "find a balance between relaxation and activity within . . . a safe, adapted environment, supported by a facilitator," (Lotan & Gold, 2009, p. 207). The MSEs were carefully designed spaces created to engage sensory systems, eliciting neurophysiological changes by using innovative technology: moving images, soft music, tactile input, colorful lighting, fiber optic cables, bubble tubes, and a multitude of other sensory experiences (Hulsegge & Verheul, 1987). The equipment in the MSE

later became trademarked products marketed under the name Snoezelen®, registered by the UK-based company Rompa®. The MSE was predominantly utilized as a therapeutic intervention for older adults in hospital settings and mental health facilities, but Messbauer (2012) notes that the use of the MSE appears to be gaining popularity as a therapeutic intervention for children with disabilities. She notes that use of moving visual stimuli elicits head movements (to visually track the stimuli), thereby stimulating the vestibular system, even in the absence of traditional suspension equipment. Proposed benefits of using MSEs include brain arousal, neuroplasticity, and vestibular stimulation, according to Messbauer (2012).

Prior Research

Published research to support the claimed benefits of MSEs is limited (Hogg, et al., 2001; Lotan & Gold, 2009). There is mixed evidence in support of the use of MSEs with adults with ASD and intellectual developmental disabilities ([IDD], Kaplan, et al., 2006; McKee, et al., 2006; Lotan & Gold, 2009). In the study by Kaplan and colleagues (2006), three participants (ages, 31, 52 and 47 years) with mild IDD*,* Autism, and severely challenging behaviors (spitting, elopement, biting of self and others, and frequent crying incidents) were treated using a stimulation paradigm in an MSE followed by having the participants engage in functional tasks of their choice, such as a color bingo game, making and eating a peanut butter and jelly sandwich, and playing catch using a ball with a staff member of his/her choice. The frequency of challenging behaviors during the functional tasks was measured to investigate if there were behavioral improvements following the MSE treatment sessions. The results suggested a reduction in the frequency of challenging behaviors following the MSE sessions. However, the small sample size and individual differences were limitations of this study.

Mckee and colleagues (2006) investigated the effects of an MSE on disruptive and prosocial behaviors on three male participants (ages 28, 31, and 32 years) in a hospital ward. Specific disruptive and prosocial behaviors were documented on ten different occasions within a two-month period, lasting between 45 and 90 minutes each. Disruptive behaviors included hitting other people, throwing objects, hitting windows, head banging, spitting, and threats. Prosocial behaviors included speaking slowly enough to be understood, assisting staff with a task, using words to communicate, and making eye contact when speaking. The authors reported that all of the participants had different responses to the MSE. None of the clients demonstrated a decrease in disruptive behaviors, one participant showed an increase in disruptive behavior, and there was only a slight increase in prosocial behaviors while engaging in the MSE. The data does not support the assertion that MSEs are effective interventions for a population with aggressive behavior. Limitations include a small sample size, individual differences, and a notion that the use of the MSE was not delivered as contingently as planned.

A meta-analysis by Lotan and Gold (2009) explored the effectiveness of interventions in controlled MSEs for a wide age range of individuals with intellectual disabilities. Ten articles were included in the analysis. Among the studies, a variety of research methodologies, therapeutic interventions, and measured goals and outcomes were reported. No randomized control trials were reported. There were 2 to 54 participants per study, with an average of 9. The ages of the participants ranged from 5 to 65 years with a mean age of 33 years. In a small percentage of the studies, the participants had a dual diagnosis of ASD and IDD. The length of the MSE sessions was between 20 and 40 minutes, with an average of 30 minutes per session. Some studies included group treatment. Intervention frequency ranged from one to five sessions per week, with an average of two sessions for each client weekly. The total number of

intervention sessions ranged between two and fifty sessions, with an average of twenty sessions per intervention per participant. A variety of outcome measures were employed, including the frequency of adaptive or maladaptive behaviors, concentration and responsiveness, engagement in a functional task, and fluctuations in heart rate. Some studies explored how the behaviors were influenced during the intervention sessions, while other studies measured the behavioral changes as they occurred in daily interactions. For the meta-analysis, four categories were created to compare the studies:

1. Behaviors measured immediately after an active intervention session in the MSE,
2. Behaviors measured ten minutes after termination of the MSE,
3. Behaviors measured in another situation (another person present but no active interpersonal therapeutic intervention), and
4. Behaviors measured within daily interactions after the MSE intervention.

The results from the studies were converted into effect sizes. Effect sizes ranged from moderate to large (0.63 to 2.63), but statistical significance was not reached due to heterogeneity between the ten studies and the small number of studies in each category. The meta-analysis suggested that use of MSE/Snoezelen® may be a beneficial therapeutic intervention when implemented on an individual basis to encourage adaptive behaviors (including engagement). The authors suggested that future studies should include larger sample sizes, improved rigor of the research designs, and the use of diverse populations to support the efficacy of MSEs.

While MSEs are implemented with various populations in a variety of settings, the philosophy of Verheul and Hulsegge (1978) asserts that people with disabilities interact with an MSE by depending on their senses in a non-directive, exploratory manner. In keeping with Verheul and Hulsegge's philosophy, occupational therapy embraces a client-centered [child-

centered] approach to therapeutic interventions. Occupational therapists utilize a dynamic and holistic approach to treatment; they do not prescribe treatment. A client-centered approach is "an orientation that honors the desires and priorities of clients in designing and implementing interventions" (AOTA, 2008, p. 670). Evidence suggests that the occupational therapy intervention process should be individualized, intensive, and comprehensive, and that it should facilitate active engagement of the individual (Tomchek & Case-Smith, 2009). It is important to note that there is limited research to support the use and efficacy of MSEs, particularly using a client-centered approach, with children with an ASD diagnosis.

Present Study

This study further examined the effects of MSE on engagement in children with ASD. The primary hypothesis was that engagement within the MSE would be greater using an individualized approach compared to a protocol-driven approach. Data were collected for a parallel project to test the hypothesis that use of an individualized approach, versus a protocol driven approach, will result in more optimal ANS activity, as measured via physiological indicators; those results will be reported separately.

Method

This study was conducted at the Sensory Playroom within ProMedica Toledo Children's Hospital Autism Center**.** The University of Toledo's Biomedical Institutional Review Board approved the study procedures. Parents or legal guardians (referred to as parents from this point forward) provided informed consent, and child participants provided assent.

Participant Characteristics

Participants recruited for this study were preschool-aged children with an ASD diagnosis. Participants were recruited through flyers and word of mouth via the community as well as

facilities and organizations serving children with ASD and their families. Participants were recruited from the Northwest Ohio region and the adjacent county in Michigan. In an attempt to find a homogenous sample of children with ASD, exclusion criteria included other major medical diagnoses such as Cerebral Palsy and Down Syndrome; primary sensory loss; history of seizures; and medical complications that affect cardiac activity. Participants were compensated with a gift card in the amount of $100 for complete participation. In addition, the child participant was offered stickers valued at $0.25 as a small token for participation, after each of the seven sessions.

Demographics Questionnaire. Parents completed an initial questionnaire to obtain demographic information. The questionnaire requested information regarding the participant's race, age, gender, age of diagnosis, medical history, family structure, current therapy received, and socioeconomic status (see Appendix A). Socioeconomic status (SES) was rated using Hollingshead's *Four Factor Index of Social Status* (1975), a measure of social status based on four domains: marital status, employment status, educational attainment, and occupational prestige. Scores range from 0-66, with the higher numbers reflecting the highest SES.

Each participant was assessed using the *Sensory Profile* (Dunn, 1999) as a baseline measure for the child's sensory processing pattern. The *Sensory Profile* was administered in a booklet format. The *Sensory Profile* is a 125-question caregiver completed profile that documents the frequency of a child's response to a variety of sensory stimuli, which is then used to infer the child's sensory processing pattern. The parent is asked to check a box to rate the frequency with which the child engages in given behaviors, rated on a Likert scale: (1) Always; (2) Frequently; (3) Occasionally; (4) Seldom; and (5) Never. This is an interval level of measurement, and the lower scores denote greater symptoms. Selected items are classified by

these sensory systems: touch, movement, body position, visual, auditory, and taste/smell, and two behavior categories: activity level and social/emotional. Those items are then grouped in three categories:

1. Sensory processing: auditory processing, visual processing, vestibular processing, touch processing, multisensory processing, and oral sensory processing
2. Sensory modulation: endurance/tone, modulation related to body position and movement, modulation of movement affecting activity level, modulation of sensory input affecting emotional responses, and modulation of visual input affecting emotional responses and activity
3. Behavioral and emotional responses: emotional/social responses, behavioral outcomes of sensory processing, and items indicating thresholds for response

Every item on the questionnaire also describes a behavior that organized specific sensory processing systems into four quadrants, described as Dunn's four-quadrant model: Low Registration, Sensation Seeking, Sensory Sensitivity and Sensation Avoiding (Dunn, 2007). The child who takes a calm, inactive method to self-regulation could fall into the Low Registration category, whereas a child who takes an active method would classify as Sensation Seeking. This child may engage in intense sensory stimulation activities. The child who displays Sensory Sensitivity is the child who may be observant of his or her surroundings instead of taking a more active approach, in order to avoid feeling overwhelmed. According to Dunn, children who display Sensory Sensitivity often fidget excessively, cover their ears with loud sounds, exhibit irritable, demanding, short-tempered behavior, and have difficulty remaining engaged (1997, 2007). A child who protects him or herself from sensory stimulation is considered Sensation Avoiding. The sum of the raw scores in each of the quadrants can be compared to normative data

to classify children with sensory processing challenges. Scores one standard deviation from the mean of the normative population (referred to as the norm) indicate a Probable Difference, whereas scores two or more standard deviations from the norm indicate a Definite Difference.

Dunn (1999) described the psychometric properties of the *Sensory Profile* as follows: Cronbach's alpha for internal consistency ranged from 0.47 to 0.91. The Standard Error of Measurement (*SEM*) was also conducted for each section and factor area. *SEM* is an alternative way to evaluate the reliability of a measure where the smaller the *SEM*, the more reliable the measure. *SEM* scores ranged from 0.92 to 2.89 for a number of sections of the profile. Internal validity correlations ranged from 0.25 to 0.76, and construct validity showed a correlation ($p < 0.05$) when comparing the results of the *Sensory Profile* to EDR. Content, convergent, and discriminant validity were established for the *Sensory Profile*. Content validity was established while creating the Sensory Profile through expert analysis, category analysis, and literature review. Construct validity was also analyzed by convergent validity with the *School Function Assessment* (Coster et al., 1998). There were large correlations between the fine/perceptual motor and the performance items on the *School Function Assessment*. Moderate correlations between the Behavioral Regulation and Positive Interaction sections of the *School Function Assessment*, and the Modulation sections from the *Sensory Profile,* suggest convergent validity. Low correlations between the more detailed items on the *School Function Assessment* and the items on the *Sensory Profile* provide evidence for discriminant validity.

The *Child Autism Rating Scale ([CARS],* Schopler et al., 1994), a behavioral rating scale with 15 items, was utilized to describe the severity of the participants' Autism. The evaluator rated the child on a scale from 1 to 4 (with midpoints scores of 1.5, 2.5 and 3.5) for each item. Total scores range from 15 to 60. Scores below 30 indicate that the individual is in the non-

autistic range, scores between 30 and 36.5 indicate mild to moderate autism, and scores from 37 to 60 indicate severe autism (Schopler et al., 1994). The *CARS* has been used in studies with children, adolescents and adults (Schopler et al., 1994; Njardvik et al., 1999; Elia et al., 2000). Schopler and colleagues (1994) described the psychometric properties of the *CARS* as follows: coefficient alpha of 0.94 for internal consistency, alpha of 0.71 for interrater reliability, and alpha of 0.88 for test-retest reliability.

MSE and Conditions

The MSE was approximately 18' x 18', featuring equipment that can be arranged in various configurations to include a variety of multi-sensory equipment (see Figure 1); a detailed description of the MSE equipment is provided (see Appendix B). In the protocol-driven condition, the MSE equipment was turned on in a slow, sequential manner in a clockwise direction around the MSE; the order of activation is provided (see Appendix B). The first piece was turned on immediately. Subsequent pieces were turned on at two-minute intervals until all ten pieces of equipment were running. The participants remained in the MSE for approximately 30 minutes. In the individualized condition, participants were free to play and engage the MSE for 30 minutes. Participants were able to request (through their usual means of communication) which MSE items or equipment they wanted activated. Devices were turned off when participants no longer engaged with them. This study employed a counterbalanced design. The order of the sessions were randomized and counterbalanced across the participant pool, using block randomization.

Procedure

Participants attended seven sessions (one introductory session and six MSE sessions). Sessions were scheduled at the convenience of parents and were completed in a three-month

span. Sessions were conducted at approximately the same time of day in an effort to control for individual differences across time of day.

In the first session, the research personnel obtained informed consent from the parents and assent from the participants. The child participant and parent were oriented to the study protocol (including the email procedure to schedule sessions and to arrive with their child rested, fed, and toileted or changed, as appropriate). The parents completed the demographics questionnaire and the *Sensory Profile* (Dunn, 1997) while the research personnel conducted the *CARS* (Schopler et al., 1994) with the child participant in an adjacent room. The *CARS* assessment was videotaped using a Panasonic high definition video recorder with audio capabilities for later offline analysis. For testing the hypotheses of parallel studies, branches of the ANS was measured using chest- and wrist-worn devices. A stuffed bear named Lucy was used to demonstrate donning and doffing of the devices during the first session. The research personnel demonstrated the use of the physiological measurement devices and asked that the parent assist in applying them to the child participant.

Upon arrival for the six subsequent MSE sessions (three in the protocol-driven condition and three in the individualized condition), the parents were asked to assist the research personnel in applying the physiological measurement devices when needed. Child participants remained seated on a child-sized chair next to the door while the physiological measurement devices were prepared to activate and stream/record. The child participant was then led to the MSE to engage in a 30-minute session.

Parents had the option to inconspicuously observe the sessions via the two wall-mounted cameras or to accompany the child. Research personnel remained with the participants in the MSE to ensure their safety and take field notes. Research personnel only interacted with the

participant if the participant initiated the interaction. When participants engaged in behaviors that were unsafe or destructive, research personnel redirected them. If unsafe or destructive behaviors persisted after three attempts to redirect, the parent was asked to intervene. If the parent intervention was unsuccessful, the session was terminated.

After completion of all MSE sessions, parents were asked to observe videotaped sessions and count incidents of desired and undesired behaviors (as they defined them). Parents were also asked to complete a reflective questionnaire about their child's experience in the MSE (see Appendix C).

Measurement

Engagement. Each session was videotaped for offline analysis from five different camera angles (one faced the bubble tubes, one was located in the loft area, one faced the ball pit, and two were wall-mounted, belonging to the facility). Engagement was used as the primary outcome measure. Engagement was measured across four variables. The first variable was the number of requests or initiations for an MSE item to be turned on or off in the individualized condition. Requests and initiations were defined as such: pointing toward an item or piece of equipment, positive vocalizations, smiling, laughing or immediately engaging/playing with an item. The second variable was the duration of engagement/play within the MSE, measured in minute:second increments. The third variable was affect, measured by identifying negative, neutral, and positive affect. The affective signs could range from extreme distress to extreme excitement. Negative affect includes signs of distress, ranging from frowns, grimacing, whining, inconsolable crying and negative verbalizations. Neutral affect includes being somber during MSE engagement/play and flat affect. Positive affect includes smiling, laughing, and positive vocalizations. Affect was quantified by tallying the number of minutes spent displaying negative,

neutral, and positive affect for each session. The fourth variable was occurrence of the top three desired and undesired behaviors identified by the parents (see Appendix B). The number of desired and undesired behaviors was tallied for each session.

Parent Opinion. Parents were asked for their opinion of the use of the MSE under the two conditions.

SNS Data. For parallel studies, the sympathetic and parasympathetic nervous systems were measured as follows: EDR, indicating SNS activation, was recorded using an Affectiva Q Sensor 2.0 (Waltham, MA, USA). The sensor, embedded in a lightweight, washable wristband, measured EDR, temperature, and acceleration. The sensor was placed on the participant's right or left wrist prior to entering the MSE. The participant's wrist was cleaned with a hypoallergenic wipe. Data was streamed via Bluetooth® wireless communication to a Dell Latitude E6430 computer and was logged on the internal USB drive on the sensor. Heart rate variability (HRV), an indicator of PNS activation, was taken from the inter-beat heart rate (R-R) and was measured via a RS800cx Polar WearLink® transmitter (New York, NY, USA). The transmitter was mounted on a chest strap, moistened with a conductive gel, and placed around the chest just below the pectoral muscles. The transmitter sent heart rate data to a wrist-worn hard drive and a local laptop via proprietary WindLink technology.

Data Analysis

For statistical analysis, the dependent variables from the second and third sessions in each condition were averaged to control for novelty of the condition and individual variation. In order to use each participant as his/her own control, paired *t*-tests were used to compare the protocol-driven condition data and the individualized condition data. The Alpha level was set at 0.05 for testing the hypothesis that engagement within the MSE would be greater using an individualized

approach compared to a protocol-driven approach. Data are presented as mean and standard error of measurement in graphs.

To assess interrater reliability, two research students rated 20% of the videotaped sessions. A linearly weighted Kappa statistic was calculated for agreement of each interrater with the researcher. The linearly weighted Kappa statistics for the two interraters were averaged. Agreement ranged from substantial to excellent (requests, .66; duration, .75; negative affect, .92; neutral affect, .84; positive affect, .98). Parent opinion was reviewed to establish patterns/categories. Patterns/categories were identified for all three questions.

Results

The parents of sixteen children provided informed consent; however, one did not attend subsequent sessions. Fifteen child participants attended all sessions. Technical difficulties resulted in the loss of video footage for two of the five camera angles. Children ranged in age from four years to seven years (5.3 ± 1.1 years). There were 13 boys and 2 girls. Ten of the fifteen children included in the study identified as having an ASD diagnosis; five of the fifteen identified as having a diagnosis of PDD-NOS. The age range of the initial ASD diagnosis was two years to five and a half years (3.1 ± 1.2 years). The participants' prior medical histories included the following: ear, nose and throat conditions, respiratory conditions, mental health conditions, speech/language delays, reproductive conditions, and allergies. During this study, eleven participants were receiving occupational therapy services, ten were receiving speech therapy, two were receiving Applied Behavior Analysis (ABA) treatment, one was receiving Perceptual Motor Development (PMD) services, and one was receiving sleep therapy. Thirteen of the participants' parents were married, two were single. Four participants had no siblings, six had one sibling, and five had two or more siblings. Ten of the families identified as White, two as

African American, two as Biracial, and one as Hispanic in origin. Hollingshead's *Four Factor Index of Social Status* (1975) scores ranged from 15 to 59.5 (34.3 ± 12.7). The mean score represents the lower middle class. See Table 1 for demographic summary.

In this study, none of the participants had *Sensory Profile* (Dunn, 1999) scores in the typical range in all four of the quadrants; however, three were in the typical range in the Low Registration quadrant; two were in the typical range in the Sensory Sensitivity quadrant; and two were in the typical range in the Sensory Avoiding quadrant. There were no participants in the typical range in the Sensation Seeking quadrant. Four participants had scores in the Probable Difference range and 9 had scores in the Definite Difference range. Nine of the participants had scores in the Definite Difference range for Multisensory Processing. The number of participants in each range for each quadrant is recorded in Table 2.

CARS (Schopler et al., 1994) scores were calculated after viewing the videotaped observations from the introductory session. One participant was not scored on the *CARS* because technical difficulties resulted in the video recording being unavailable. According to the *CARS* criteria, four participants scored in the Typical (0-29) range, eight participants scored in the Mild/Moderate range (30-37), and two participants scored in the Severe range (38-60).

To test the hypothesis that engagement within the MSE would be greater using an individualized approach compared to a protocol-driven approach, engagement data were obtained from the video recorded observations of each of the sessions and measured across four variables, including: 1) The number of requests/initiations for an MSE item to be turned on/off in the individualized condition, 2) the duration of engagement /play within the MSE, measured in minute increments, 3) affect, measured by identifying negative, neutral and positive affect, and 4) the top three desired and undesired behaviors identified by the parents. The average number of

requests or initiations per session during the individualized condition was 26.1 ± 3.7, ranging from 7.5 to 53 requests/initiations. The average number of requests/initiations per session during the protocol-driven condition was 23.2 ± 2.1, ranging from 10 to 39 requests/initiations, representing no statistically significant difference ($p = .318$). The average total duration of meaningful engagement during the 30-minute sessions, measured in minutes:seconds, in the individualized condition was 24:32 ± 0:49, ranging from 17:45 to 29:50 minutes:seconds compared to 23:30 ± 1:15, ranging from 15:28 to 29:13 in the protocol-driven condition. There was no statistically-significant difference ($p = .433$).

Participants' observable facial expressions and behaviors were interpreted to reflect affect and categorized as negative, neutral, or positive. The average number of minutes in which affect was negative per session in the individualized condition was 1.5 ± 0.8, ranging from 0 to 11. In the protocol-driven condition, the average number of minutes in which affect was negative averaged 1.6 ± 0.7 per session, ranging from 0 to 10.5. The average number of minutes in which affect was neutral in the individualized condition was 19.1 ± 1.6, ranging from 8.5 to 28.5. In the protocol-driven condition the occurrence of neutral affect averaged 17.8 ± 1.4 minutes, ranging from 7.5 to 23.5. The average number of minutes in which affect was positive in the individualized condition were 8.7 ± 1.8, ranging from 2 to 21. In the protocol-driven condition positive affect averaged 9.4 ± 1.4 minutes, ranging from 3 to 22.5. There were no statistically significant differences in affect between the individualized and protocol-driven conditions ($p = .719, .282, .545$ for negative, neutral, and positive affect, respectively).

Parents of participants listed their top most desired and undesired behaviors. They then watched video recordings of their children's sessions and counted the number of incidences of each. Occurrences of behaviors that parents desired in the individualized condition averaged 27.1

± 7.4 per session, ranging from 0 to 75.5. The average number of occurrences of parent-desired behaviors in the protocol-driven condition were 24.2 ± 6.9, ranging from 0.43.5, representing no statistically-significant difference (p = .642). Occurrences of behaviors that were undesired by parents in the individualized condition averaged 8.8 ± 2.6, ranging from 0 to 32. The average number of parent-undesired behaviors in the protocol-driven approach were 8.5 ± 2.8, ranging from 0 to 30.5. There was no statistically significant difference (p = .910). See Figures 2 - 5. For examples of desired and undesired behaviors identified by parents, see Appendix D.

Categorization of parent opinions regarding what they value and do not value in the use of MSE resulted in identification of five categories: choice/autonomy, engagement, interpersonal communication, limited interaction with equipment, and negative behaviors. See Table 3. In the individualized-driven condition, parents valued choice (n=10) and interpersonal communication (n=10). Parents did not value limited interaction with the equipment (5) and negative behaviors (4). In the protocol-driven approach parents valued engagement (6) and exploration (4). Three parents preferred the individualized-driven approach, four parents preferred the protocol-driven approach, and seven parents did not identify a preference. Thirteen parents described a positive impression of the MSE and two parents remained neutral but found value in using the MSE for "sensory breaks."

Discussion

This study sought to evaluate whether engagement within the MSE would be greater using an individualized approach compared to a protocol-driven approach; this hypothesis was not supported by data analysis. One possible explanation for the lack of difference between the two is the potential for a ceiling effect. The research sample was largely comprised of children with mild to moderate Autism, many of whom were or had been receiving various therapies.

This may account for their relatively high engagement, as measured by all dependent variables, under both conditions. Results may have been different with participants with increased severity of ASD.

Another possible reason the hypothesis was not held up is potential for an order effect for individual participants. A factor that may have influenced engagement during MSE sessions was the interaction with the research personnel. During the protocol-driven approach, the research personnel activated the equipment during timed intervals and the participants had an opportunity to see how the MSE worked. If a participant encountered the individualized condition first, he/she may not have known of the possibilities of activating the equipment. In the individualized condition, the research personnel would only interact with the participant if the participant initiated the interaction. The participants who engaged the MSE in a protocol-driven approach knew what they liked and would request the favored items. Some of the participants who engaged the MSE during the individualized approach did not explore the MSE and missed out on items they may have enjoyed.

In our study there was no difference in the number of requests/initiations made by the participants in the two conditions; there were 23-26 requests in the 30-minute sessions. However, the provision of choice may be one reason that there were three more requests in the individualized condition. It is also interesting to note that requests/initiations had the lowest interrater reliability; one possible reason for this is the researcher's personal relationship with the participants, helping to make the researcher more sensitive to participants' subtle requests/initiations. In the present study, there was no difference in the duration of play under the two conditions. However, the participants engaged in meaningful play for 78-82% of sessions, regardless of the condition, lending support to the ceiling effect.

In both conditions, 62-65% of observable affect was neutral, 30-33% positive, and 5-6% negative. Outside factors may have influenced these findings. Several participants had flat affect; therefore, the neutral affect was to be expected regardless of the condition. Parents were pleased with the positive affect displayed, reporting that positive affect was higher in the MSE than in the home environment. In some instances of negative affect the participant was having "a bad day" prior to entering the MSE (as recorded via field notes/parent reports).

Though there were no differences in engagement in the MSE between the conditions, parents expressed opinions in support of the use of the room in general. Since many children with ASD have difficulty with joint attention (the ability to share a common focus on something), engaging the research personnel was important to several parents. Many of the parents expressed how impressed they were that their children were interacting/communicating with the researcher. However, one interpretation of this feedback is that the human factor of the researcher's personal characteristics and interaction skills accounts for the social engagement as opposed to any therapeutic effect of the MSE.

Parents reported a preference for "routine." Many of the participants and/or their parents had exposure to Applied Behavioral Analysis (ABA). ABA is the analysis of how learning takes place and uses behavior modification as part of the treatment process. It has strong roots in classical and operant conditioning. Well-known Autism resources cite ABA as a leading intervention for children with ASD (U.S. Department of Health, 1999, Autism Speaks Inc., 2014), and some parents prefer its rigor. In ABA, learning takes place in a highly-structured manner throughout the day. There is a great emphasis on positive reinforcement for demonstrating socially-acceptable behaviors or skills. For example, if social behavior is targeted, when the child makes an appropriate request, an environmental modification is introduced such

as a reward accompanied by teaching instructions. Changes are then objectively measured. In complying with this philosophy, parents are trained so that they can carry out this structure throughout the child's day. The child does not receive rewards for behaviors that are not socially appropriate. It is possible that preference for the ABA approach may have influenced parents to prefer the protocol-driven condition.

The physiological and developmental challenges faced by young children with ASD, particularly sensory processing, communication, and social interaction struggles often cause difficulty in engaging in activities/occupations. Parents and caregivers of children with ASD often seek innovative and creative therapeutic interventions. Occupational therapists seek ways to enhance occupational performance and promote occupational engagement by utilizing novel approaches to therapy. Use of MSEs is a prime candidate for exploration. Novelty can be challenging for children with ASD due to each child's individual sensory processing pattern. Pediatric occupational therapists with a vast knowledge and understanding of sensory integration principles utilize the MSE to introduce novelty in a non-threatening way. Occupational therapists also understand the importance of rapport building and strive to introduce new sensory experiences in a manner that will help children reach their developmental potential. They understand that each child is unique; therefore, sensory experiences are individualized. It is interesting to note that none of the participants in this study were afraid of the MSE, every participant was eager to re-enter the MSE after the first visit, and most of the parents supported the use of MSE with children with ASD.

The findings of this study provide insight for occupational therapy professionals, caregivers of young children with ASD, and facilities using MSEs as therapeutic interventions for young children with ASD. The results provide a snapshot of engagement within MSE in

terms of requests/initiations, duration of engagement, affect, parent-identified desired/undesired behavior, and first-hand accounts of the use of an MSE from parents of children with ASD. Previous research by Lotan and Gold (2009) suggested that use of MSE/Snoezelen® may be a beneficial therapeutic intervention when implemented on an individual basis to encourage adaptive behaviors (including engagement). It is interesting to note that although the use of the individualized approach did not enhance engagement, it also did not reduce it, so clinicians could continue to use either at their own clinical judgment in selecting between protocol-driven and individualized approaches.

Limitations

A number of limitations must be considered when interpreting the results of this study. This study has similarities to a past research by Lotan and Gold (2009). In both studies, the sample size was small, the duration in the MSE was similar, and there was no statistical differences with use of the MSE. The present study, however, employed a counterbalanced design, which allowed for pair wise *t*-testing. This type of design reduced but did not eliminate errors of false negativity. Despite the fact that the research used a counterbalanced design, qualitatively, the researcher and parents perceived an order effect. These results are at risk for a Type II error due to the small sample size or dispersion due to measurement error. Low external validity may also be a limitation of this study due to artificiality of the use of the MSE. Participants were not regular users of the MSE, nor was attendance at research sessions a regular part of their routines. Participants were fairly high functioning on the Autism Spectrum. Another limitation was measurement sensitivity. Behavior rating systems are prone to interpretation; however, there was adequate interrater reliability. Categorical data from parents is individual and subjective. Loss of data was a limitation in this study. Video footage from up to 3 of the 5

cameras was lost to technical difficulties, including one of the *CARS* assessments. There may have been confounding factors influencing the children's behavior in the MSE. The intent was to study engagement, but the human factor of having the research personnel in the MSE was a limitation. Data were collected in winter, and several of the participants were recovering or experiencing cold/flu symptoms. Results should be interpreted with caution, due to the subjectivity of the behavior ratings as well as the ceiling and order effects throughout.

Future Research and Conclusion

Several elements of research design and data collection may warrant adjustment in future studies. For example, future studies might utilize more sensitive measures of engagement, enroll participants with more diverse demographics, focus on children with more severe autism symptoms, or could be carried out in the summer months (or in a different climate).

The use of MSEs is gaining popularity in the United States as therapists are continuously seeking novel approaches to therapy. It is imperative for therapists to know and understand what effective strategies exist in order to increase occupational engagement. This study suggests that clinicians should use their knowledge of individual clients and their needs to select between the use of an individualized approach or a protocol approach, as each may have its benefits. Under the individualized approach, affording the participants choice may be a successful strategy for increased engagement. On the other hand, children may become more familiar with the opportunities afforded by the MSE under a protocol-driven approach. To gain a better understanding of the best practices in using MSEs, further research regarding the use of MSEs for engagement in children with ASD is needed.

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References

Affectiva, Inc. Overview. Resources. Retrieved from http://www.qsensortech.com/overview/

Affleck, A., Bianchi, E., Cleckley, M., Donaldson, K., McCormack, G., & Polon, J. (1984). Occupational therapy and the patient with pain. In F. Cromwell (Ed.) *Occupational Therapy in Healthcare*, *1*, (pp. 17-42). New York, NY: Haworth Press.

American Academy of Child & Adolescent Psychiatry (2010). Autism Resource Center. FAQs on Autism. *What is Autism?* Retrieved from http://www.aacap.org/cs/autism_resource_center/faqs_on_autism

American Occupational Therapy Association (2001). Tips for living – Understanding Autism. [Fact sheet]. Retrieved from www.aota.org/autism

American Occupational Therapy Association. (2008). Occupational therapy practice framework: Domain and process (2nd. ed.). *American Journal of Occupational Therapy, 62,* 625-683. Retrieved from http://www.aota.org/Practitioners/Official.aspx

American Occupational Therapy Association (2011). Occupational therapy's role with Autism. [Fact sheet]. Retrieved from www.aota.org/practitioners/resources/docs/factsheets/

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, D.C.: American Psychiatric Publishing.

Autism Society of America (2004a). *About Autism*. Diagnosis: Related conditions. Retrieved from http://www.autism-society.org/about-autism/diagnosis/related-conditions.html

Autism Society of America (2004b). *About Autism*: Causes. Retrieved from http://www.autism-society.org/about-autism/causes/

Autism Society of America (2004c). *About Autism*: *Symptoms*. Retrieved from http://www.autism-society.org/about-autism/symptoms/

Autism Speaks Inc. (2014). *What is Autism?* Applied Behavior Analysis. Retrieved from http://www.autismspeaks.org/what-autism/treatment/applied-behavior-analysis-aba

Ayres, A.J. (1971). Characteristics of types of sensory integrative dysfunction. *American Journal of Occupational Therapy*, *25*, 329-334.

Ayres, A.J. (1979). *Sensory integration and the child*. Los Angeles, CA: Western Psychological Services.

Baranek, G.T., Foster, L.G. & Berkson, G. (1997). Tactile defensiveness and stereotypic behaviors. *American Journal of Occupational Therapy*, *51*, 91-95.

Baranek, G.T. (1999). Autism during infancy: a retrospective video analysis of sensory-motor and social behaviors at 9-12 months of age. *Journal of Autism and Developmental Disorders*, *29*, 213-224.

Baranek, G.T., Boyd, B., Poe, M., David, F. & Watson, L. (2007). Hyperresponsive sensory patterns in young children with autism, developmental delay, and typical development. *American Journal of Mental Retardation*, *112*, 233-245.

Baird, G., Cass, H., & Slonims, V. (2003). Diagnosis of autism. *British Medical Journal*, *327*, 488-493.

Benson, H. (1982). The relaxation response: History, physiological basis and clinical Usefulness. *Acta Medica Scandinavica*, *660*, (Supple.), 231-237.

Benson, H., Beary, J.F., & Carol, M.P. (1974). The relaxation response. *Psychiatry*, *37*, 37-46.

Case-Smith, J., & Arbesman, M. (2008). Evidence-based review of interventions for

Autismused in or of relevance occupational therapy. *American Journal of Occupational Therapy*, *62*, 416-429. doi: 10.5014/ajot.62.4.416

Case-Smith, J., & O'Brien, J.C. (2010). *Occupational therapy for children* (pp. 170-172). Maryland Heights, MO: Mosby Elsevier.

Centers for Disease Control and Prevention (2009). *Autism Spectrum Disorders*: Documents. Retrieved from: http://www.cdc.gov/ncbddd/autism/documents/AutismCommunityReport.pdf

Centers for Disease Control and Prevention (2010). *Autism Spectrum Disorders*: Signs And symptoms. Retrieved from: http://www.cdc.gov/ncbddd/autism/signs.html

Centers for Disease Control and Prevention. (2014). *Autism Spectrum Disorders: Data & statistics.* Retrieved from http://www.cdc.gov/ncbddd/autism/data.html#risk

Coster, W., Deeney, T., Haltiwanger, J., & Haley, S. (1998). *School Function Assessment*. San Antonio, TX: The Psychological Corporation/Therapy Skill Builders.

Dahlgren, S.O., & Gillberg, C. (1989). Symptoms in the first two years of life: A preliminary population study of infantile autism. *European Archives of Psychology and Neurological Sciences*, *238*, 169-174.

Dunlap, G., dePerczel, M., Clarke, S., Wilson, D., Wright, S., White, R., & Gomez, A. (1994). Choice making to promote adaptive behavior for student with emotional and behavioral challenges. *Journal of Applies Behavior Analysis*, *27*, 505-518.

Dunn, W. (1997). The impact of sensory processing abilities on the daily lives of young children and their families: A conceptual model. *Infants and Young Children*, *April*, 23-25.

Dunn, W. (1999). *The Sensory Profile Manual.* San Antonio, TX: The Psychological Corporation.

Dunn, W. (2007). Supporting children to participate successfully in everyday life by using sensory processing knowledge. *Infants and Young Children*, *20*, 84-101.

Dunn, W., Myles, B.S., & Orr, S. (2002). Sensory processing issues associated with Asperger syndrome: A preliminary investigation. *American Journal of Occupational Therapy*, *56*, 97-102.

Elia, M., Ferri, R., Musumeci, S. A., Delgracco, S., Bottitta, M., Scuderi, C., Miano, G., Panerai, S., Bertrand, T. & Gruber, J. C. (2000). Sleep subjects with autistic disorder: A neurophysiological and psychological study. *Brain and Development*, *22*, 88-92.

Eunice Shriver National Institute of Child Health and Development (2005). *Autism overview: What we know* [Fact sheets]. Retrieved from http://www.nichd.nih.gov/publications/pubs_details.cfm?from=&pubs_id=3903

Fombonne, E. (2003). Epidemiological surveys of autism and other pervasive developmental disorders: An update. *Journal of Autism and Developmental Disorders*, *33*, 365-382.

Goin-Kochel, R. P., Mackintosh, V. H., & Myers, B. J. (2009). Parental reports on the efficacy of treatments and therapies for their children with autism spectrum disorders. *Research inAutism Spectrum Disorders*, *3*, 528–537. doi:10.1016J.RASD.2008.11.001.

Grandin, T., & Scariano, M. M. (1986). *Emergence: Labeled Autistic*. Novato, CA: Arena.

Green, V. A., Pituch, K. A., Itchon, J., Choi, A., O'Reilly, M., & Sigafoos, J. (2006). Internet survey of treatments used by parents of children with autism. *Research in Developmental Disabilities*, *27*, 70–84.

Hess, W. R. (1957). The functional organization of the diencephalon. New York, NY: Grune & Stratton.

Hogg, J., Cavet, J., Lambe, L., & Smeddle, L. (2001). The use of 'Snoezelen' as multisensory stimulation with people with intellectual disabilities: a review of the research. *Research in Developmental Disabilities*, *22*, 353-372.

Hollingshead, A. B. (1975). *Four Factor Index of Social Status*. Unpublished working paper, Department of Sociology, Yale University, New Haven, CT.

Howell, D. (1999). Neuro-occupation: Linking sensory deprivation and self-care in the ICU patient. *Occupational Therapy Health Care*, *11*, 75-85.

Hulsegge, J., & Verheul, A. (1987). *Snoezelen Another World*. Chesterfield, UK: ROMPA.

Kanner, L. (1943). Autistic disturbances of affective contact. *Nervous child*, 2, 217-250.

Kern, L., Mantegna, M. E., Vorndran, C. M., Bailin, D., & Hilt, A. (2001). Choice of task sequence to reduce problem behaviors. *Journal of Positive Behavior Interventions*, *3*, 3-10.

Kleim, J. A. & Jones, T. A. (2008). Principles of experience-dependent neural plasticity: Implication for rehabilitation after brain damage. *Journal of speech, language and hearing research*, *51*, S225-S239.

Kaplan, H., Clopton, M., Kaplan, M., Messbauer, L., & McPherson, K. (2006). Snoezelen multi-sensory environments: Task engagement and generalization.

Research in Developmental Disabilities, *27*, 443-455.

Kuhn, R., & Cahn, C. H. (2004). Eugen Bleuler's concepts of psychopathology. *History of Psychiatry*, 15, 361-366. Retrieved from 10.1177/0957154X04044603 (Original work published in 1910).

Lotan, M., & Gold, C. (2009). Meta-analysis of the effectiveness of individual intervention in the controlled multisensory environment (Snoezelen ®) for individuals with intellectual disability. *Journal of Intellectual & Developmental Disability*, *34*, 207-215.

Lough, C. L., Rice, M. S., & Lough, L. G. (2012). Choice as a strategy to enhance engagement in a colouring task in children with autism spectrum disorders. *Occupational Therapy International*, *19 (2012)*, 204-211. doi: 10.1002/oti.1337

Mandell, D. S., Novak, M. M., & Levy, S. (2005). Frequency and correlates of treatment use among a community sample of children with autism. *Proceedings of the 4th International Meeting for Autism Research,* San Diego, CA.

Mckee, S. A., Harris, G. T., Rice, M. E., & Silk, L. (2007). Effects of a Snoezelen room on the behavior of three autistic clients. *Research in Developmental Disabilities*, *28*, 304-316.

Messbauer, L. (2012). American Association of Multi Sensory Environments (2012). *FAQ*. Retrieved from http://www.aamse.us/faq.php

Miller, L. J. Coll, J.R., & Schoen, S.A. (2007). A randomized controlled pilot study of the effectiveness of occupational therapy for children with sensory modulation disorder. *American Journal of Occupational Therapy*, *61*, 228-238.

Njardvik, U., Matson, J. L., & Cheery, K. E. (1999). A comparison of social skills in

adults with autistic disorder, pervasive developmental disorder not otherwise specified, and mental retardation. *Journal of Autism and Developmental Disorders*, *29*, 287-295.

Padilla, R., & Peyton, C. G. (1997). Neuro–occupation: Historical review and examples. In C. B. Royeen (Ed.). *Neuroscience occupation: Links to practice* (pp. 1–31). Bethesda, MD: American Occupational Therapy Association.

Pagliano, P. (2012). The multisensory handbook: A guide for children and adults with sensory learning disabilities. New York, NY: Routledge.

Parham, D. L. (2002). Sensory integration and occupation. In A.C. Bundy, S. J. Lane, & E. A. Murray (Eds), *Sensory integration: Theory and practice* (2nd ed., pp. 413-434). Philadelphia, PA: F.A. Davis.

Parham, D. L., Cohn, E. S., Spitzer, S., Koomar, J., Miller, L. J., Burke, J. P.,…Summers, C. A. (2007). Fidelity in sensory integration intervention research. *American Occupational Therapy Foundation*, *61*, 246-257.

Parham, L. D., Roley, S. S., May-Benson, T. A., Koomar, J., Brett-Green, B., Burke, J. P., et al. (2011). Development of a fidelity measure for research on the effectiveness of the Ayres Sensory integration intervention. *American Journal of Occupational Therapy*, *65*, 133–142. doi: 10.5014/ajot.2011.000745

Peacock, E. (2012). Top 8 autism therapies- reported by parents. *Autism Speaks Official Blog*. Retrieved from http://www.autismspeaks.org/blog/2012/09/25/top-8-autism-therapies-%E2%80%93-reported-parents

Polar, Inc. Products. Running and multisport. Retrieved from http://www.polar.com/en/products/maximize_performance/running_multisport/RS800CX

Schaaf, R. C., Benevides, T., Mailloux, Z., Faller, P., Hunt, J. van Hooydank, E… Kelly D. (2013). An intervention for sensory difficulties in children with autism: A randomized trial. *Journal of Autism and Developmental Disorders*, *November*, 1-14. doi: 10.1007/s10803-013-1983-8

Schopler, E., Reichler, R. J., & Renner, B.R. (1994). *The Childhood Autism Rating Scale*. Los Angeles, CA: Western Psychological Services.

Slavik, B. A., & Chew, T. (1990). The design of a sensory integration treatment facility: The ayres clinic as a model. In S.C. Merrill (Ed.), *Environment: Implications for occupational therapy practice* (pp.85-101). Rockville, MD: American Occupational Therapy Association.

Tomchek, S. D., & Case-Smith, J. (2009). *Occupational therapy practice guidelines for children and adolescents with autism.* Bethesda, MD: AOTA Press. Retrieved from http://www.aota.org/DocumentVault/Autism-Resources/Resources.aspx

Tomchek, S. D. & Dunn, W. (2007). Sensory processing in children with and without autism:A comparative study using the Sensory Profile. *American Journal of Occupational Therapy, 61*, 190-200.

U.S. Department of Health and Human Services (1999). Mental health: A report of the surgeon general – executive summary. *U.S. Department of Health and Human Services. Substance Abuse and Mental Health Services Administration*. Retrieved from http://autism.healingthresholds.com/research/mental-health-report-surgeon-general-executive-summary

Walker, K. F. (1991). Sensory integrative therapy in a limited space: An adaptation of the Ayres Clinic design. *Sensory Integration Special Interest Section Newsletter*, *14*,

1, 2, 4.

Walloch, C. (1998). Neuro-occupation and the management of chronic pain through mindfulness meditation. *Occupational Therapy International*, *5*, 238-248.

Way, M. (1999). Parasympathetic and sympathetic influences in neuro-occupation Pertaining to play. *Occupational Therapy Health Care, 12*, 71-86.

Wimpory, D. C., Hobson, R. P., & Nash, S. (2007). What facilitates social engagement in preschool children with autism? *Journal of Autism and Developmental Disorders*, *37*, 564 – 573.

Table 1

Participant demographics (n = 15)

Gender	Age	Age of Diagnosis	SES	Min/Max SES	CARS (n = 14)	CARS SEM
Male: 13	*5.3 ± 1.1 years	3.1 ± 1.2 years	34.3 ± 12.7	Min SES: 15	31.8 ± 7.4	*SEM* = 2.0
Female: 2				Max SES: 59.5		

Note: *Data are presented as mean plus/minus SD and *SEM*

Table 2

Summary of Sensory Profile quadrant results for participants, number of participants whose scores fell into each range (n = 15)

	Low Registration	Sensory Seeking	Sensory Sensitivity	Sensory Avoiding
Probable Less	0	0	0	0
Typical	3	0	2	2
Probable Difference	3	4	6	7
Definite Difference	7	9	4	4

Table 3

Parents were asked to reflect on what they valued and did not value during use of the MSE in both the protocol-driven approach and during the individualized approach. They were also asked to describe their impression of Sensory Playrooms and their use for children with an ASD diagnosis.

Participant Number	Q1: Valued: Protocol	Not Valued: Protocol
1.	Engagement, variety, exploration	No peers to play with, limited engagement with researcher
2.	Positive behavior, enjoyment	
3.	Social, communicative, engaged	
4.	Slow introduction, patience	
5.	Remaining engaged	Stimming/hand flapping
6.	Engagement, social	
8.	Exploration/interests	"A lot going on," fixated on one or two things
9.	Slow introduction, opportunity to explore	
11.	Patience	
12.	Timed intervals, more like a routine	Lack of opportunity for socialization (she did not have to ask for items to be turned on)
15.	Interesting, fascinating	Lack of interaction with researcher
16.	Social, communication, opportunity to explore	
17.	Exposure to something child cannot control	
18.	Exposure to something child cannot control	Very noisy
19.	Friendliness	

Participant Number	Q2: Valued: Individualized	Not Valued: Individualized
1.	Choice, interpersonal engagement, music	Not taking initiative with items they may enjoy
2.		It seemed to make him more wild
3.	Seeing him make choices	Even with choice, less engaged, more bossy and rough
4.	Choice	Even with choice, less engaged, more bossy and rough
5.	Staying engaged/interests	Trying to escape
6.	Autonomy, relaxation, opportunity for increased communication/ socialization	Times when not interacting with equipment
8.	Increased verbalizations	
9.	Autonomy	More hyper, running around, limited engagement
11.	Choice and opportunity for increased communication	
12.	Choice, increased vocalizations, socialization	Another child with ASD in the room
15.	Interesting, fascinating	Lack of interaction with researcher
16.	Choice	
17.	Choice, ideas for home	
18.	Choice	Did not play with most of the equipment
19.	Researcher listened to son	

Participant Number	Q3: Impressions
1.	Playroom had a calming effect. I think they are excellent for children with ASD, with many ways to tailor the sensory experience to the individual child. The facilitator can use "trial and error" to see what sensory experiences the child may benefit from.
2.	I think the sensory playroom is wonderful for a child on the spectrum! I know for a fact that it made an impact on my son because we noticed on several occasions that when he is having a bad day he's asked us to take him to the room with the lights. On a side note, I think it helped that the researcher made such an impact/great impression/connection with my son.
3.	We enjoyed our experience at the sensory playroom and [our son] talked about his time there with family and friends. We do think it is something we would love to have access to in the future.
4.	We think the room was very calming for our son with ASD. His voice remained calm and remained at a low level the majority of the time. With some excitement his voice raised in a happy way, which is acceptable. Thankfully there wasn't much to frustrate him in the room and facilitator was always able to divert his attention to another area. He did tend to get "tired" or "bored" in some cases, which could be due to the cold or being an early riser. Overall we think it was a great room with lots of sensory input that can stimulate enough and not over stimulate some kids with ASD.
5.	Love the playroom!
6.	I love that [my son] could be calm and relaxed and have other moments of joyful playtime. I found the playroom to be an amazing resource to take [my son]. It seemed to have a calming effect on him. I think there needs to be someone trained to help get the full effect for the children to benefit. The items offered are a good start.

Participant Number	Q3: Impressions
8.	Sensory playroom was great experience for [my son]. All ASD kids are different so I can only speak for my son. I think my son would like the experience even more if he had friends or siblings to explore with. So for my own child, this would be a great room to play with others. He does the social aspect and enjoys others. Sensory room however is fun and lights and many things for kids to enjoy. I did not have any negative feelings about his playing. Overall, I don't think the room did much for changing any behaviors, good or bad, but gave him a "sensory" break.
9.	The sensory room is a nice tool to be used as part of a "sensory" diet. It was not surprising to see my son continually use the ball pit, as he often seeks proprioceptive input. Several times, he just sat in the pit and "relaxed." He also sought out the light ropes, either on the rocking chair or hanging ones. Once again, he liked having the [fiber optic] lights lay on him or tried to swing on the ones from the ceiling. My son often puts items in his mouth, including his hands. Surprisingly, I did not see this behavior at all, except one time and he was easily redirected. I thought his communication and "narration" of his play increased significantly during time in the playroom. But, the researcher was very much using a "child lead" approach and played along with his "ideas." I did not like the idea of having all the items on at once. It seemed over-stimulating and think that they could be used more efficiently, separated.
11.	I believe that sensory playrooms are very beneficial to a child like mine with Autism. In my experience with playrooms, I was able to see my child in a calm manner, which he usually does not possess. For a short amount of time, we are able to connect with him in a different way.
12.	We really loved this study, especially [our daughter]. I loved it. My daughter loves lights, music, and mirrors. I believe for her it was very soothing, also made her aware of her surroundings. Usually if there is a mirror in the room, she does not move away from it. She played or at least touched every sensory object in the room. Me, as a parent enjoyed that I could watch her as she was playing. It helped us with ideas for her and what caught her eye. In a very short time she became attached to [the researcher], also she now associates her with the playroom. I think this room will help children with ASD to open up and allow them to shine more than they already do. These children are very smart and just need a little help expressing their feelings. My daughter was excited every time we pulled in, she recognized the building and [the researcher], she pulled her shirt up to put the chest monitor on and held out her wrist for the arm one. One great experience for us. I would love to see some schools with the fiber optic lights in them for children who can't afford private schools – that was one of her favorites.

Participant Number	Q3: Impressions
15.	I had never heard of research such as this. I thought the research was great and very interesting. I loved the idea of being able to "see" my son's meltdown coming instead of dealing with the aftermath.
16.	The sensory room helps remove distractions for a person with Autism, especially for [our son]. I think it was very important and helps the individual try different items. Helps to stimulate different or all senses.
17.	I felt that the use of the sensory playroom provided [my son] and myself the opportunity to see how different textures, sounds, lights, and objects affect his mood. It will be helpful to use these things I have learned at home when I am trying to "set the stage" for various activities such as playtime, quiet time and learning (school work). He loved the ball pit.
18.	This playroom is a great idea for children with low functioning ASD. Not really for children of Asperger's or higher functioning ASD, since they can generally communicate their needs/desires.
19.	Researcher knew how to handle my son.

a.

b.

c.

d.

e.

f.

g.

h.

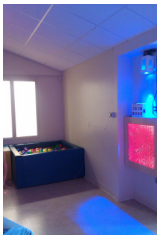

Figure 1. In the protocol driven sessions, the equipment above was turned on in a slow, sequential manner in a clockwise direction around the MSE, beginning with the bubble tubes. a. ball pit, fiber optic lights, switch activated wall light, b. wall-mounted manipulatives and textured surfaces, c. loft and rock-climbing wall, d. plinth with lighted bubble tubes, fiber optic light cables, and switch-activated wall light, e. bean bag and wall-mounted sound-sensitive light display, f., loft, bean bag, and sound-sensitive light display, e. rock wall, wall-mounted manipulatives and textured surfaces, and light projection, h. ball pit, wall-mounted, lighted manipulatives. The rock-climbing wall, and area under the loft was not accessible to participants during the study.

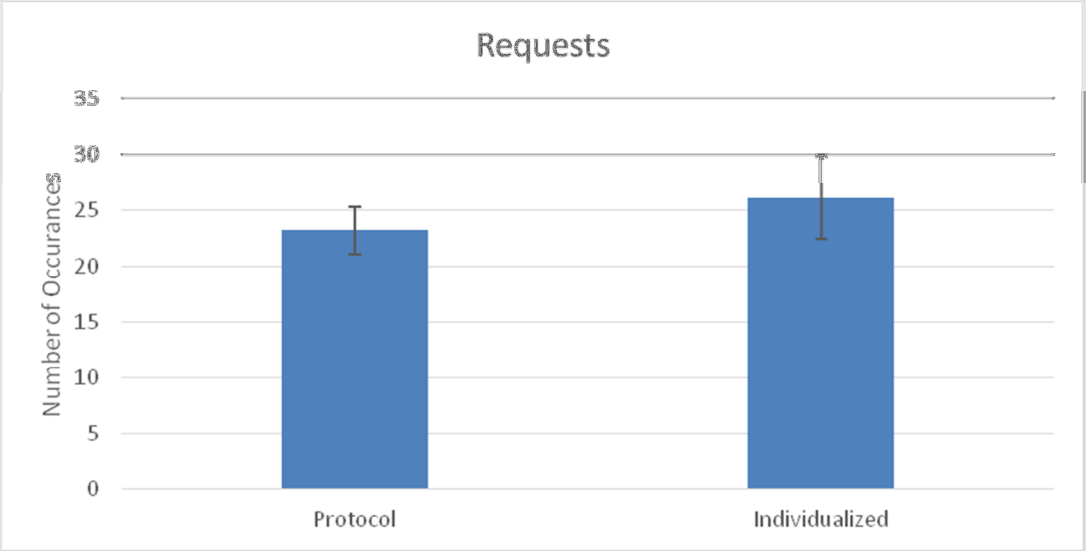

Figure 2. The average number of requests/initiations per session during the protocol-driven condition was 23.2 ± 2.1, ranging from 10 to 39 requests/initiations, representing no statistically significant difference ($p = .318$).

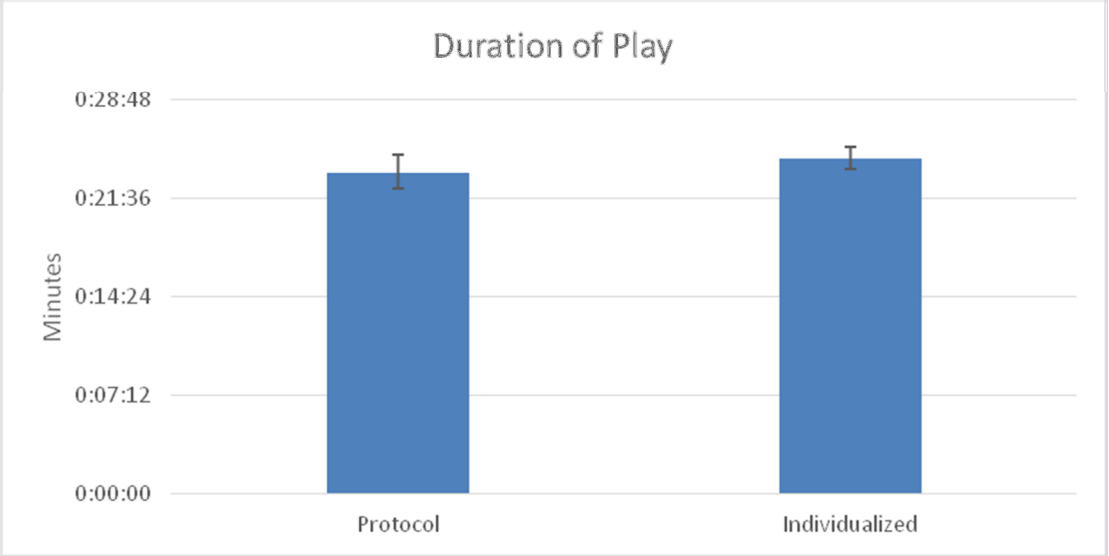

Figure 3. There was no statistically-significant difference in duration of play measured in minutes:seconds during the individualized and protocol-driven conditions ($p = .433$).

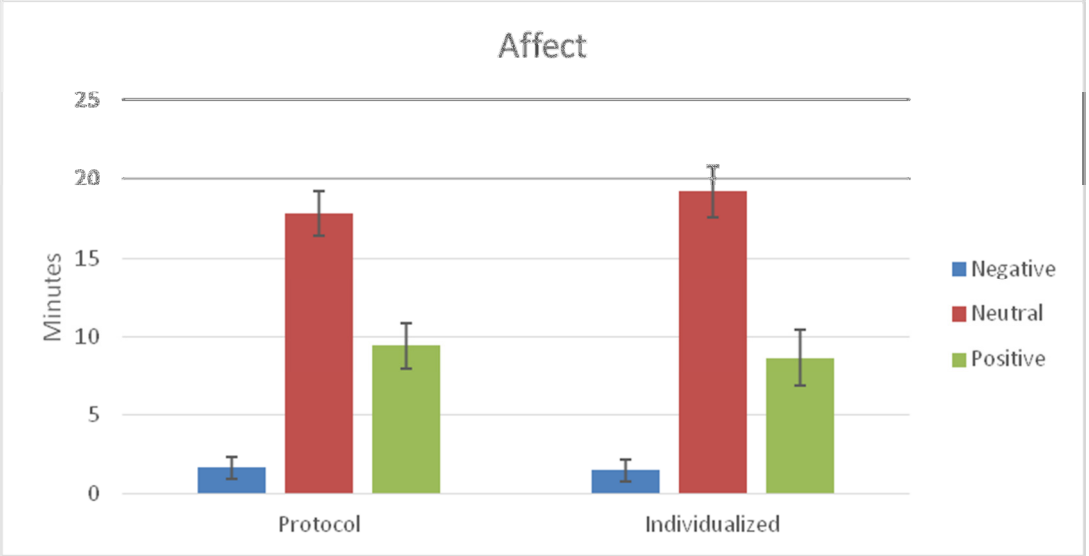

Figure 4. There were no statistically-significant differences in affect between the individualized and protocol-driven conditions (p = .719, .282, .545 for negative, neutral, and positive affect, respectively).

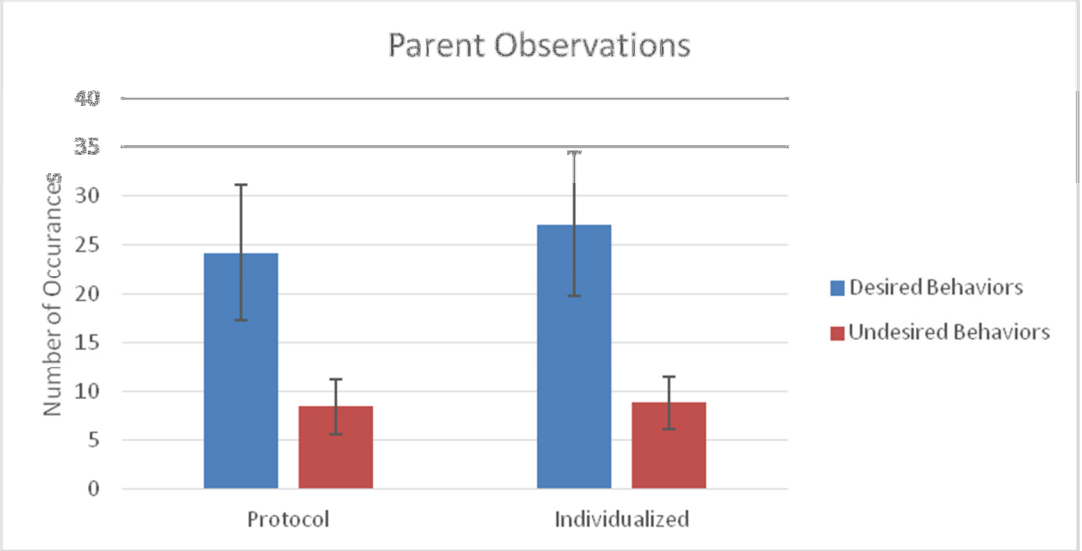

Figure 5. There was no statistically-significant differences in the number of occurrences of parent-desired and parent-undesired in the protocol-driven ($p = .642$) or individualized condition ($p = .910$).

Appendix A

The following information is being asked in order for us to accurately describe the group of people who participated in our study. This information will be kept strictly confidential.

Please answer the following questions:

1. What is your child's age? _____ years

2. Date of Birth: _____

3. Gender: _____

4. Diagnosis:_____Age of initial diagnosis: _____

5. Medical history: _____

_____

_____

6. Family structure: _____

_____

7. Current therapy received: _____

_____

Indicate the race of the child participant. Please mark any of the following which apply: [¯] White [¯] Black or African American [¯] American Indian or Alaska Native [¯] Asian [¯] Native Hawaiian or other Pacific Islander [¯] Some Other Race	Please indicate whether the child participant is: [¯] Not of Hispanic, Latino, or Spanish origin [¯] Of Hispanic, Latino, or Spanish origin

Please provide responses about yourself in this column	Please provide responses about any other adult living in the home, such as your spouse or committed partner in this column
Level of school completed, select one: [¯] Less than seventh grade [¯] Junior high school (9th grade) [¯] Partial high school (10th or 11th grade) [¯] High school (private, parochial, trade, or public) [¯] Partial college or specialized training [¯] Standard college or university [¯] Graduate professional training	Level of school completed, select one [¯] N/A (i.e. you are single, widowed, divorced) [¯] Less than seventh grade [¯] Junior high school (9th grade) [¯] Partial high school (10th or 11th grade) [¯] High school (private, parochial, trade, or public) [¯] Partial college or specialized training [¯] Standard college or university [¯] Graduate professional training
If employed, please list current job title:	If employed, please list current job title:

Date:_____ Participant # _____

Appendix B

Equipment	Description
Bubble tube	Large clear tubes filled with water with streams of bubbles that float throughout. The tubes are illuminated and change color to allow for visual stimulation.
Vibrating bubble tube plinth	The vibrating seat surrounding the bubble tube provides added sensory stimulation. The intensity of the vibration can be adjusted using the remote control. The vibration has a calming effect for participants seeking this input.
Fiber Optic Padded Platform	Long, smooth fiber optic cables with light travelling though the center of a padded platform for a glowing effect. The light wand is smooth to the touch and can be explored with the participant's hands (i.e. braiding it). The light can change colors as well as be draped over the child for further exploration. The light wand is great visual stimulus, a tool for visual tracking, and good for participants with low vision.
ICE Popcorn Tube 4 multisensory wall panels (tactile, auditory and visual)	Small "popcorn" pellets floating in large color changing tube. Interactive wall-mounted panels, which allow for tactile, visual and sound sensations. The moveable objects in the tracks allow for tactile input and development of motor skills. Clients with visual impairments enjoy the fiber optic lighting and mirrors.
ICE Wall Washer	Decorative color-changing light to promote engagement.
Speakers and Stereo for Music	Music, particularly soothing music, can enhance the MSE experience. A large selection of gentle melodies were offered to promote relaxation.
Projector with Varying Wheels	Slowly rotating patterns and special effects are projected onto the walls around the room. The 6" blue-green liquid effect wheel was used in this study.
Vibrating Rocker Chair	A medium-sized foam rocking chair with built-in speakers to provide vibration to arouse the senses.
ICE Fiber Optic Cascade	Long, smooth fiber optic cables with light travelling through the center hung from the ceiling on a mirrored panel, for a glowing effect. The light wand is smooth to the touch and can be explored with the participant's hands (i.e. braiding it). The light can change colors as well as be draped over the child for further exploration. The light wand is great visual stimulus, a tool for visual tracking, and good for participants with low vision.

Equipment	Description
Ball Pit/Crash Pit	A large pit that has 4” soft foam sides covered by safety-approved (CPSC), vinyl square-shaped unit with a soft foam pad cushion at the bottom. The pit can be filled with small plastic balls to arouse the senses or it can be filled with a large weighted blanket to create a soft, calming space.
ICE Marble Panel	LED technology combines with changing color in the room, tactile input, and the sound of marbles.

Appendix C

Date: _____ Participant Number: ____

Your child has now completed six (6) play sessions in the Sensory Playroom. In half of the sessions, the researchers turned the equipment in the Sensory Playroom on in an ordered, prescribed manner (the Protocol-Driven Approach). In half the sessions, the researcher turned on the equipment as requested by your child—in whatever way your child communicates, whether by eye gaze, physical proximity, gestures/signs, vocalizations, or verbalizations (the Individualized Approach).

We are interested in your opinion and your impressions.

Please complete the following questions:

1. Reflect on the use of the Sensory Playroom under the Protocol-Driven Approach. What did you value? What did you not value?

2. Reflect on the use of the Sensory Playroom under the Individualized Approach. What did you value? What did you not value?

3. Describe your impression of Sensory Playrooms and their use for children with an ASD diagnosis?

Appendix D

Desired Behaviors: Protocol-Driven Approach	Undesired Behaviors: Protocol- Driven Approach	Desired: Individualized Approach	Undesired: Individualized Approach
Delight	Indecisive	Calm	Passive
Calm	Less active	Singing	Stayed in one activity at length, decreased variety
Exploration	Stayed in one area too long	Conversant, initiated new conversation	Not making choices, stayed in ball pit
Physical activity	Flipping hair	Relaxed	Complain of headache
Conversant	Not changing activities much	Smiling	Throwing balls out of ball pit
Smiling	Too quiet	Imaginative play	Repetitive
Happy	Stuck on one activity	Making choices	Did not request new choices often
Laughing	Passive	Not rowdy	Somewhat withdrawn
Sitting still	Not physically active	Laughing	Too quiet
Relaxed	Very easily upset	Obeys	Unable to distract from counting
Singing	Rowdy/rambunctious	Smiling	Continues to go back to the same subject – cannot change his mind
Initiating conversation	Putting objects in mouth	Happy	Very easily upset/disappointed
Appropriate social cue reading	Motor tics/fidgeting	Follows instructions/rules	Unable to sit still/relax

Desired Behaviors: Protocol-Driven Approach	Undesired Behaviors: Protocol- Driven Approach	Desired: Individualized Approach	Undesired: Individualized Approach
Conversation back and forth	Rowdy	Initiate conversation	Writing numbers in the air
Socially appropriate – waited for reply	Stimming – figure 8 bouncing on toes	Appropriate social behavior with facilitation	Rowdy/rambunctious
Wanting to play	Blowing through teeth/lips	Make belief play	Bad language
Calm voice	Regressing into shell	Initiate conversation	Putting things in mouth
Using manners	Rude talking/rough play	Engaging with equipment – wanting to play	Stimming
Patience	Screams/loud voice	Appropriate social behaviors	Regressing into shell
Trying to imitate words	Rude talking	Initiate conversation	Blowing through teeth/lips
Observant	Failure to follow directions	Appropriate behaviors	Figure 8 bouncing on toes
Using equipment in appropriate manner	Loud voice	Plays in room with different equipment	Being in own world – not engaging
Trying stairs	Rude talking/rough play	Manners	Loud voice
Not flapping	Failure to follow directions	Calm voice	Screaming

Desired Behaviors: Protocol-Driven Approach	Undesired Behaviors: Protocol- Driven Approach	Desired: Individualized Approach	Undesired: Individualized Approach
Clear speech	Escaping from room	Nice voice	Rude
Appropriate requests	Hand stimming	Patience	Rough play
Wanting interaction with others	Head down running to next object/thing	Rope light	Failure to follow directions
Focused/engaged	Jumping	Waiting for rope light to come on	Head down running saying “eeeeee”
Increased verbal clarity	Arm flapping	Mounted marbles with color seemed calming for him	Escaping behind black curtain
Explored new areas	Spends majority of time in front of mirrors	Calm when in ball pit	Sucking on fingers
Looking at and interacting with self in mirror	Auditory sensitivity	Playing with rope light – he stopped running	Stimming
Following rules/routine	Spinning	Imagination	Rough w/ equipment
Narrating play	Excessive crash and bang	Laughing, playing, exploring	Impulsive/unsafe
Calm play	Rough play	Wanting to interact with others	Ignoring (facilitators) questions
Easy transition into a new environment	Overstimulation	Clean verbalization	Mouthing objects

Desired Behaviors: Protocol-Driven Approach	Undesired Behaviors: Protocol- Driven Approach	Desired: Individualized Approach	Undesired: Individualized Approach
Letting facilitator into personal space	Unruly	Exploring in room, and commenting on different things	Crashing and banging
Stopping a misbehavior when asked	Rough play	Enjoying playing with facilitator and communicating with her	Unclear speech
Not breaking anything	Impatience	Eye contact	Defiance to rules
Try different tasks	Unruly	Decreased hyperactivity	Impatience
No tantrums	Undressing	Clear speech when requesting	Over stimulation
Positive engagement with facilitator	Touching camera when asked not to (more than once)	Calm playing	Not listening to directions (going behind curtain)
Compromised with facilitator	Yelling when told “no” for touching the equipment	Following rules properly	Touching camera when she knows better
Recognized changes in environment	Turning off equipment	Stayed away from mirror longer	Not making eyes contact when her name is called
Showed interest by asking lots of questions about things in the room	Undressing	Kept clothes on	Screaming for no reason

Desired Behaviors: Protocol-Driven Approach	Undesired Behaviors: Protocol- Driven Approach	Desired: Individualized Approach	Undesired: Individualized Approach
Enjoyment	Purposely "testing facilitator" when told no	Explored more (loft)	Taking clothes (top) off
Dancing	Breaking something	Singing ABC's and counting clearly	Lack of concentration on task
	Disobeying direct orders	Playing with sensory objects with purpose (imaginary play)	Controlling behavior
	Having a meltdown	Understanding the objects touched will be turned on	He perceived music as sad instead of soothing
	Bored	Independent in remembering to take shoes off	
	Tantrum	Positive interaction with facilitator	
	Did not retrieve balls when asked	Focused attention on several activities	
	Had to be told not to touch switches on walls several times	Showed interest in sequence of color change	
	"Bossy" in directed facilitator to get balls for him	Variety of stimulation in room enhanced imagination	
	Responded to music by calling it "sad music"	Asked permission to do certain activities	

Desired Behaviors: Protocol-Driven Approach	Undesired Behaviors: Protocol- Driven Approach	Desired: Individualized Approach	Undesired: Individualized Approach
	Overly concerned about balls spilling out of ball pit	Enjoyed feeling of having light strands and having control of things	
	Body scrunching	Enjoyed the various sensory materials and described them in a positive manner	
	Growling/yelling	Using imagination, asking “what if” questions	
	Hanging on pipes		
	Throwing balls out of ball pit		