Can Multi-Sensory Stimulation Help Students with Autism Self-Regulate?

A Master’s Research Project Presented to
The Faculty of the Patton College of Education
Ohio University

In Partial Fulfillment
of the Requirements for the Degree
Master of Education

by
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August, 2013
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Abstract
Autism is a growing phenomenon in special education. Autism spectrum disorder (ASD) is a developmental disorder characterized by atypical development. This case study analyzes a single participant identified by doctors as having autism and sensory processing abnormalities, and asked, can multi-sensory stimulation help a student with autism self-regulate. Like many individuals with autism, the participant struggled with processing sensory information, resulting in a number of stereotypical, undesired, repetitive behaviors. This research utilized an ABAB design to determine whether three interventions (deep pressure using a gym ball, a large pillow (crash pad) to sit on, jump on, and lay on; and a carpeted barrel for the child to lie on, lay in, and rock or roll in/on) helped the participant self-regulate and led to decreases in two specific sensory-seeking behaviors (rocking and spinning). Behaviors were tracked using formal and informal observations, during two meetings, for 20-minute increments.

The highest incidence of rocking was 24 and lowest was 5.5 as compared to the highest incidence of spinning behavior which was 24 and the lowest incidence of 2. The overall weekly results fluctuated and offered little consistency, potentially due to some of suggested limitations. However, findings indicated some positive results, which suggest the interventions played an active role in reducing undesired target behaviors, ultimately helping the participant self-regulate.
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Autism is a growing phenomenon in special education. Autism spectrum disorder (ASD) is a developmental disorder characterized by atypical development. Differences are evident in “social interactions, language as used in social communication, or symbolic or imaginative play” (American Psychiatric Association, 1994, p. 71). ASD can limit a person’s ability to communicate and relate to other people. It can be detected in young children whose characteristics and needs fall along a spectrum from mild to severe. Some people on the spectrum have savant abilities, while others struggle to speak. No single behavior is an indicator of autism (Bhargava, 2012). More research is being conducted to examine and assess behaviors observed in students, and possible interventions that may be successfully presented to individuals.

Even though data is scarce, research states that as many as 90% of students with autism demonstrate sensory processing abnormalities (Baker, Lane, Angley, & Young, 2007). Some stereotypical behaviors seen in students with sensory processing difficulties include rigid and repetitive behaviors such as flapping arms, spinning, and rocking. One proposed reason for these behaviors could be the individual’s attempt to make sense of and self-regulate stimulation received from the environment, which could result in a reduction of the observed repetitive behaviors (Baker et al., 2007).

The purpose of this single-subject case study was to assess one student’s sensory processing differences and responsiveness to multi-sensory stimulation. This study assessed the impact of specific interventions on self-regulation. These results may be useful for teachers to assess and use the same or modified interventions with their students depending on individual needs. This will ultimately benefit students and help them by increasing their participation in academic tasks and learning, by decreasing the need to engage in sensory-seeking behaviors.
Based on a thorough review of previous research and the results of this study, connections can be made and conclusions drawn as to whether multi-sensory stimulation might be useful in the self-regulation of behaviors for other students who may be similar to the individual in this case study.

**Review of Literature**

This literature review provides definitions related to this research including autism, sensory processing abnormalities, and self-regulation. It also includes a review of research evaluating a variety of multi-sensory interventions and discussing their results related to assisting individuals with autism, or other conditions that demonstrate similar behaviors, in self-regulation. Sufficient data is provided so that comparisons and evaluations can be made, adding validity to the current research project.

**Autism**

Autism spectrum disorder (ASD) can be defined as “a pervasive developmental disorder that is characterized by severe impairments in social, communicative, cognitive, and behavioral functioning (Strickland, 1997, p. 81). Recent studies have estimated approximately one in 110 children are being diagnosed with ASD each year (Strickland, 1997) effecting four times as many boys as girls (Bhargava, 2012).

Stereotypical impairments observed in people with ASD include: lack of eye contact, difficulties understanding and demonstrating facial expressions, failure to develop peer relationships, delay or lack of verbal communication, repetitive use of language, difficulties in imaginative or social play, inflexibility to daily routines, preoccupation in patterns, objects, and or subjects of interest, and social or emotional reciprocity (American Psychiatric Association, 1994). Stereotypical undesirable behaviors observed in children with ASD consist of motor
movements such as flapping arms, spinning, and rocking (Baker et al., 2007), aimless running, aggressive and self-injurious behaviors (Dawson & Watling, 2000). All of the previously mentioned behaviors are frequently observed in individuals with ASD. However, it is important to remember that many individuals with autism are very intelligent and able to function in the regular classroom setting (Strickland, 1997).

Undesirable and repetitive behaviors can be described as being self-stimulatory for individuals with ASD. Self-stimulatory behaviors are repetitive body movements or movements with objects (Edelson, 2013). These types of behaviors are suggested to occur as they provide the individual with a form of internal pleasure, or assist in calming the individual (Edelson, 2013). According to Mays, Beal-Alvarez, and Jolivette, “self-stimulatory behaviors may interfere with a student’s ability to attend, communicate, learn, and interact, as well as prevent the acquisition of new skills” (2011, p. 46). With all of this in mind, it is crucial that teachers provide interventions to students with ASD to decrease or replace self-stimulatory behaviors. Replacing self-stimulatory behaviors will help children learn new skills and be able to attend to instruction (Mays, Beal-Alvarez, & Jolivette, 2011).

**Sensory Processing Abnormalities**

Sensory processing refers to ways that sensory information is taken in and managed in the brainstem and cerebral cortex (Baker et al., 2007). Abnormalities, or difficulties, have been reported to occur across all sensory domains, including visual, auditory, tactile, and vestibular or proprioceptive stimulus. People who demonstrate difficulties processing sensory information are often said to “misinterpret everyday sensory information such as touch, sound, and movement” (Murray, Baker, Murray-Slutsky, & Paris, 2009, p. 246). Many therapists and teachers who work with students demonstrating sensory processing difficulties refer to the classic sensory
integration approach, originally developed by A. Jean Ayres (1972). The sensory approach uses enhanced and individualized sensory experiences in a meaningful and self-directed activity, designed to support an individual’s vestibular, proprioceptive, and tactile sensations, which have a powerful effect on the regulatory mechanisms of the nervous system (Kandel, Schwartz, & Jessell, 2000), and facilitate a person’s ability to appropriately adapt their functions (Watling & Dietz, 2007).

Sensory processing difficulties have been observed in many students with autism. Research states that as many as 90% of students with autism demonstrate sensory processing abnormalities (Baker, Lane, Angley, & Young, 2007). Some characteristics of autism include the lack of social relatedness, communication skills, and the presence of stereotyped behaviors, interests, and activities. Stereotyped behaviors include rigid and repetitive behaviors, such as flapping arms, spinning, and rocking. Research states that a possible reason for these behaviors could be an individual’s attempt to make sense of and self-regulate stimulation received from the environment (Baker et al., 2007).

Even though sensory processing abnormalities are not considered a typical characteristic of individuals with autism, they appear to be an extremely common trait (Dawson & Watling, 2000). Literature includes reports of different types of responsiveness to sensory input. Hyper-responsive is a response type where the individual is extremely sensitive to the stimuli. Hypo-responsive is a second response type where the individual is oblivious to stimuli, demonstrating distractibility. The last type of responsiveness is sensory seeking and occurs when the individual demonstrates stereotypical, repetitive behaviors, such as licking or rubbing, seeking stimuli to meet his/her sensory needs (Baker et al., 2007).
Each sensory domain must be addressed and evaluated to determine if a specific intervention will meet the specific sensory needs of the individual. The sensory domains that need to be addressed include: visual (sight), auditory (sound), olfactory (smell), tactile (touch), gustatory (taste), vestibular input (movement), and proprioceptive input (pressure). Vestibular input refers to the disturbances in an individual’s awareness of his/her own body movement, balance, posture, and body weight (Baker, Lane, Angley, & Young, 2007); and according to Masterton and Biederman, proprioceptive sensory input refers to the muscle “information for location of the body and its parts when stationary or moving as well as information for touch, pressure, pain, etc.” (1983, p. 142). See table 1 for specific examples of common self-stimulatory behaviors evident in individuals with ASD in each sensory domain.

Table 1.

*Sensory Domains and Examples of Repetitive, Self-Stimulatory Behaviors*

<table>
<thead>
<tr>
<th>Sensory Domain</th>
<th>Commonly Observed Self-Stimulatory Behaviors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory (sound)</td>
<td>Noisemaking (e.g. banging on objects), vocalizations, covering ears</td>
</tr>
<tr>
<td>Visual (sight)</td>
<td>Covering eyes, closing eyes, looking at hands out of the corner of eyes, flapping hands, filtering light (waving fingers in front of light), looking at lights, rapidly blinking</td>
</tr>
<tr>
<td>Tactile (touch)</td>
<td>Rubbing different textured objects, placing items in mouth, pinching and biting self/others</td>
</tr>
<tr>
<td>Olfactory (smell)</td>
<td>Smelling items, holding noise</td>
</tr>
<tr>
<td>Gustatory (taste)</td>
<td>Licking things, ruminating (sucking on things)</td>
</tr>
</tbody>
</table>
Vestibular (movement) | Rocking, bouncing, spinning, swinging
---|---
Proprioceptive (pressure) | Crashing into things and people, squeezing things and people, grinding teeth, biting self, chewing on things, deep pressure

Note. Adapted from Mays, Beal-Alvarez, & Jolivette (2011).

It is important to evaluate each individual’s behaviors and his/her responsiveness to each sensory domain. Once this has been established, it is possible to hypothesize which sensory interventions may be therapeutic and necessary for each student diagnosed with autism. Specific and individualize interventions may help students self-regulate, resulting in a reduction of the observed repetitive, self-stimulatory, behaviors.

**Self-Regulation**

According to Baird and Gomez, self-regulation is “a factor in social-emotional development which refers to one’s ability to regulate emotional state and to organize a behavioral response” (2000, p. 108). In light of this definition and what is known about individuals with autism, connections can be made between the two. It is known that individuals with autism have difficulties with social and emotional development, and with these same developmental skills included in the definition of self-regulation, an inference is made that individuals with autism will also have issues with self-regulation.

According to the Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood (DC: 0-3; Zero to Three, 2005) regulatory disorders are based on the individual child as well as behavioral patterns, emotional inclinations, and motor and sensory patterns (p. 34). Hypersensitive and underactive behaviors are just two types of behaviors that are predominant in individuals who struggle with self-regulation (Baird &
Gomez, 2005) and are also examples of two types of responsiveness observed in students with sensory processing difficulties and students with autism.

Even though research is limited, other connections have been made between autism and regulation difficulties. A longitudinal study by Baird and Gomez (2005) surveyed 65 parents of children who had been diagnosed with autism whose ages ranged from three and a half to almost fourteen years old. An invitation was mailed out to randomly selected participants who fit into the proposed criteria. The willing respondents were provided with a consent form, cover letter, directions and the assessment tool.

The assessment tool, Temperament and Atypical Behavior Scale (TABS), is an “observation rating system for the early assessment and clarification of significant problems in self-regulatory behavior in children from 11 to 71 months of age” (Baird & Gomez, 2005, p. 110). Four categories were covered by the assessment tool. The first category measured detachment, e.g., being disconnected from daily routines. The second category assessed hypersensitivity, or activity, e.g., the individual being overactive, or demonstrating impulsivity. The third category measured whether the individual was underactive, e.g., being under responsive, or having a high sensory tolerance. The last category assessed dysregulated behaviors, e.g., being disorganized. The assessment tool evaluated individuals’ behaviors in natural family contexts by people who the children knew well. Data was mailed back to the assessors, inputted into spreadsheets and analyzed using Statistical Package for the Social Sciences (SPSS) for Windows (Baird & Gomez, 2005).

Baird and Gomez (2005) found that the appearance of behaviors reflective of self-regulation difficulties in young children can be used as an early diagnosis of individuals with
autism. The results of the study concluded those identified as having self-regulation difficulties at a young age were later diagnosed with autism (Baird & Gomez, 2005).

A second connection was made between autism and regulation difficulties, through a second longitudinal study by Bieberich and Morgan (2004). This study looked at the relationship between affective expression (i.e., lack of appropriate responsiveness to other’s emotions) and self-regulation in individuals with autism and Down syndrome during play. Only results for the children with autism are reviewed.

This longitudinal study consisted of an original study and a follow-up study completed two years after the first. The participants consisted of 18 children with autism and 18 children with Down syndrome, of which only 14 children with autism and 15 children with Down syndrome completed the follow-up study. The mean age of the participants for the first study was 8.3 and 10.3 years for the second study. Invitations for the study were sent out to participants and phone call confirmations were provided.

The study used the Minnesota Preschool Affect Ratings Scale (MN-PARS) as a measure of affective expression and self-regulation. The MN-PARS assessment tool consists of a seven-point Likert scale (seven being the most developmentally deviant and one being the least). The assessment tool analyzed self-regulation (attention, flexibility, and perseverance), negative affect (e.g., irritability and resentment), and positive affect (e.g., sharing). The participants were video taped with their mothers during a 25-minute play session. The assessors then rated the session using the MN-PARS assessment tool and percentages were analyzed and evaluated.

The results concluded that across both study sessions, children with autism were more deviant on the self-regulation factor and positive factors than children with Down syndrome. “More specifically, children with autism, demonstrated deficits in attention, flexibility,
engagement, and goal-directedness during play activities” (Bieberich & Morgan, 2004, p. 445). The study’s findings confirmed its original hypothesis, that there is a relationship between self-regulation deficits and affective and social deficits in individuals with autism (Bieberich & Morgan, 2004).

Connections have been made between sensory processing abnormalities and individuals with autism, as well as self-regulation difficulties and individuals with autism. With these connections established, research on multi-sensory interventions will now be reviewed to determine their effectiveness in helping students with autism self-regulate.

**The Ziggurat Model**

If an individual demonstrates repetitive behaviors, suggesting he/she is showing under-responsive or sensory-seeking behaviors, then an intervention is needed. Such interventions help individuals to self-regulate, and process sensory information received from the environment (Baker, Lane, Angley, & Young, 2007). An early and comprehensive intervention is needed as it is critical for later development of the child with autism. Myles, Grossman, Aspy, and Henry, (2009) support the idea that interventions are needed for children with autism through their research and evaluation of the Ziggurat Model.

The Ziggurat Model, co-authored by Aspy and Grossman (2008), is an intervention model, which is designed to assist with the planning of interventions for individuals with autism. The Ziggurat Model addresses an individual’s strengths and needs that may result in stereotypical social, and emotional, behaviors seen in those with autism. The model is a hierarchical system, with five different levels of intervention. The stages of intervention implementation consist of: sensory differences and biological needs, reinforcements, structure and visual/tactile supports, task demands, and skills to teach (Myles, Grossman, Aspy, & Henry,
2009). Each level suggests a systematic implementation of interventions. Much like Maslow’s Hierarchy of Needs, an individual’s needs “are arranged in a hierarchal order such that the fulfillment of the lowest needs propels an organism on to the next highest level” (Crain, 2005, p. 373), meaning an individual’s underlying needs must be targeted first. When these needs are met, the next intervention can be implemented. With the use of the Ziggurat Model and an underlying characteristics checklist (UCC) a comprehensive intervention plan can be developed and implemented. The intervention will provide supports in areas of need. The five hierarchal levels of the Ziggurat Model are described in the following sections.

**Sensory and biological needs.** The first level, sensory differences and biological demands, addresses the individual’s unmet sensory and biological needs. While sensory differences are not included in the symptoms of autism, they are present and can be some of the biggest challenges for individuals with autism (Myles, Grossman, Aspy, & Henry, 2009). For example, anxiety, over activity, and poor social skill development are included in the sensory section and must be addressed (Myles et al., 2009). When these needs are met, the individual can progress to the next level in the Ziggurat model. The authors also discuss the importance of integrating interventions for sensory differences into the everyday program for an individual with autism.

**Reinforcement.** Reinforcement is the second level of the Ziggurat model because of its essential need. “Without reinforcement, there is no intervention. Indeed, effective intervention programs deliver reinforcement for positive behaviors” (Myles, Grossman, Aspy, & Henry, 2009, p. 168). Interventions used for reinforcement must be something that reflects an individual’s interests so it is motivating and effective. Some examples include a desired activity, such as computer time or swinging on a swing, or an external reward such as marshmallows. Positive
reinforcements are provided to students with autism when positive desired behaviors are observed.

**Structure and visual/tactile supports.** Individuals with autism are often visual learners and are more successful when their day is predictable (Myles, Grossman, Aspy, & Henry, 2009). Visual supports such as graphic organizers, work task strips, or schedules will assist with the predictability of the day. Tactile supports can be offered as a support especially for individuals who may have a visual impairment (Myles et al., 2009). This level of intervention is directly related to characteristics associated with individuals with autism.

**Task demands.** “The term, task demand, can be thought of as an obstacle removal” (Myles, Grossman, Aspy, & Henry, 2009, p.168). Such obstacles prevent an individual from being successful. An example of an obstacle may be a child’s lack of skills that inhibits their participation in an activity (Myles et al., 2009), such as an individual’s lack of social skills resulting in lack of participation in small group discussions. An intervention will be needed to help make the student more successful such as a ‘buddy’ training partner, or circle of friends, which provide the individual with opportunities to practice the important social skills needed for the task.

**Skills to teach.** The final level of the Ziggurat Model looks at the actual teaching of skills to individuals with autism. The previous four levels in the Ziggurat Model “set the stage” for actual skill attainment, which is this final level (Myles, Grossman, Aspy, & Henry, 2009). Interventions support individuals to assist them with the learning of skills needed for independence and growth. Successful interventions should be evidence-based and meet the individual’s needs.
The Ziggurat Model focuses on the importance of meeting an individual’s basic needs before being able to implement other interventions. If an individual exhibits behaviors that suggest a need for sensory intervention, these behaviors will interfere with the child’s ability to learn new skills or be attentive when it comes to instruction. With this focus identified, meeting the individual’s sensory needs through individualized interventions, will help them achieve self-regulation. Assisting with self-regulation will result in a reduction of the observed repetitive, self-stimulatory, behaviors, potentially allowing them to participation in academic tasks and learning without needing to engage in sensory seeking behaviors.

**Ayres’s Sensory Integration Approach for Children with Autism**

Despite strong correlations between individuals with autism, sensory processing abnormalities, and self-regulation, at present, there are only a few studies supporting the use of multi-sensory interventions and how they help students with autism self-regulate. Watling and Dietz (2007) completed a study that evaluated Ayres sensory integration approach as an intervention for decreasing undesired behaviors and increasing task engagement among young children with ASD.

Four boys, between the ages of three and four years old, were chosen for a clinical study. Each child participated in a different number of sessions due to absences, ranging from 31-34. Children were presented with table top activities that were used for data collection. Observations focused on specific targeted behaviors: undesired and engagement. An ABAB design was used where the participants’ behaviors were observed before the interventions were presented (phase A) and during the interventions (phase B), and repeated for validity. The children were given an opportunity to become familiar with the table top activities, 10 minutes of baseline data was collected during the A phase. During phase B, children were offered 15 minutes of “treatment”
activities typically used with Ayres’s sensory integration; (swings, tunnel, toys with various textures), which was preceded by the 10 minute data collection period. Activities were selected based on the child’s preferences and developmental level; examples include puzzles, stickers, beads and string and blocks. Each child had ten table top activities.

Undesired behaviors and engaging behaviors were observed and documented during each intervention stage; the results were graphed and evaluated (Watling & Dietz, 2007). Each child had his/her own undesired behaviors, including licking self or others, squint eyes, repetitive movements, and hand flapping. Engaged behaviors were defined as, “intentional, persistent, active, and focused” (Watling & Dietz, 2007, p. 576) and were measured by how intentional the child’s behavior seemed during the table top activity. For example, if a child used his marker to make a mark, the behavior was recorded as engaged if his gaze was toward coloring on the page.

The primary purpose of the study was to evaluate the immediate effects of “Ayres’s sensory integration theory as an intervention for decreasing undesired behavior and increasing task management among children with ASD” (Watling & Dietz, 2007, p. 581). Interestingly, results suggested that the Ayres’s approach didn’t make a considerable difference on children’s undesired behaviors or engagement. The observers suggested that Ayres’s sensory integration provided potential improvement in the children’s ease of transitions, socialization, and compliant behaviors. However, this suggestion needs further research (Watling & Dietz, 2007).

A second study also focused on Ayres’s sensory Integration theory and provided a comparison of the results from two studies for validity purposes. Case-Smith and Bryan (1999) collected data on five boys, between the ages of four and five, all previously diagnosed with autism. An AB design was used during this study with phase A occurring prior to the intervention and phase B being the intervention. Phase A consisted of a 10-week collection of
baseline data and the identification of individual targeted behaviors. Participants then partook in a 10-week intervention phase where they received “direct and consultative occupational therapy services emphasizing sensory integration” (Case-Smith & Bryan, 1999, p. 491). The intervention activity focused on each boy’s individual needs and goals. Examples of interventions include tactile (brushing), stimulation achieved with the use of swings, proprioceptive input to limbs, and other interventions that met the boy’s needs. Unlike Watling and Dietz’s results, all findings in this study were positive. The Case-Smith and Bryan (1999) study reported improvements in task engagement and decreases in undesired behaviors among pre-school children with ASD after using Ayres’s sensory integration approach. A comparison of these findings leads one to believe that multi-sensory interventions may have a positive effect on children with ASD and could help them achieve self-regulation; however more research is needed in this area as results have been inconclusive.

Ayres’s Sensory Integration approach has been criticized by some scholars and the theory has been criticized as being outdated due to the neurological assumptions it is based upon. The neurological approach focuses on the “neurological processing of sensory information being a foundation for learning of a higher-level” (Baranek, 2002, p. 406). Baranek also sees Ayres’s approach as not valid due to the often debated assumption that sensory experiences potentially have an effect on an individual’s ability to learn (2002). Another issue is the expense associated with sensory integration interventions. Sensory integration therapy is usually implemented by an occupational therapist who specializes in sensory integration, and charges more than a special education teacher; with the cost of the equipment as an additional factor to consider, although specific itemized costs are difficult to determine.
Another negative associated with sensory integration therapy is the pull-out model occupational therapists most likely employ. Students are pulled out of their classroom as this method of intervention is individualized and is typically only utilized on a one-on-one basis to one student at a time. With this in mind, the intervention is also seen to be more time intensive and may conflict with inclusionary principles (Baranek, 2002). These issues were taken into consideration and modified for the current study, (i.e., the intervention was completed in the student’s regular classroom and was not pulled out for one-on-one therapy).

Dawson and Watling (2000) conducted a meta-analysis that evaluated a number of research studies and the effectiveness of interventions for auditory, visual, and motor integration for individuals with autism. One area of focus was on the Sensory Integration Therapy developed by Ayres (1972, 1979). The results of four studies looked at controlled sensory experiences such as deep pressure, and their effect on behavioral and motor performance. The activities were based on the child’s individual needs with an emphasis on functional responses to sensory stimulation. Dawson and Watson found some positive changes in participants’ behaviors following participation in sensory activities (2000) even though there was a limited array of studies upon which conclusions were drawn. Findings suggest positive outcomes associated with multi-sensory interventions and assisting individuals with achieving self-regulation, however, further testing and more information on each child’s individual needs could result in a more valid conclusion.

**Self-Regulation and Children with Autism**

Schalock and Silva (2012) found strong correlations between sensory responses and self-regulatory delays for individuals with autism. The study did not include any interventions; instead it assessed the accuracy of The Sense and Self-Regulation Checklist (SSC) instrument
used to identify correlations between sensory responses and self-regulation. Data was collected from 265 participants, 99 who had previously been diagnosed with ASD. The SCC included items on self-regulation that were informed by “Chinese medical theory as well as a knowledge of normal developmental trajectory for self-regulatory milestones in the first three years of life” (Schalock & Silva, 2012, p. 179). The SCC was administered to caregivers over a five year period. The caregivers completed all items on the SCC by scoring the item 0-3, 0 being never and 3 being often.

Strong correlations were apparent between individuals with autism and sensory and self-regulation impairments. The SSC reported a prevalence for sensory and self-regulation symptoms that approached 100% accuracy, demonstrating its adequacy (Schalock & Silva, 2012). Because of the high rate of effectiveness of the tool, the report states that it “begs the consideration that sensory and self-regulatory symptoms represent an integral part of autism rather than separate a comorbid group of symptoms, as currently considered” (Schalock & Silva, 2012, p. 184). This finding supports the previously outlined assumptions suggesting that individuals with autism have difficulties with self-regulation that could result in a reduction of observed repetitive behaviors. More research is needed to support the hypothesis that meeting the sensory needs of students with autism also helps them self-regulate. Specific interventions must be tested and analyzed to support and add validity to this suggested correlation.

Multi-Sensory Interventions for Children with Autism

Smith, Press, Koenig, and Kinnealy (2005), conducted a study that evaluated the effect of sensory integration interventions on self-stimulation and self-injurious behaviors. Seven participants between the ages of 8-19 years old diagnosed with pervasive developmental disorder (PDD) were selected. PDD is related to autism because individuals have delays in the same
areas. Autism and PDD are two of the five categories that fall under the umbrella term of ASD; however, autism is the most common (Boyse, 2008). Participants were provided with interventions in tactile, vestibular, proprioception, and general areas, based on their unique sensory needs. The students were observed 15 minutes immediately following the sensory intervention and again one hour later. Teachers observed individual targeted behaviors and recorded results using a five point Likert scale with a rating of one indicating never and five being constant (Smith, Press, Koenig, & Kinnealy, 2005).

Results concluded that self-stimulating behaviors remained relatively the same before and after sensory integration training. However, one hour after the sensory integration intervention was provided, the frequency of self-stimulating behaviors decreased; suggesting that a latency period is important to the sensory integration approach (Smith, Press, Koenig & Kinnealy, 2005). Even though this study did not use individuals diagnosed with autism, it still assessed self-stimulating behaviors, and multi-sensory interventions, and the study was relevant in providing information on the type of interventions utilized in the present study.

Edelson, Edelson, Kerr, and Grandin (1998) conducted a study assessing behavioral and physiological effects of deep pressure on children with autism. Twelve children with autism ranging in age from 4 to 13 years were randomly assigned to either receive deep pressure or not receive deep pressure from a disengaged Hug Machine. After a familiarization period, the children received 12, 20-minute sessions in the hug machine (two sessions a week for six consecutive weeks). Parents completed the Conner’s Parent Rating Scale (CPRS) after every session. The CPRS was used to evaluate anxiety behaviors. It was concluded there was a significant reduction in anxiety for children who received the deep pressure compared to those who did not and that deep pressure may have a calming effect for persons with autism (Edelson,
Edelson, Kerr, & Grandin (1998). The study demonstrates positive results and a reduction in unwanted behaviors when it comes to individuals with ASD and specific sensory interventions that meet their individual needs.

**Summary**

Individuals with ASD have many different characteristics. One common trait includes having difficulties processing sensory information. Most children who struggle processing sensory information, demonstrate stereotypical, undesired, repetitive behaviors. These behaviors fall into the different sensory domains including tactile (deep pressure) input, vestibular input, and proprioceptive input. Even though research is limited, some studies have begun to make connections that individuals with ASD, will begin to self-regulate if their sensory needs are met and the behaviors decrease in frequency. The Ziggurat model discusses the importance of meeting the sensory needs of individuals with ASD first. It is stated that achieving this will allow a reduction in anxiety levels, which will then allow the implementation of other interventions.

Previous studies conclude that there is a connection with different types of multi-sensory interventions, and their therapeutic and positive effect on reducing self-stimulatory behaviors in children with developmental delays (Smith, Press, Koenig, & Kinnealy (2005), especially individuals with autism. A number of the studies assess sensory interventions in the different sensory domains, and report positive results in decreasing undesired behaviors. Even though a number of these studies do not include information about individuals with autism being able to self-regulate, some studies have inferred a connection between the two. This has led to an understanding that if self-regulatory behaviors are increased, then individuals will be more likely to learn new information and be attentive to instruction. These potential connections led to the
investigation in the current study and the hypothesis: can multi-sensory stimulation help students with autism self-regulate?

**Method**

This section provides information of the setting and participants for this study. Details of the tools used to collect the data and how the information was obtained and analyzed is also provided. The information will allow other educators to accurately assess whether the multi-sensory interventions provided in the study might be useful in the self-regulation of behaviors for other students who may be similar to the individual in this case study.

**Setting**

The study took place at a culturally diverse elementary school in Southeastern Ohio. The majority of the community where the elementary school is located, is Caucasian (United States Census Bureau, 2013). The area has a great deal of support from the University situated in the area, and because of the college, there is unusually large international pull resulting in a slightly more diverse environment. The elementary school in which the study took place, receives a large number of culturally diverse students from international countries. The school has an English Language Learners (ELL) program that serves the entire school district. The elementary school were the study took place serves students in K-6th grade. The school has three classrooms for each K-3rd grade age group, and two classrooms for each 4th-6th grade age group. The school has a large ELL program, a learning disabilities program, and one multiple disabilities classroom. The multiple disabilities classroom serves students in K-6th grade who require special educational services.
Participant

The study is a single-subject case-study. The participant was a five year old male, who attends elementary school in kindergarten. The participant’s family is from a country outside of America and English is the family’s second language. The family practices a number of cultural traditions and uses the language of their native country. Even though the family is from a different country, the participant was born in America and has only ever lived in America. The student was identified by doctors from a young age as having autism and sensory processing abnormalities. Like many individuals with autism, the participant appeared to struggle with processing sensory information, resulting in a number of stereotypical, undesired, repetitive behaviors. Examples of these behaviors include rocking, clapping, spinning, running, and noise making. Verbal noises consisted of tongue clicking, humming, and repetitive consonant sounds, such as the letters “M”, “K”, “P”, and “B”. The observed clicking and humming sounds were sometimes intertwined with the consonant sounds. A “yeah”-like sound, was also observed during physical activities that included impulsive running or bouncing. The participant spontaneously clapped his hands during activities, especially during seated instruction, or while participating in a sensory-type activities.

The participant also exhibited a number of unprompted spinning-like behaviors. The first consisted of occasional spinning of the body, making circle figures, if sitting on the floor. The second was a consistent spinning of the hands; 180° clockwise and 180° counter-clockwise, in a fast back and forth motion. The last was spinning toys in circular directions on the floor or in his hand, instead of playing with the toys for which they were originally designed.

From observations and assessments it was determined that the participant was at the basic sensory and biological level on the Ziggurat model. His sensory needs had to be met first and
were the top priority. As a result of this analysis, and lack of academic results during assessments, the student currently receives an alternative curriculum different from his typically developing peers. Sensory interventions and services from other staff are provided to assist with meeting the student’s basic sensory and biological needs.

The student is currently non-verbal and communicates using various methods. He occasionally uses basic sign language including the signs for “more”, “food”, or “drink”, and/or the picture exchange communication system (PECS) to communicate his basic wants and needs.

He was identified as a participant for the study by the information presented in his personal documents (e.g., IEP’s, school records), observations made by staff of specific sensory-seeking behaviors, results of curriculum-based assessments, and sensory interventions already being provided by the special education staff at the elementary school. Permission for this study was then requested and provided by the participant’s parents.

**Instrumentation**

Throughout the study, the participant’s behaviors were tracked using formal and informal observations. Formal observations were recorded using a frequency check sheet (Appendix A). The frequency check allowed for a numerical record to be kept of how often the targeted behaviors occurred during 20-minute increments. The frequency checklists allowed for data to be averaged and analyzed effectively. Informal researcher’s notes were also kept to document anything that may have affected the participant’s behaviors each day, which may have affected and helped to explain the data.

**Procedures**

The parents of the participant received information about the study. The written information provided details of the study and requested permission for their child’s participation in the study.
Following parental consent, the targeted behaviors were established through extensive observations. Interventions were researched and decided upon, and data collection took place.

**Data Collection.** The method of choice for this single-subject design was a reversal design, also known as an ABAB design, with four stages. The first stage, phase A, is the initial collection of data. The second stage, phase B, is the initial implementation of a research-based intervention. To verify the validity of the intervention’s effects, the intervention was removed, and the process was repeated. The third stage, phase A (2), returns to initial baseline conditions. The fourth stage, phase B (2), is the reintroduction of the intervention (Alberto & Troutman, 2009). This type of design allows the assessor to analyze the dependent variable (targeted behaviors) and the independent variable (intervention) to assess if there is a “functional relation between the two variables” (Alberto & Troutman, p. 126). The ABAB design needs a prediction stating which interventions might increase or decrease targeted behaviors, verification of the prediction, which is determined during the first intervention phase of the reversal design, and replication of the effect which is determined during the second intervention phase for validity (Alberto & Troutman).

During this study during phase A, baseline data was collected for five days. The researcher observed two targeted behaviors. The researcher documented the frequency of rocking and spinning behaviors occurred during 20-minute increments throughout the school day. Rocking behaviors were defined by rocking back-and-forth and side-to-side motions, either in a standing or sitting position. Spinning behaviors were defined by spinning of the body, i.e., making circle figures on the floor, or spinning in a circle in a sanding position; spinning of the hand (180° clockwise and 180° counter-clockwise motion, in a fast back and forth motion); and spinning of toys in circular figures on the floor, or in his hand.
The data was collected during the morning meeting in his homeroom at 9am and during the special education room’s meeting at 11am, for validity. Researcher notes were also taken during both times. For the phase B stage, three interventions were implemented before the two meetings, for two weeks. The interventions were: deep pressure using a gym ball, a large pillow (crash pad) to sit on, jump on, and lay on; and a carpeted barrel for the child to lay on, lay in it, and rock or roll in/on it.

The participant was presented with the choices of all three interventions, in pictures form. The participant then chose the picture of the intervention he wanted. For example, he chose either a picture of the gym ball, the large pillow, or the carpeted barrel. The researcher then presented the participant with the chosen intervention for the 10 minutes prior to each meeting time, or a mix of interventions, depending of the participant’s requests.

To ensure the participant wished to participate, the observer presented the participant with a yes/no switch. The participant had previously practiced pressing the switch before the study took place, to ensure he had an understanding of the purpose of the switch. The switch was presented before the intervention and/or meeting so the participant was given the opportunity to press the switch to indicate if he did not want to participate. Body language and facial expressions were also an indicator of his desire to participate. If he demonstrated behaviors that suggested he may not want to participate, data was not collected for that day. If he indicated he wanted to participate, the researcher observed the two targeted behaviors, rocking and spinning, to determine the frequency of those behaviors.

The observations occurred during the participant’s morning meeting in his homeroom at 9am and during the special education room’s meeting at 11am. Each observation lasted for 20 minutes and notes were taken during this time. All of the interventions had already been used
at one time or another with the participant, but until this time no formal data had been collected to determine the efficacy of each on the specific targeted behaviors.

As part of the ABAB design, the interventions were removed, and the process was repeated. The second set of baseline data was collected for five days (phase A (2)). The researcher again observed the two targeted behaviors, rocking and spinning, to determine the frequency of those behaviors during the two 20 minute meetings already described. Again, researcher notes were taken during this time. The three interventions were presented to the participant, again allowing him to demonstrate if he wanted to participate with the yes/no switch, and chose which intervention he wished to receive using the pictures to represent each intervention. The intervention of choice was presented for 10 minutes, for a second time (phase B (2)), preceding the two meetings, for two weeks. Again, the interventions were deep pressure using a gym ball, a large pillow (crash pad) to sit on, jump on, and lay on; and a carpeted barrel so the participant could lay on it, lay in it, and rock or roll in/on it. Notes were again taken during this time.

Detailed descriptions of the specific targeted behaviors allowed for objective observations to be made. The assessor knew exactly what was meant by spinning and rocking, resulting in more valid results. While making notes, the researcher only documented the behaviors or events that may have had an effect on the formal results.

**Data Analysis.** Data collection occurred during both daily meeting times. Each day, the results from the two meeting times were added together and divided by two, to find a daily average for each targeted behavior. Each day there were two averages, one for rocking behaviors, and the second for spinning-like behaviors. The two daily averages were graphed
weekly. The graph included headings to demonstrate the different stages of the reversal design; for example headings differentiated between intervention and baseline stages.

The two meeting times were averaged because of the participant’s changing schedule. Changes in his schedule occurred due to field trips, specials (P.E., music, art.), examination periods, and absences. Some days both meetings were observed, on other days just one meeting was held, and on other days the time of the meetings were altered due to these changes, again, this was due to the inconsistency of the participant’s schedule and a lack of desire to partake that day. The meeting data was averaged so daily data allowed for appropriate comparisons to be made.

Frequency checks were plotted in a weekly line graph. Each weekly graph included the averages for the two targeted behaviors. The graphs were used to compare results and to draw conclusions. Researcher notes were also compiled, and written up to identify possible factors to explain certain situations. The goal was to assess if targeted behaviors decreased during the implementation phases, leading to self-regulation of the target behaviors. Conclusions were drawn to determine potential connections during the study and to assess the hypothesis: can multi-sensory stimulation help students with autism self-regulate?

Results

The hypothesis addressed by this research project is whether multi-sensory stimulation can help students with autism self-regulate their behaviors. This research analyzed the use of three multi-sensory interventions, which consisted of: a deep pressure using a gym ball; a large pillow (crash pad) to sit on, jump on, and lay on; and a carpeted barrel so the participant could lay on it, lay in it, and rock or roll in/on it, to determine their impact on the participant’s self-
regulation and whether they helped decrease specific sensory-seeking behaviors. Research based
the Ziggurat model indicates a hierarchy of needs. The first level, which looks at meeting the
sensory and biological needs of the child, must be met before moving onto the next level (Aspy
& Grossman, 2008). The present research was designed to determine if the interventions would
help the participant meet the first level of sensory needs with the ultimate goal of assisting the
student in moving through the hierarchy of levels, which would allow the participation in
academic tasks and learning without needing to engage in sensory-seeking behaviors. Figures
one through six illustrate the results in each of the phases in the ABAB intervention (i.e., the two
baseline phases and the two intervention phases).

The participant was observed daily, during class meetings in both the morning and
afternoon. The results from both of the meetings were added together and divided by two to
determine a daily average. The figures indicate the daily average of each of the targeted
behaviors: spinning (indicated in blue) and rocking (indicated in red). Each figure is followed by
a description of the observation and notes taken by the researcher, which were used to document
any changes in the target behavior during that phase.

Baseline (Phase 1)

Figure 1 indicates that the highest incidence of rocking during the first week of baseline
was 24. The highest incidence occurred on Wednesday, the day after the participant left school
early with a fever. The lowest incidence of rocking was 6.5 which was observed Thursday, the
first day of data collection. These findings can be compared to the highest rate of spinning which
was 18.5 and occurred on Friday (the second day). The lowest occurrence of spinning was 8.5
and was recorded on Tuesday, the day the participant went home early with a fever.
Figure 1.

*Phase A: Baseline Occurrences of Rocking and Spinning*

![Graph showing baseline occurrences of rocking and spinning](image)

**Observations.** The student was very verbal during week one; each day in the observers notes includes a comment on the participant being verbal during each meeting. On Thursday, (the first day of baseline), the participant looked around the classroom, reached out to peers in the classroom, covered ears during loud sections of the meetings, and tried to get up and down out of his designated seat/spot. Friday (day two), the participant attempted to lie down during the morning meeting and in the afternoon, he continued to get up and down out of his seat. Monday (day three), the participant laid down/lay back during both meetings. Tuesday (day four), the participant reached out for peers and attempted to lie down and lay backwards. The participant went home later in the day with a fever. Wednesday (day five), the participant tried to get up and down out of his designated seat/spot during the class meetings.
Intervention (Phase 2)

Three interventions were implemented prior to the two daily class meetings: deep pressure using a gym ball, a large pillow (crash pad) to sit on, jump on, and lay on; and a carpeted barrel for the child to lie on, lay in, and rock or roll in/on it. These interventions were offered to the student prior to the morning and afternoon meetings and observations once again were taken during the daily meetings. Daily averages were calculated and are reported in Figure 2.

Figure 2.

Phase B: Occurrences of Rocking and Spinning Following First Week of Interventions

<table>
<thead>
<tr>
<th></th>
<th>Spinning</th>
<th>Rocking</th>
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</thead>
<tbody>
<tr>
<td>Thursday</td>
<td>8.5</td>
<td>16</td>
</tr>
<tr>
<td>Friday</td>
<td>17</td>
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</tr>
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<tr>
<td>Tuesday</td>
<td>11.5</td>
<td>7.5</td>
</tr>
<tr>
<td>Wednesday</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Figure 2 indicates that the highest incidence of observed rocking during the week, which followed 10 minutes of intervention before both meetings, was 16 which occurred on Thursday. The lowest incidence of rocking behavior was 7.5 and occurred on Tuesday, one of the days the participant had a different paraprofessional, and the day before he was absent. This can be
compared to the highest incidence of spinning which was 19.5 and occurred on Monday, the first day the participant had a different paraprofessional. The lowest incidence of spinning was 8.5 and occurred on Thursday.

**Observations.** Thursday, the first day of intervention, the participant attempted to get up and down out of his designated seat/spot during both meetings. Friday (day two), the participant turned around in his spot trying to reach out for his regular paraprofessional, and attempted to get up and down out of his designated seat/spot during both meetings. Monday (day three), the participant worked with an unfamiliar paraprofessional. The participant grabbed and demonstrated scratching-like behaviors and made whiny/crying noises. Tuesday (day four), the participant was again accompanied by the same unfamiliar paraprofessional. The participant was inappropriately verbal in both meetings, making sounds that consisted of tongue clicking and humming noises. The participant was absent on Wednesday, due to a high fever, therefore, no data was collected.

Figure 3.

*Phase B: Occurrences of Rocking and Spinning Following Second Week of Interventions*
Figure 3 indicates that the highest incidence of rocking during the second week of intervention was 12.5 which occurred on Monday, the day of a whole-school morning meeting. The lowest incidence of rocking was 7.5 and was observed on Thursday, the day after the participant returned from being absent. This can be compared to the highest rate of spinning which was 15.5 and was observed on Tuesday. The lowest occurrence of spinning of 5 was observed on Wednesday—-the final day of the two-week intervention stage (Phase B).

**Observations.** By comparison, the participant was less verbal during week three. Each day it was noted the participant seemed to be more attentive during meeting activities as compared to the previous weeks. Thursday and Friday, (days one and two of the second week of intervention), the participant was actively involved during both meetings. Monday, day three, was the whole school morning meeting. The participant lay down during part of the meeting and placed his hands over his ears during louder sections. Tuesday (day four), the participant attempted to get up and down out of his designated seat/spot during both meetings. Wednesday
(day five), the participant was actively engaged during both meetings, with the exception of attempting to lie backwards during the afternoon meeting.

**Baseline Phase 2**

Following two weeks of interventions, all interventions were ceased so that a second baseline could be taken over the course of the fourth week. Figure 4 indicates that the highest incidence of rocking (12.5 incidences), occurred on Friday, the second day of phase 2 baseline. On that day, the participant was sent home in the early afternoon with a high fever. The lowest incidence of rocking was measured at nine which happened on both Thursday and Monday. This can be compared to the highest incidence of spinning behavior of 24 which occurred on Thursday. The lowest spinning incidence of 13 was observed on Wednesday.

Figure 4.

*Phase A2: Baseline Occurrences of Rocking and Spinning*

<table>
<thead>
<tr>
<th></th>
<th>Spinning</th>
<th>Rocking</th>
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<tbody>
<tr>
<td>Thursday</td>
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<td>9</td>
</tr>
<tr>
<td>Friday</td>
<td>21.5</td>
<td>12.5</td>
</tr>
<tr>
<td>Monday</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>Tuesday</td>
<td>13.5</td>
<td>10</td>
</tr>
<tr>
<td>Wednesday</td>
<td>13</td>
<td>10</td>
</tr>
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</table>
**Observations.** Observation notes indicated the participant was verbal during all week four meetings. Thursday, the first day of the second baseline, the participant was verbal during both meetings; as well as attempted to turn around in his spot to reach out for his paraprofessional. Friday (day two), the participant demonstrated grabbing and scratching-like behaviors. The participant also made whining/crying noises. The participant went home early Friday with a high fever. On Monday, Tuesday, and Wednesday of week four, the second baseline phase during the research, the participant attempted to get up and down out of his designated seat/spot during all meetings, as well as attempted to lie backwards and lay down.

**Intervention Phase 3**

During week five, a second round of interventions followed the second baseline. Figure 5 indicates that the highest incidence of rocking behavior observed during week five was 15 and occurred on Tuesday. The observations again took place during the morning and afternoon meetings, after 10 minutes of interventions. The lowest incidence of rocking was 5.5 and occurred on Friday. This can be compared to the highest incidence of spinning which was 12.5 on Friday. The lowest incidence of spinning was two and this occurred on Tuesday.

Figure 5.

*Phase B2: Occurrences of Rocking and Spinning Following the First Week of the Second Round of Interventions (Phase 3)*
Observations. The participant was observed to be verbal during week five’s meetings.

On Thursday (the first day of week five), the participant attempted to stand up and move around during the morning meeting and attempting to lie backwards during the afternoon meeting.

Friday (day two), the participant attempted to lie backwards and lay down during both meetings. The participant’s paraprofessional provided extra pressure, to the shoulders and head during these meetings which stopped attempts to lie backwards. Monday (day three), the paraprofessional again provided extra pressure to the participant’s shoulders and head during both meetings in response to whining/crying behavior. On Tuesday and Wednesday of week five, the participant was actively engaged during both meetings.

Once again, during week six, the participant was provided with three intervention techniques for 10 minutes prior to the morning and afternoon class meetings. Figure six indicates that the highest incidence of rocking during week six was 13.5 which happened on Thursday, the day before the participant was absent due to an ear infection. The lowest incidence of rocking was 8.5 which was observed on Wednesday, the final day of the second two week intervention.
stage. This can be compared to the highest incidence of spinning behavior which was 24 and occurred on Thursday, the day before the participant was absent due to an ear infection. The lowest incidence of spinning was 8.5 and occurred on Tuesday.

Figure 6.

Phase B2: Occurrences of Rocking and Spinning Following the Second Week of the Second Round of Interventions (Phase 3)

Observations. Observation notes indicate the participant was very verbal the first day of week six’s meetings, however, the participant was less verbal Monday through Wednesday, days three, four, and five, of the sixth week six. On Thursday (the first day), the participant demonstrated whining/crying noises. The participant’s paraprofessional provided extra pressure to his shoulders and head during both meetings in response to these noises. The participant was absent on Friday due to a doctor’s appointment for an ear infection; therefore no data was collected. On Monday, Tuesday, and Wednesday (days three through five), the participant was actively engaged during both meetings. Monday morning’s meeting was an exception, where the
participant attempted to lie backwards and continuously looked around the room. During Tuesday’s morning meeting, the participant was observed reaching out for some of his peers.

**Summary**

Figure 7 provides a summary of all daily observations of rocking and spinning behaviors and shows the highest incidence of rocking was 24 that occurred during the first baseline and lowest was 5.5, which occurred during the first week of the second intervention phase (week 5). This is compared to the highest incidence of spinning behavior which was 24 and occurred during the second baseline and the lowest incidence of spinning was 2 which also occurred during the first week of the second intervention phase (week 5).

Figure 7.

*Summary of Rocking and Spinning Behaviors During Baseline and Intervention Data Collection Phases (ABAB)*
Figure 8.

**Weekly Averages of Spinning and Rocking Behaviors During Baseline and Intervention Data Collection Phases (ABAB)**

Figure 8 displays the weekly averages for the targeted behaviors of spinning and rocking. The results demonstrate nearly parallel weekly averages. The highest weekly average for spinning behaviors is 17.4 incidences during week four, which is the baseline for the second phase. The highest weekly average for rocking behaviors is 12.2 incidences, during week two; the first intervention week during phase B1. The lowest spinning weekly average is 7.5 incidences; during week five, which is the first week of interventions during phase B2. The lowest rocking weekly average is 9.3 incidences, during week five of phase B2. Visually, Figures 7 and 8 show little consistency in frequency and visible fluctuation in both targeted behaviors (spinning and rocking) during all phases of the research.

<table>
<thead>
<tr>
<th></th>
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<th>Week4</th>
<th>Week5</th>
<th>Week6</th>
</tr>
</thead>
<tbody>
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<td>9.7</td>
<td>10.1</td>
<td>9.3</td>
<td>10.5</td>
</tr>
<tr>
<td>Spinning</td>
<td>13.1</td>
<td>14.1</td>
<td>10.5</td>
<td>17.4</td>
<td>7.5</td>
<td>13.5</td>
</tr>
</tbody>
</table>
**Discussion**

The study was designed to determine the impact of multi-sensory stimulation to assist students with autism to self-regulate. This research utilized an ABAB design and analyzed whether the interventions helped the participant self-regulate and led to decreases in two specific sensory-seeking behaviors (rocking and spinning). The three interventions included deep pressure using a gym ball, a large pillow (crash pad) to sit on, jump on, and lay on; and a carpeted barrel for the child to lie on, lay in, and rock or roll in/on it.

**Rocking Behaviors**

During all data collection phases--weeks one through six--the overall frequency of the behaviors was not consistent fluctuated daily, as well as weekly. Looking specifically at the highest incidence of rocking behaviors, the first intervention phase resulted in a decrease from the week one’s baseline collection (24 incidences) to week two (16 incidences) and week three (12.5 incidences), during the first intervention phase. These results demonstrating a decrease in frequency, suggest that the interventions helped the participant self-regulate.

The second phase illustrates a slight fluctuation. The highest incidence of rocking behaviors seemed to plateau and level off during the second baseline after a previous high of 12.5. The incidence increased during week five (15 incidences) and then decreased again during week six (13.5 incidences). Even though there was no decrease in incidences of rocking from the first to the second intervention phase, the results represent a decrease from the initial baseline in week one to the last data point in week six. This finding suggests that the interventions impacted the participant’s ability to self-regulate.
Looking specifically at the lowest incidences for the rocking behavior, the frequencies during all data collection phases one through six were too inconsistent to be able to reach any firm conclusions. With this in mind and the observation notes made during the highest incidences, it is evident that further research is needed to provide more conclusive results.

**Spinning Behaviors**

The results of observations of the spinning behaviors indicate a decrease in frequency during both intervention phases (one and two). Specifically, the greatest incidences of spinning during phase one showed a slight increase from baseline week one (18.5 incidences) to the first week of interventions (week two = 19.5 incidences) followed by a decrease during week three’s intervention (15.5 incidences). However, when the interventions were removed during the second baseline week, spinning behaviors greatly increased (24 incidences). Next, during week five, which began the second phase of intervention, there was again a decrease in spinning behaviors (12.5 incidences) followed by a spike in week six to 24 incidences which was the week the participant was diagnosed with an ear infection.

The lowest incidence of spinning behaviors occurred during phase one during the first baseline week (8.5 incidences). The incidences remained the same during the first intervention phase. Specifically, week two had 8.5 incidences and then decreased during week three to 5 incidences. During phase two, the second baseline collection week, (week four) there was a spike in spinning behaviors (13 incidences) when the interventions were removed. Then there was again a decrease in spinning behaviors in week five (2 incidences) followed by another increase in week six (8.5 incidences) which again, occurred the week the participant was diagnosed with an ear infection. The results demonstrate an overall decrease in frequency, which suggests the
interventions played an active role in reducing undesired spinning behaviors, ultimately assisting the participant self-regulate. However, findings related to the spinning behaviors were inconsistent, similar to results for the rocking behaviors, suggesting further research is needed to provide more conclusive results.

It should be noted that an overall pattern of decrease in the target behaviors occurred during the intervention stages; sporadic increases were noted and could potentially be associated with multiple illnesses experienced by the participant and some fluctuation in the paraprofessionals who were assigned to the participant. High fever, ear infections, and absences could have impacted the consistency in the results related to the interventions.

Watling and Dietz (2007) assessed Ayres’s sensory integration theory. Targeted behaviors were observed after 10 minutes of sensory-based activities which were designed to meet each individual’s needs. One purpose of the study was to determine if activities targeting the stages of Ayer’s sensory integration theory decreased undesired behaviors. However, the study showed that not much difference was found when it came to decreasing participants’ undesired behaviors. Overall, the study provided unclear results and suggested a need for further investigation (Watling & Dietz, 2007), similar to the findings of the current study. Other studies (Case-Smith & Bryan, 1999; Dawson & Watling, 2000; Smith, Press, Koenig & Kinnealy, 2005), reported decreases in undesired behaviors following participation in multi-sensory activities and participants achieved self-regulation. However, these studies concluded further research is needed as results were inconclusive, criticized due to being outdated (Baranek, 2002), and needed more valid conclusions (Dawson & Watling, 2000).

The results of this study, and other studies focused on the use of multi-sensory interventions designed to decrease the need to engage in sensory-seeking behaviors and to
ultimately assist students to increasing their participation in academic tasks and learning (thereby meeting participants’ sensory needs--the first level of the Ziggurat model), all suggest the need for further research. Even though this study indicated positive results, they fluctuated and were too inconclusive to draw specific and decisive conclusions to support and evaluate the original hypothesis of whether multi-sensory stimulation help students with autism self-regulate.

**Implications for Practice and Recommendations**

Even though further research is recommended to further validate the findings, the interventions used in this study did lead to some positive (although inconsistent) results and are recommended for use by teachers and other trained professionals. It was the author’s intent to provide a detailed description of the participant’s behaviors and the interventions utilized in this study to help readers determine if the participant’s behaviors can be generalized to that of the their own situation, allowing them to determine if they can use the same interventions, or modified versions, with their own students, to address targeted behaviors.

Prior research has established a hierarchy of needs based on the Ziggurat Model (Myles, Grossman, Aspy, & Henry, 2009). The first level of the Ziggurat Model focuses on meeting the sensory and biological needs of the child before moving to the second level of the model (Myles et al., 2009). This model points to the second benefit of the present study--that multi-sensory interventions helped the participant establish the first level of sensory needs, before moving to the second level; which is designed to ultimately assist students with eventual participation in academic tasks and learning without needing to engage in sensory-seeking behaviors.

Finally, the results of this research also point to the importance of being aware of individual students’ needs. Interventions can be effectively presented, and sensory seeking behaviors decreased, once individual sensory needs have been met (Watling & Dietz, 2007).
Limitations

One potential limitation of this study could be the participant’s changing schedule. Changes in his schedule occurred due to field trips, specials (P.E., music, art.), examination periods, and absences. Some days, it was possible to observe both meetings however, on other days just one meeting was held, and on other days the time of the meetings were altered due to schedule changes. Again, this was due to inconsistencies of the participant’s schedule and a lack of desire to partake in activities for that day. A replication of this study should take into account any potential schedule changes during the data collection phases, so data can be consistently collected.

A second potential limitation in this study was the use of three interventions. If this study were to be replicated, it should be completed over a longer time period which would allow all interventions to be introduced and assessed separately. This could be completed with the use of an ABCDABCD design, so the interventions could be assessed separately. Additionally, one intervention could be fully assessed first using the ABAB design, followed by the second intervention using an ABAB design, and finally an introduction of the third intervention using an ABAB design. These suggestions will allow for a more detailed analysis to be made for each individual intervention. A third limitation is that this study was a single-subject case study. This study only evaluated one set of behaviors and interventions. If this study were to be replicated, more participants could be included in the study to offer greater depth and validity to the research.

Conclusions

This study was designed to test the hypothesis of whether multi-sensory stimulation can help students with autism self-regulate undesired behaviors. The participant was observed and
two undesired behaviors, rocking and spinning, were targeted. Using an ABAB design, the undesired behaviors were observed. Behaviors were observed during two phases; Phase A, the baseline data (no interventions) and Phase B (with interventions), both phases were repeated to establish validity of the findings. Three interventions (deep pressure using a gym ball, a large pillow (crash pad) to sit on, jump on, and lay on; and a carpeted barrel for the child to lie on, lay in, and rock or roll in/on it) were designed to address the participant’s individual needs (i.e., proprioceptive and vestibular sensory needs) The interventions were analyzed to determine if they assisted in decreasing the participant’s undesired behaviors and helping the participant self-regulate. The overall weekly results fluctuated and offered little consistency, potentially due to some of suggested limitations. However, findings indicated some positive results. Some of the targeted behaviors decreased during Phase B when the interventions were presented, when compared to the baseline (Phase A). The results indicate a decrease in frequency, which suggests the interventions have played an active role in reducing the undesired spinning and rocking behaviors, ultimately helping the participant self-regulate. However, like other studies (Case-Smith & Bryan, 1999; Dawson & Watling, 2000; Smith, Press, Koenig & Kinnealy, 2005; Watling & Dietz, 2007), the results were inconsistent; suggesting the need for further research is needed to provide more valid and conclusive results and conclusions to be drawn.
References


Appendix A

**Total Time** - **20 minutes**
Behaviors observed during a 9am homeroom / 11am MD meeting

I will check when a targeted behavior is observed, Including which behavior is observed.

Intervals will be every **30 seconds**

<table>
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Key - rocking / spinning behaviors
Rocking (R)
Spinning (S)

Notes: