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Dahl, Maisie J. *Meeting the Sensory Needs of Students with Autism in the Classroom*

Abstract

Autism affects many children starting at a very young age. Each individual is impacted differently, and are categorized as being on a spectrum. One thing that many people on the autism spectrum have in common is lack of sensory awareness, which causes sensory issues in one or more senses. Individuals with autism can suffer from different kinds of sensory issues including auditory, visual, gustatory, olfactory, tactile, vestibular, and proprioception. The most common issues among this population pertain to the tactile, vestibular, and proprioception senses. This literature review and critical analysis examines current research regarding the effectiveness of sensory integration techniques and interventions in the classroom for children on the autism spectrum concerning tactile, vestibular, and proprioception sensory issues.

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Table of Contents

Abstract.....	2
Chapter I: Introduction.....	5
Purpose of the Study.....	7
Research Questions.....	7
Assumptions of the Study.....	8
Definition of Terms.....	8
Chapter II: Literature Review.....	10
Autism.....	10
Sensory Integration and Autism.....	12
Interventions for Sensory Needs.....	17
Chapter III: Summary, Conclusions, and Recommendations.....	24
Summary.....	24
Conclusions.....	26
Recommendations.....	27
References.....	29

Chapter I: Introduction

According to Center for Disease Control (CDC; 2016), autism affects 1 out of 68 births in the United States each year. To many people this may not seem like a big number, but it has been increasing over time (Matson & Sturme, 2011). Autism is a general term that refers to a group of individuals who have pervasive deficits in social communication and restricted, repetitive behaviors, interests, or activities. The manifestation of autism symptoms differs from child to child, where every case is unique in its own way.

According to the American Psychiatric Association (APA; 2013), the diagnostic term for autism is Autism Spectrum Disorder (ASD). ASD is a neurodevelopmental disorder characterized by deficits in two areas: restricted, repetitive patterns of behavior, interests or activities and social-communication and interaction. These deficits could include difficulty making friends, difficulty understanding gestures, hand flapping, sensitivity to sights or sounds, and/or inflexible adherence to routines. Autism may look different from person to person due to the fact symptoms vary from one individual to another, the severity of the condition ranges from mild to severe, and is associated with a variety of other disorders (APA, 2013). The most common conditions associated with autism are Attention Deficit/Hyperactivity Disorder (ADHD), anxiety disorders, and obsessive-compulsive disorder (OCD; National Autism Association, 2017).

Another comorbid condition associated with autism is sensory integration dysfunction. Sensory integration dysfunction is the “inability to modulate, discriminate, coordinate, or organize sensation adaptively” (DiMatties & Sammons, 2003, p. 3). Children with sensory integration dysfunction do not have the ability to use their motor planning skills, such as coming up with ideas, sequencing required movements, and implementing the movements in a

coordinated and well-timed manner. Children are also unable to organize the intensity of the stimuli they are receiving and respond appropriately in different circumstances (DiMatties & Sammons, 2003).

According to Ayres' theory (Ayres, 1972 as cited in DiMatties & Sammons, 2003), there are seven different kinds of sensory input that may affect a child's ability to self-regulate the body. They are touch (tactile), sound (auditory), sight (visual), taste (gustatory), smell (olfactory), vestibular (movement and balance), and proprioception (joint/muscles). Some children have a hypersensitivity to some types of sensory input while others might have an hyposensitivity to certain types of sensory input. This means that every child reacts to the stimuli in the environment differently. When overstimulated many children do not know how to interpret the information they are receiving simultaneously. When children are understimulated they seek out other ways to get the sensory input they need to self-regulate. These underlying sensory impairments can create barriers for a child's ability to develop social relationships, function in everyday environments, and learn social rules (Smith & Arbesman, 2008).

Children on the autism spectrum can face many sensory processing issues. One major sensory issue is difficulty with sense of touch or the tactile sense. Different textures on various materials or even the simple touch of skin to skin contact can influence a child's tactile sense. Another significant sensory issue that impacts these children is vestibular processes, or in other words movement and balance. This is how children know where they are in space and where their body needs to be when moving or in motion. The third major sensory issue is proprioception. This sense helps children with their body awareness and whether or not they are exerting enough force with their joints and muscles to complete a task (Howe, Brittain, & McCathren, 2004).

Sensory issues can really impact an individual's ability to learn in the classroom. Most individuals on the autism spectrum have difficulty self-regulating, including while in the classroom (Howe & Stagg, 2016). Since they cannot organize the information they are receiving from the environment, the individual loses concentration and the ability to comprehend what they are supposed to be learning. Sensory integration techniques may help address such difficulties. For instance, some students would benefit from time away from the classroom to do activities to help regulate their sensory issues. Occupational therapists are calling this a sensory diet. Sensory diets help students with attention, arousal, and adaptive responses based on level of need (Hatch-Rasmussen, 1995).

Purpose of the Study

Since the prevalence of autism is on the raise, educators need to be looking for options to accommodate for these individuals learning in the classroom setting. As stated before, children with autism may have sensory processing issues. By incorporating ways for children on the autism spectrum to control or self-regulate sensory information will crucially impact how they can learn effectively. The purpose of this paper is to better understand the sensory needs of children with autism within the school setting. Additionally, this review of the literature will examine techniques and intervention to address these needs. Lastly, this paper will investigate the benefits of these strategies.

Research Questions

The research questions of the study focus on how much sensory integration affects student learning in the classroom. This literature review will attempt to answer to the following questions:

1. Will there be an observable difference in behavior, concentration, and academic performance when sensory integration is available for students on the autism spectrum?
2. Are sensory integration techniques shown to be effective in the classroom?

Assumptions of the Study

The current study is a comprehensive review of published literature on sensory integration therapy, sensory integration interventions, and the effectiveness of sensory integration. It does not include experimental methods or involve an original investigation. It is assumed that the previously published research on sensory integration is reliable and valid.

Definition of Terms

The following terms are defined for clarity.

Autism spectrum disorder. “Persistent deficits in social communication and social interaction across multiple contexts, as manifested by deficits in social-emotional reciprocity, deficits in nonverbal communicative behaviors used for social interaction, deficits in developing, maintaining, and understanding relationships, as well as restricted, repetitive patterns of behavior, interests, or activities” (APA, 2013, p. 50).

Hypersensitivity. Being overly sensitive to stimuli received from one or more of your senses (touch, taste, sound, sight, smell, vestibular, or proprioceptive).

Hyposensitivity. Being under sensitive to one or more of your senses (touch, taste, sounds, sight, smell, vestibular, or proprioceptive).

Pervasive development disorder not otherwise specified (PDD-NOS). One of the previous subtypes of autism. The DSM-IV defined PDD-NOS as a pervasive impairment in the

development of reciprocal social interaction, communication skills, or the presence of stereotyped behavior interests, and activities (Autism Speaks, 2017).

Self-regulation. Being able to regulate your emotions and behaviors in a socially accepted manner.

Self-Stimulatory behaviors. Repetitive movements that serve no perceptible purpose in the environment, can have considerable social, personal, and educational implication and often limit the ability to participate in normal life routines (Pfeiffer, Koenig, Kinnealey, Sheppard, & Henderson, 2011).

Sensory diet. A group of activities that are specifically scheduled into a child's day to assist with attention, arousal, and adaptive responses. The activities are based on the child's need for specific types of sensory input. Various types of sensory input are introduced during the day helping to regulate attention and appropriate level of arousal (Hatch-Rasmussen, 1995).

Sensory integration. The neurological process that organizes sensation from one's own body or environment and makes it possible to use the body effectively within the environment (DiMatties & Sammons, 2003).

Sensory integration dysfunction. The inability to modulate, discriminate, coordinate, or organize sensations adaptively (Lane et al., 2000).

Chapter II: Literature Review

This chapter will include a review of published research on sensory integration as it relates to students' academic performance in the school setting. An overall description of autism and sensory integration are explained, along with sensory issues individuals with autism face, and interventions used in the school setting today.

Autism

Autism Spectrum Disorder (ASD) is the current diagnostic term for autism in the Diagnostic Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), a diagnostic tool developed by the American Psychiatric Association (APA; 2013). According to the DSM-5, ASD is characterized by deficits in social interaction and communication (APA, 2013). Some examples of social interaction deficits include failure to read non-verbal cues such as eye contact and body posture. Another example of a social interaction deficit is lack of shared enjoyment, accomplishments, and interests with peers. A communicative deficit includes lack of social or emotional reciprocity, or the inability to engage in back and forth conversations. Individuals with autism may lack development in the area of spoken language. ASD is also characterized by the presence of restricted, repetitive behaviors, interests, or activities, such as hand flapping and/or persistent preoccupation with parts of objects (APA, 2013).

Individuals with autism experience limited functioning due to their symptoms (APA, 2013). Autism is categorized in three different levels of severity. The severity levels are used to describe briefly the current symptoms a child may be experiencing. Level one states that a child requires support. Without the support, deficits in social communication cause impairments. A child at level one may have trouble initiating social interactions or have a decreased interest in social interactions. These children also show signs of inflexible behavior that cause interference

with functioning in one or more contexts. When a child is categorized as a level two of severity, this indicates that they require substantial support. When children with autism have a level two severity they have deficits in verbal and nonverbal social communication skills even with support in place already. These children also show inflexible behavior, difficulty coping with change, and show more frequent repetitive or restricted behaviors, which interfere with various areas of functioning. Level three requires very substantial support. A child with level three severity shows severe deficits in verbal and nonverbal communication skills and shows very minimal initiation or response in social interactions. They also are extremely inflexible to changes and repetitive or restricted behaviors interfere in all domains of functioning (APA, 2013).

The prevalence rates of an autism diagnosis have been increasing over the past few decades. Even in the early 2000's the prevalence for autism spectrum disorder was about 1 in 150 children. Today, the most recent statistics from the CDC show that about 1 in 68 children have autism (CDC, 2016). It is unclear as to why there has been a steady increase in autism diagnoses. Hypotheses for the increase include increased awareness of what autism is, the expansion of the diagnostic criteria, or that there has truly been an increase in the prevalence autism spectrum disorder (APA, 2013). Autism is also diagnosed four times more often in boys than girls. Research has not found any correlating factors with race, region, or socio-economic status (National Autism Association, 2017).

In terms of what causes autism, it is believed that both genetics and the environment play a role (Autism Society, 2015). Researchers have examined genetic coding and irregular segments of genes in children with autism. They have also found genetic patterns in families that have someone diagnosed with autism, which further supports the theory that there is a genetic

component to the cause of autism. Researchers are also looking at the possibility of something interfering with brain development that could cause autism. Brain scans have shown differences in the shape and structure of the brain in children with autism versus children without autism. Environmental factors such as viral infections, metabolic imbalances, and exposure to chemicals are also being looked at as potential causes for autism. Autism seems to occur more frequently among individuals who have other medical conditions, including fragile X syndrome, tuberous sclerosis, congenital rubella syndrome, and untreated phenylketonuria (PKU). Researchers have studied links between harmful substances ingested during pregnancy and an increased risk of autism (Autism Society, 2015).

Other disorders, such as intellectual disorder and language disorders, are more prevalent in the autism population than the general population. Thus, an individual with ASD may also exhibit symptoms of a comorbid condition. An intellectual impairment is categorized by limitations in intellectual functioning and adaptive behavior skills. These are the skills needed for everyday life functioning. Language disorders are often categorized by the inability to communicate effectively. An example of this is when a child cannot comprehend or construct sentences with proper grammar (APA, 2013). Another disorder that is highly correlated to autism is attention-deficit/hyperactivity disorder (ADHD). Many of the core features of ADHD are often seen in a child with autism, for example the inability to sustain attention or difficulty with organization (APA, 2013). Sensory integration dysfunction is also common in children with autism.

Sensory Integration and Autism

Sensory integration is still unfamiliar to many educators. The idea was originally developed by A. Jean Ayres in 1972, when she coined the term sensory integration. The theory

that Ayres developed revolved around the processing of sensory information and how disruptions in neurological processing effect the production of organized and purposeful behaviors that play a key role in how we learn and develop new skills (Watling & Dietz, 2007). Sensory integration has been studied and linked to help students on the autism spectrum with things such as concentration, repetitive motor movements, and academic performance. Being able to control these factors with sensory integration techniques will help the students overall in their general education.

An individual can have sensory dysfunction in one of more the sense. These senses include sight, hearing, smell, taste, touch, vestibular, and proprioceptive. The sensory information we experience can either be too much, or in some cases not enough. When a child is more reactive to sensory input than peers, he/she is hypersensitive to that sensory information. When a child is not as responsive to sensory input as peers, he/she is hyposensitive to that sensory information.

Sensory processing refers to the way that the brain processes input from the environment to exhibit an appropriate motor or behavioral response (STAR Institute, 2017). When an individual receives input from the environment through one of the seven senses, the brain takes that information and sorts it to exhibit a correct response applicable to what the individual is doing. When an individual suffers from a sensory dysfunction, their ability to interpret the environments information is inhibited and certain parts of the brain do not receive the correct information (STAR Institute, 2017). For instance, the tactile system provides the nervous system with the information about our bodies through touch. The tactile system provides information including light touch, pain, temperature and pressure (Hatch-Rasmussen, n.d.). This sensory system is connected to regions of the brain that are related to arousal, emotion, and control of the

body's automatic and reflexive functions (Howe et al., 2004). In a tactile system of an individual without sensory dysfunction, types of touch (light or deep) can be interpreted or discriminated easily. After the touch is interpreted by the brain, it sends a signal to the individual about whether or not the touch is threatening or comforting. In an individual with sensory dysfunction, there is an imbalance between how the brain interprets or discriminates different types of touch. This imbalance of interpreting touch can produce negative emotions and reactions in that individual.

Having hyposensitivity to touch could exhibit symptoms such as wanting applied pressure on certain parts of the body, finding joy in touching various textures, or even enjoying heavy objects on top of the body (National Autistic Society, 2016). Individuals that are hyposensitive to touch may also not be able to tell when something is hot, sharp, or even when they are injured. When a child has hypersensitivity to touch, it can sometimes be painful and uncomfortable to be touched by others. Individuals with hypersensitivity may withdraw when being touched, avoid getting their hand dirty (sticky objects, sand, finger paint, etc.), and use only their fingertips rather than whole hands to manipulate objects. A child may also have issues with certain textures or clothing types because of how it feels on his/her skin. As a result, he/she may only wear certain types of clothing (National Autistic Society, 2016). Certain food textures may cause children discomfort. In this case, many children will only eat smooth or soft food like mashed potatoes, applesauce, or ice cream for example (National Autistic Society, 2016).

Children with hyposensitivity to smell may have no sense of smell and fail to notice extreme smells or odors. When a child's sense of smell is hypersensitive, many smells can be very intense or overpowering. Many common products like perfumes, shampoos, cleaning supplies, certain foods, etc. can be overpowering for some children (National Autistic Society,

2016). Hyposensitivity to taste usually shows in the child liking very spicy foods and unusual textures. A child may put things other than food in his/her mouth to satisfy a sensory need. Eating non-edible things like stones, dirt, grass, or metal, is characteristic of a condition called pica (National Autistic Society, 2016). Children with hypersensitivity to taste may find some foods or flavors to be too strong, and they will not eat many foods.

Children with hyposensitivity to sight might lose some features of objects; have their central vision blurred, but their peripheral vision sharpened; have the central part of an object magnified, while peripheral vision is blurred; and poor depth perception, problems with throwing and catching, and clumsiness. If a child has hypersensitivity to sight, he/she might exhibit distorted vision, fragmented images, focus more on details rather than a whole object, or difficulty with sleeping (National Autistic Society, 2016). When a child has hyposensitivity to sound, he/she may only hear sounds in one ear, only acknowledge certain or distinct sounds, or might enjoy noisy places or loud objects. Noises can be amplified or distorted to an individual with hypersensitivity to sound. Additionally, the individual may be unable to cut out sound or background noise, which leads to difficulties concentrating (National Autistic Society, 2016).

The vestibular sense revolves around the inner ear (the semi-circular canals) and gives the body information about what an individual's body is doing, head positions, and detects movement positions and speed. When our vestibular sense is working properly, it helps the body regulate its posture, balance, muscle tone, and eye movements (Howe et al., 2004). It works closely with the auditory and visual systems to aid in the vibration of sounds and tracking of the eyes. The vestibular sense also has a rotary movement input, which usually helps stimulate the nervous system. Examples of rotary input would be things like riding a roller coaster, spinning on a swing, or doing cart wheels (Howe et al., 2004).

When this type of sensory input is interpreted correctly, individuals find these activities pleasant and are not afraid of them or how they make their body feel. When there is a dysfunction in the vestibular sense, the nervous system is unable to interpret the vestibular input which could make an individual respond fearfully to the movement or respond by seeking the movement excessively (Howe et al., 2004). Some individuals find it hard to do ordinary everyday movements like walking up inclines or stairs because of the uneven ground. They may feel dizzy or nauseous after being exposed to an unwanted movement. These types of children often seem clumsier because of not being exposed to their physical environments. Others that are seeking more input from the vestibular sense will have an increased body movement doing things like body whirling, jumping, or spinning (Hatch-Rasmussen, n.d.). These types of children always like to be moving and trying new experiences, so it is hard for them to pay attention and focus.

Our vestibular sense has to do with our movement, while our proprioceptive sense deals with the information that our body receives from receptors in our muscles and joints (Howe et al., 2004). The brain receives signals of how and what body parts are moving when our body compresses, stretches, and bends. According to Howe et al. (2004), this sense helps us determine how hard or soft to throw something or push on a crayon. It also helps us use our fine motor skills like write with a pencil or button a shirt (Hatch-Rasmussen, n.d.). After learning new body movements, our brain is able to form motor memories and develop more automatic responses to how our body should move when doing previously learned activities (Howe et al., 2004). This helps us respond more quickly to different movements instead of having to think about them. A child with hyposensitivity to proprioception cannot measure proximity to others and lacks the judgment of personal space. They also have trouble navigating rooms, avoiding objects, and may

bump into people often. Children with hypersensitivity to proprioception often have more difficulties with their fine motor skills. They also move their whole body to look at something instead of moving just their eyes (National Autistic Society, 2016).

Every individual with autism has different sensory issues. Some may exhibit hyposensitivity in one area, while showing hypersensitivity to another. The three main senses that have shown the most sensory processing issues in children with autism are tactile, proprioceptive, and vestibular. According to Hatch-Rasmussen (n.d.), these three senses are very much interconnected as well as connected to other parts of the brain. They allow individuals to experience, interpret, and respond to the different stimuli in the environment. The reactions or outcomes that follow the sensory dysfunction will vary, and can be seen on a spectrum from high to low.

Interventions for Sensory Needs

Many classrooms are adapting to fit the inclusionary factors for individuals on the autism spectrum. Educators have begun incorporating interventions for sensory issues that will aid in autistic students' learning. "Interventions based on the classic Sensory Integration theory use planned, controlled sensory input in accordance with the needs of the child and are characterized by an emphasis on sensory stimulation and active participation of the client and involve client-directed activities" (Pfeiffer et al., 2011, p. 77). These interventions are also another way to appropriately replace unwanted or unusual behaviors. This will then allow students to complete tasks and participate within the classroom environment successfully (Mills, Chapparo, & Hinitt, 2016).

One type of intervention that teachers are implementing more in their classrooms is dealing with the tactile sensory system. One such intervention is providing fidgets. A fidget is

used when an individual is craving some type of touch. The fidget helps keep the individual's mind stay focused on what the task is at hand and keeping excessive touching to one object. The object is usually something small that can be kept in the individual's lap, so it is not distracting others around them. Some examples of things that can be used as fidgets are stress balls, pieces of soft fabric, or something small that contains switches or buttons. There is a debate on whether or not fidgets are an effective tool or if they are more of a distraction to the individual and those around them. There is limited evaluation research. One study by Stalvey and Brasell (2006) examined the effectiveness of stress balls to help sixth grade students focus and maintain attention during direct instruction times. They found that the frequency of distractions decreased when stress balls were used. Furthermore, the researchers found this effect in multiple classes (Stalvey & Brasell, 2006).

Another strategy is providing sensory bins that contain different textures or materials that individuals can play with. Sensory bins are relatively inexpensive and can be made from just about anything. Sensory bins usually contain materials or textures that a child likes to manipulate (Howe et al., 2004). They can be made using rice, beans, sand, fabric, or even water. Feeling the different textures and materials on the skin can provide a calming effect for some individuals on the autism spectrum (Howe et al., 2004). However, there is no research on the effectiveness of sensory bins to ameliorate sensory integration issues.

Teachers can also incorporate interventions in their classrooms that revolve around vestibular sensory issues. One way that they are doing this is by providing different seating arrangements for students who have a hard time sitting still. One option is having the individual sit on a therapy ball instead of in a regular chair. The therapy balls are stabilized in a ring or by feet to keep it stable. This alternative way of sitting at a desk or table allows the student to

actively move and maintain an optimal arousal level (Bagatell, Mirigliani, Patterson, Reyes, & Test, 2010). According to Bagatell et al. (2010), using therapy balls as an alternative to a chair helps with issues related to balance, postural control, attention, and sensory seeking behaviors of the vestibular and proprioceptive sensations. A study by Bagatell et al. (2010) further explored research on the effectiveness of therapy balls in the classroom setting with in seat behavior and attention or engagement. Their study consisted of six students between kindergarten and first grade with autism spectrum disorder. They used an A-B-C design, where A is the baseline data, B is the intervention data, and C is the choice condition. The intervention occurred over a four-week period during the class' circle time, with nine of the days having the children sit on the therapy balls. The results from the study were unique to each student and varied depending on the day. There are some limitations to the study, including sample size, the definition of engagement, and length of the intervention.

Teachers can also help with vestibular sensory issues by providing therapy cushions. Therapy cushions are inflatable discs that were originally used for core strengthening and balance, but are now used to provide students with a seating surface that has sensory feedback. They are small and easily portable for students to use in a variety of settings (Umeda & Deitz, 2011). A study done by Umeda and Deitz (2011) looked at the effectiveness of therapy cushions for in-seat and on task behavior in kindergarten students (both male) during their math lesson. The study consisted of two kindergarten students with a diagnosis of autism spectrum disorder (ASD) for 4.5 days a week during a 10-15 minute interactive math lesson for about 13.5 weeks. Data was collected on A-B-A-B-C basis, with A as baseline, B as intervention data, and C as choice data. Unfortunately, the researchers did not find any differences in the in seat and on task behaviors for the two students. This was due to lack of a population size and relevant research

from the past on therapy cushions. Umeda and Deita (2011) hypothesized that the therapy cushions lack the sensory input intensity that some students need.

Teachers have also been providing students with movement breaks throughout their day. These movement breaks can give an individual the time needed to collect their thoughts and emotions, as well as get out any extra energy so the individual can sit and focus during instruction times. Studies have been done to look at how physical activity or movement can increase the alertness, attentiveness, and willingness to learn in students. In a study done by Bershwinger and Brusseau (2013), teachers were asked to incorporate activity breaks in their daily routine. The activity breaks were between 10-15 minutes in length and implemented 1-3 times per day. The results were positive in that the activity breaks helped increase physical activity levels, classroom behavior, and alertness in students. Another intervention that teachers have been implementing for students on the autism spectrum is time to go to a sensory room, which is very similar to a movement break. These sensory breaks can offer students with autism other activities that cannot be offered in the classroom, such as the chance to use swings or trampolines. Allowing children to leave the classroom for a small amount of time to release unwanted feelings could change their attitude towards learning.

Some of the most common proprioceptive issues that students have are with motor control of their bodies, including postural control, motor planning, matching proprioception with vision during reach, and decreased organization of space (Blanche, Reinoso, Chang, & Bodison, 2012). Brushing and joint compressions can be done to help individuals as part of a proprioceptive sensory issue. A brushing protocol, also known as the Wilbarger protocol (Weeks, Boshoff, & Stewart, 2012), can be introduced to an individual who is seeking more proprioceptive sensations. It is done using a surgical brush on the legs, arms, back, and feet

(depending on each individual) using a firm pressure. After brushing is done, joint compressions should be done on the hips, elbows, shoulders, knees, and ankles. Doing these two things together can help an individual notice their surroundings and where their body is in space. This type of intervention has been shown to be able to help an individual with transitions from one activity to another, anxiety, attention span, or overall sensitivity to touch (National Autism Resource, 2017). This is usually done multiple times a day, during free time or before an activity that might cause an upset in the individual.

Research has investigated the utility of brushing. For instance, Davis, Durand, and Chan (2010) performed a study with a four-year-old boy on the autism spectrum receiving the Wilbarger brushing protocol. The researchers wanted to see if the brushing protocol would decrease the boy's stereotypic motor behavior (finger flicking and body rocking). The results showed that the brushing protocol did not decrease the stereotypical stimulatory behavior during the set intervention period. They hypothesized that the brushing protocol was not enough to satisfy the boy's sensory stimulation to not engage in self-stimulatory behaviors and that it was not consistent with the type of sensory input he was accustomed to receiving from his self-stimulatory behaviors (Davis et al., 2010). However, research has shown mixed results on the effectiveness of brushing (Davis et al., 2010). Furthermore, there have been very few rigorous outcome evaluation studies conducted on brushing (Weeks et al., 2012). Thus, brushing should be used with caution.

Massage is another strategy for addressing proprioceptive needs. A study by Field et al. (1997), investigated the use of massage with youth who had been diagnosed with autism. The participants included twenty-two, male students, enrolled in a half-day preschool program and ranged in age from four to five years old. All of the participants had an autism diagnosis.

Participants were divided evenly into two groups. The treatment group received massage from a volunteer at the preschool for fifteen minutes, twice a week for a total of four weeks. The control group played a game while sitting on the volunteer's lap for the same amount of time. The researchers compared the two groups and found that participants who received massage exhibited reduced aversion to touch, less off task behavior, and less repetitive motor movements.

Another intervention that can be done outside of the classroom, usually under the supervision of an occupational therapist, is balance training. Balance training can help with an individual's posture and motor control of their body. A recent study looked at the effects of a balance training intervention on postural control of children with autism (Cheldavi, Shakerian, Boshershri, & Zarghami, 2013). They had a total of twenty male participants between the ages of seven and ten that had a diagnosis of autism spectrum disorder. The participants were split evenly for an intervention group and a control group that did not receive the balance training intervention. Data was collected using a Bertec force plate and measured the individual's postural sway. The participants stood on the force plate with bare feet with either their eyes open or closed. The researchers then marked where their feet positions were for each trial on the foam pad the individuals stood on. For the intervention, participants attended three balance training sessions per week for eighteen sessions, which lasted about forty-five minutes. For each session, the participants completed four exercises: single leg stance, balance path, dynamic balance, and double leg. Overall, the results from this study suggested that balance training did show results of improvement of postural control in individuals with autism (Cheldavi, Shakerian, Boshershri, & Zarghami, 2013).

Another activity that can be used as an intervention under the supervision of an occupational therapist are motor coordination exercises. These exercises are designed to help

individuals that have impairments in gross and fine motor eye-hand and eye-body coordination. Our eyes tell us what we are seeing and help our body move accordingly. Caro, Tentori, Martinez-Garcia, and Zavala-Ibarra (2014) looked at creating their own program to help kids on the autism spectrum that have motor coordination difficulties because all of the past research was for elderly populations. They created an exergame (exercise game) called FroggyBobby and did a three-week intervention on eight children with low functioning autism with presenting motor problems. The FroggyBobby game consisted of having the individuals use their arms for up, down, right, and left movements to catch multiple-colored flies to feed the frog. The researchers included exercised for strength and motion, cross lateral exercises, and coordination and visual spatiality exercises. Overall, the researchers said that the exergame was easy to use, engaging, and fun. They found the FroggyBobby game to help with the students' motor coordination. It also showed other benefits including being an outlet for frustration and gaining body awareness.

One strategy teachers and occupational therapists can use to help students outside of the classroom with their proprioceptive sensory issues is providing heavy work or resistance activities. These types of activities help individuals organize the information they are receiving from their nervous system (Sensory processing disorder, n.d.). Activities that work with the proprioception sense include pushing, pulling, or carrying objects, jumping and bouncing, squishing activities, and using weighted items. The activities should be based on the need of the individual (Sensory processing disorder, n.d.). According to a systematic review by Petrus et al. (2008), seven studies showed weak to moderately effective exercising strategies to help decrease stereotypic behaviors in students ages 4 to 15 years old with ASD. A few of those studies also looked at the effectiveness of exercise on academic performance. Given there were so few evaluation studies and the level of effectiveness varied, this strategy should be used with caution.

Chapter III: Summary, Conclusions, and Recommendations

This chapter will provide a critical analysis and discussion on the topic of sensory integration and its influence on the student's performance in the classroom. Recommendations for practice and further research will also be discussed.

Summary

Individuals on the autism spectrum can exhibit a variety of sensory needs. The most common areas of sensory needs are associated with seeking touch, vestibular, or proprioceptive input. Individuals on the autism spectrum can also use many ways to show that they are or are not getting enough of a certain sense that they crave. These ways can include repetitive or restrictive behaviors, yelling, hitting, kicking, etc. Being able to have control over their sensory needs by using sensory based interventions in the classroom will give students the tools to concentrate and be able to learn in the classroom environment.

Including sensory integration interventions into inclusive classrooms has shown to help students on the autism spectrum with attention, behavior, and academic performance (Watling & Hauer, 2015). When students with autism are able to help control the sensory input they are receiving from the environment, they are more likely to learn new skills and engage with their peers. Over or under stimulation from all stimuli can be very difficult to tune out when trying to learn in the academic environment, which is why teachers are starting to incorporate things in the classroom to help students with their sensory needs.

Interventions for tactile sensory issues are important because they help students with tactile problems be able to tolerate different textures as well as help them concentrate on a learning task. Fidgets are good for students that need movement at all times. They can help students get the "idea" of movement in a confined area. A downfall to using fidgets in the

classroom is that they sometimes become a distraction to the individual or others around them. This can hinder both learning and focus on a task. Sensory bins are also very helpful when exploring new textures and sensations. They are best used with younger students who do not understand certain textures. Many times sensory bins are used as a calming strategy when an individual needs to self-regulate their emotions. A downfall to sensory bins is that they can be costly and messy and many teachers will need to purchase the materials on a small budget. Another great idea to keep in mind when working with students on the autism spectrum is to give them their own workspace away from all the clutter and stimulating environment. Sometimes, bigger classrooms can be over stimulating to some individuals on the autism spectrum. This can be seen as a drawback because isolating kids from their peers takes away from their socialization and group collaboration skills.

Incorporating interventions for vestibular sensory issues are also very important when working with an autism population. Teachers can provide alternate seating, such as therapy balls instead of a regular chair. Therapy balls can benefit students by giving them the sensory input from bouncing as well as help their posture when sitting. They provide movement for students to help them attend, strengthen core muscles, and help with bad posture. Therapy balls can be costly and distracting to other students. Another way that teachers can incorporate vestibular input is through therapy cushions. Therapy cushions are a good and inconspicuous way of providing sensory input to students. A good thing about therapy cushions are that they are portable and can be used in so many different settings. A downfall to using therapy cushions is that sometimes students misuse them and they become distracting to other students in the room. Lastly, another good intervention strategy that teachers are trying to implement in their rooms are movement breaks. Movement breaks can give individuals time to refocus on what they were

doing and give them a few minutes to relax before jumping into more work. One downfall to a movement break is that it does take time out of lessons to implement.

Teachers have also been implementing interventions for proprioceptive sensory issues. One way that teachers do this is by giving a student a break time to do heavy work or resistance activities. These types of activities get the students muscles moving and send messages to their nervous systems on what to do with their bodies. These types of activities are also good to help “tire” out the student’s body before going back to sitting in class. A downfall to this intervention is that it usually has to be done outside the classroom, which in turn takes away from the student’s amount of time to learn. Another intervention that can be implemented in the classroom is a brushing and joint compression protocol. Brushing and joint compression can be very helpful in calming down the body as well as giving the individual an idea of where their body is in space. This intervention can also be seen as distracting to other students. Brushing can also disrupt learning since it is done so many times per day to be effective. Other things that the teacher can implement as an intervention for someone with proprioceptive sensory issues are balance training and motor coordination activities. These could be done as a whole group or individually. These activities can help students that have poor postural control, help with fine and gross motor skills, as well as eye-hand/eye-head coordination. A downfall of these types of interventions are that they need to be implemented outside of the classroom, and sometimes the students need to be eligible for occupational therapy services.

Conclusions

After examining the research on sensory integration, it is concluded that these interventions strategies could show positive effects on students’ academic success, depending on the severity of the sensory needs of the individual. The interventions that teachers should

consider should be based on the individuals need and severity of their sensory issue type. Not all interventions will work for every individual; so many times teachers will need to try different interventions to find the best fit. The interventions that were mentioned are the most common interventions that are trying to make their way into classrooms today, but lack research and support of effectiveness. Researchers mentioned that doing research with the autism population regarding sensory integration is difficult to generalize because of the children's varying developmental levels and nature of the treatment. The responses to the interventions from the individuals are unpredictable (Pfeiffer et al., 2011).

Therefore, the studies that were discussed in this literature review should be interpreted with caution because of the limitations to the validity of the studies. One limitation that should be noted is the fact that many of the studies described above had small sample sizes. This makes it hard for researchers to generalize their findings to the whole autism population. Another limitation to the studies was the fact that not all of the interventions will be accessible to all teachers. Some schools do not have the resources to provide sensory based interventions in the classroom. Lastly, another limitation to the studies is the lack of current research that is on sensory based interventions. Many studies that were discussed above said that it would benefit from more research and bigger population sizes.

Recommendations

Based on the available research for this study, it is recommended that research continues to examine the connection between sensory issues and student performance. It is recommended that research look specifically at the various interventions and their effectiveness. Many of the current studies showed mixed effects so it is recommended that research continues in each of the sensory areas. It is also recommended that researchers look to expand their populations to bigger

sample sizes and longer intervention periods, since many of the studies had limited numbers of students, and were not able to generalize with the whole autism population. Pfeiffer et al. (2011), put into perspective on how designing future studies to carry over interventions throughout daily routines and to use more individualized measurement tools because of the diverse nature of the autism population.

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