THE IMPACT OF SENSORY STIMULATION ON THE TRANSITIONS OF CHILDREN WITH AUTISM SPECTRUM DISORDER

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Title of Study: THE IMPACT OF SENSORY STIMULATION ON THE TRANSITIONS OF CHILDREN WITH AUTISM SPECTRUM DISORDER

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Abstract: Research pertaining to the transition behaviors and transition difficulty for children with ASD and other disabilities has been broadly researched, however there is little published research focused on the impact of sensory stimulation interventions on transition behaviors for children with disabilities. The aim of this study was to understand the impact of sensory stimulation interventions on transition behaviors of children with ASD. This study was a single-subject AB design focused on a single participant with results indicating that sensory stimulation interventions can decrease transition difficulties. This study adds to the limited research pertaining to difficulties that children with ASD experience during horizontal transitions.

TABLE OF CONTENTS

Chapter Page

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

CHAPTER I

INTRODUCTION

Rationale for the Study

Research pertaining to the transition behaviors and transition difficulty for children with Autism Spectrum Disorder (ASD) and other disabilities has been broadly researched, however there is little published research focused on the impact of sensory stimulation interventions on transition behaviors for children with disabilities. Children who have difficulties transitioning between activities can have challenging behaviors for parents, caregivers, teachers, therapists, etc. to manage that range in severity (protesting, whining, crying, screaming, tantrums, etc.) (Banda et al., 2009; Sterling-Turner & Jordan, 2007; Stoner et al., 2007). In everyday life people are constantly moving or switching between tasks (transitioning from one activity to another), which is a necessary part of life. In daycare and school settings children transition between activities on average between 15 and 20 times per day, which adds up to taking away 70 minutes of instructional time or as much as 25% of the day devoted to transitioning between activities (Olive, 2004; Schmit et al., 2000).

Statement of the Problem

As the field of Recreational Therapy (RT) continues to grow, there is a need for

research focused on RT to provide evidence to interventions utilized with patients. There is a small body of work related to sensory stimulation with transitions specifically in the RT field (Olive, 2004; Schmit et al., 2000). Thus it was necessary to conduct RT research in this area.

Purpose and Significance of The Study

The purpose of this study was to gain understanding of the impact of RT through sensory stimulation interventions for children with ASD, who have difficulties with transitioning between activities. The families, teachers, therapists, of the children and others may benefit from the information this study may provide, allowing possible insight to easing transition difficulty in everyday life.

Assumptions

For this study, the following assumptions have been made:

1. It is assumed that the observers understand proper observation techniques.
2. It is assumed that the researcher understands the observation notes and how to accurately enter observational data for analysis.

Definition of Terms

The following terms have been included for increased understanding of the terms used throughout the study.

- Sensory Stimulation: Is the process of the senses being stimulated. It is commonly thought that there are the five senses (visual, auditory, tactile, gustatory or tasting, and olfactory or smelling), but in reality humans have more than five senses, including vestibular (balance), proprioception (relation of where the body is to other body parts), interoception (sensation

from internal organs), thermoception (feeling hot and cold), nociception (pain), and more are continuing to be researched and defined (Zero to Three, 2016). More specifically sensory stimulation interventions aim to produce a response to sensory stimuli for various reasons, ranging from cognition and memory, to stress relief and relaxation techniques (Bestbier & Williams, 2007; Bower, 1967; Case-Smith et al., 2015; Norberg et al., 1986; Paire & Karney, 1984; Porter & Burlingame, 2006; Richman, 1969).

- Transition Behavior: For the purposes of this study, transition behaviors specifically refer to the behaviors children display when moving from one activity to another and can range from no difficulty to extreme difficulty (Luczynski & Rodriguez, 2015; Olive, 2004).
- Quality of Life: Quality of life (QOL) can be defined as an "individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns," according to the World Health Organization (WHO) (WHO, p. 1, 1997).
- Health-related quality of life: Health-related quality of life (HRQOL) refers to the patient's perceptions of the disease's impact and following treatment impact on multiple domains of life, including physical, mental, and social functioning (Varni, Seid & Rode, 1999).
- Children with Autism Spectrum Disorder: For the purposes of this study, a child or children with Autism Spectrum Disorder (ASD), includes any child under age 18-years old that has been diagnosed with Autism

Spectrum Disorder (ASD). ASD is a neurodevelopmental disorder (developmental disability) typically diagnosed in early childhood that is characterized by stereotyped, repetitive behaviors, and social impairments (American Psychiatric Association [APA], 2013).

- Recreational Therapy, Therapeutic Recreation: According to the American Therapeutic Recreation Association, Recreational Therapy (RT) is a treatment that utilizes recreation and activity based interventions "to restore, remediate and rehabilitate a person's level of functioning and independence in life activities to promote health and wellness as well as reduce or eliminate the activity limitations and restrictions to participation in life situations caused by an illness or disabling condition" (ATRA, n.d.).

Hypotheses

The aim of this study was to understand the impact of sensory stimulation interventions on transition behaviors of children with ASD. This study collected quantitative data to analyze the following hypotheses:

H_1: The child with ASD will have decreased negative behaviors during transitions time after RT treatment utilizing sensory stimulation interventions.

H_0: The child with ASD will not have decreased negative behaviors during transitions time after RT treatment utilizing sensory stimulation interventions.

H_2: The child with ASD will have decreased time of negative behaviors during transitions time after RT treatment utilizing sensory stimulation interventions.

H_0: The child with ASD will have decreased time of negative behaviors during transitions time after RT treatment utilizing sensory stimulation interventions.

Limitations

Limitations of this study included sample size, research experience and bias, and potential observer error. The sample size of the study could limit the generalizability of the results to the ASD population, however the small sample size reflected the need to seek out a child (individual younger than 18-years old) who had been diagnosed with ASD, who had difficulties with transitioning between activities, and who also participated in Recreational Therapy through OSU's Warm-Water Therapy Laboratory. Due to the limited number of children that met the criteria within the Stillwater, Oklahoma community, the study reflected a single-subject research design.

The researchers' prior experience and bias associated with Warm-Water Therapy, RT, and ASD could influence the approach and analysis of the study, as well as possible error or misinterpretations of behaviors or observational data by raters could have potentially impacted the study.

CHAPTER II

LITERATURE REVIEW

Children with Autism Spectrum Disorder

Disabilities in childhood can range from physical to mental (cognitive) impairment, encompassing common diagnoses, such as Down Syndrome, Autism Spectrum Disorder (ASD), Intellectual Disability, Developmental Disability, Cerebral Palsy, and learning disabilities, that impact development and functioning during childhood (17 years and younger) (Individuals with Disabilities Education Act [IDEA], 2004). Children with disabilities can experience a wide range of symptoms and deficits depending on their specific diagnosis.

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder (developmental disability) typically diagnosed in early childhood that is characterized by stereotyped, repetitive behaviors, and social impairments as defined in the *Diagnostic and Statistical Manual of Mental Disorders: 5th Edition* (*DSM-5*) (American Psychiatric Association [APA], 2013). ASD has five major diagnostic criteria: (1) persistent deficits in social communication and interaction across multiple contexts, (2) restricted, repetitive patterns of behavior, interests or activities, (3) symptoms must be present in early development, (4) symptoms must be clinically significant causing impairment in social, occupational and other major life areas, and (5) symptoms are not better explained by an

intellectual disability or developmental delay (APA, 2013). Within the second criterion (restricted, repetitive patterns of behavior, interests or activities), these behaviors must be characterized by at least two of the following: (1) stereotyped or repetitive motor movements, use of objects or speech, (2) insistence on sameness, inflexibility of routines, ritualized patterns, or verbal and nonverbal behavior, (3) highly restricted, fixated interests of abnormal intensity of focus, and (4) hyper- or hypoactivity to sensory input or unusual interest in sensory stimuli of the environment (APA, 2013). Sub-criterion one (stereotyped or repetitive motor movements, use of objects or speech) are commonly referred to as self-stimulation behaviors, self-stim, or stimming (APA, 2013; Lovaas et al., 1971; Runco et al., 1986). Self-stimulation allows children with ASD to provide themselves sensory feedback (Lovaas et al., 1971; Runco et al., 1986). There is debate surrounding self-stimming behavior, as it may interfere with learning new behaviors and skills, and responding appropriately, while others may think it is acceptable for self-stimulation as a way for children to self-regulate (Risley, 1968). Sub-criterion four, hyper- and hyposensitivity to sensory input, has particular interest within this study, given that sensory stimulation interventions will be utilized to impact transition behaviors.

The *DC: 0-5, Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood* diagnostic book by Zero to Three (2016), also defines ASD for young children. Diagnostic criteria within *DC:0-5* are similar to *DSM-5* diagnostic criteria for ASD, however they have more emphasis placed on the impact on the child and their family, and the child's sensory systems (Zero to Three, 2016). ASD within the *DC:0-5* (Zero to Three, 2016) has four major diagnostic criteria that must all

be present for diagnosis: (1) there must be limited or atypical social-emotional responsivity, sustained social attention, or social reciprocity, deficits in nonverbal social-communication behaviors, and peer interaction difficulties, (2) symptoms are not better explained by a sensory impairment, (3) at least two repetitive and restrictive behaviors are present (stereotyped or repetitive babbling/speech, motor movements, or use of objects and toys, resistance to change, demands sameness and shows distress in response to change or transitions, extreme or atypical fixation on an item or topic of interest, or atypical responsivity to sensory inputs), and the final major criterion (4) symptoms of the disorder, or caregiver accommodations in response to the symptoms, significantly affect the child's and family's functioning by causing distress to the child, interferes with child's relationships, limits child's participation in developmentally expected activities or routines, limits family's participation in everyday activities or routines, or limits the child's ability to learn and develop new skills or interferes with developmental progress. Though the *DSM-5* and *DC:0-5* share the similar diagnostic criteria, the *DC:0-5* accounts for specific manifestations of ASD within young children that are act differently than adolescents or adults due to young children not yet having fully developed their social-communication and relationship skills (Zero to Three, 2016).

Children with ASD may have difficulties transitioning between tasks (Banda et al., 2009). There are several hypotheses about why children with ASD may have difficulty transitioning between tasks (Banda et al., 2009; Bitsika & Sharpley, 2019; Flannery & Horner, 1994; Sterling-Turner & Jordan, 2007; Schmit et al., 2000). ASD is associated with restricted, repetitive patterns of behavior, interests or activities, which can be characterized as being inflexible to routine changes or highly fixated on interests. The

insistence on sameness/routine and fixations, may increase transition difficulty in children with ASD (Bitsika & Sharpley, 2019; Banda et al., 2009; Sterling-Turner & Jordan, 2007).

Children are typically diagnosed with ASD early in life (though some individuals may be diagnosed later in life into adulthood), with early symptoms of language and social impairments often being the first signs of ASD (APA, 2013). ASD is diagnosed four times more often in males, which may be related to females often having a comorbid intellectual disability diagnosis, suggesting females may be underdiagnosed with ASD unless intellectual or language impairments are recognized as well (APA, 2013). Within ASD there are three severity levels depending on each child's social communication and restricted and repetitive behaviors with level 1 requiring the least support ("requiring support"), level 2 "requiring substantial report", and level 3 requiring the most support ("requiring very substantial support") (APA, 2013, p. 52).

Sensory Stimulation

Sensory stimulation is the process of the senses being stimulated. It is commonly thought that there are the five senses (visual, auditory, tactile, gustatory or tasting, and olfactory or smelling), but in reality humans have more than five senses, including vestibular (balance), proprioception (relation of where the body is to other body parts), interoception (sensation from internal organs), thermoception (feeling hot and cold), nociception (pain), and more are continuing to be researched and defined (Zero to Three, 2016). More specifically sensory stimulation interventions aim to produce a response to sensory stimuli for various reasons, ranging from cognition and memory, to stress relief and relaxation techniques (Bestbier & Williams, 2007; Bower, 1967; Case-Smith et al.,

2015; Norberg et al., 1986; Paire & Karney, 1984; Porter & Burlingame, 2006; Richman, 1969). Sensory stimulation interventions may also be used to help individuals learn to interpret and integrate sensory stimuli, allowing individuals to become more aware of themselves and their environments (Leekam et al., 2007; Tomcheck & Dunn, 2007).

Intervention types within sensory stimulation are wide ranging, as are the reasons for utilizing sensory stimulation interventions. Sensory stimulation interventions can include aromatherapy (smelling of various scents to promote relaxation, memory, cognition, etc.), sensory deprivation and deprivation chambers (intentional decrease/restriction/elimination of certain senses to promote relaxation), and deep pressure therapy (tactile sensations from being hugged, squeezed, stroked or held) (Bestbier & Williams, 2017). Children often engage in sensory stimulation as part of their typical development, taking in sensory input to help them learn about themselves and the world (Ayers, 1979; Gross, 1998; Mastergeorge & Paschall, 2018; Piaget, 1971). At times these activities can be targeted activities to specifically learn about the senses (such as squishing playdough or sand to feel the textures), but often sensory stimulation is integrated within the context of other activities or objectives (such as playing basketball or swinging on the playground) (Ayers, 1979; Gross, 1998; Mastergeorge & Paschall, 2018; Piaget, 1971).

Children may be either over or under responsive to sensory stimuli (i.e. hyposensitive or hypersensitive) due to their ASD diagnosis, or as part of a separate sensory processing disorders (APA, 2013). If children are hyposensitive to stimuli, they may not recognize feelings of pain (such as touching a hot object) potentially leading to increased injury. In contrast, children who are hypersensitive to stimuli, may have

grandiose reactions to certain sounds, lights, textures, physical touch (such as hugging), etc. It is evident that some children experience either hypo- and hypersensitivity to certain stimuli, which can lead to further complications. ASD and other diagnoses recognize hypo- and hypersensitivity to stimuli as characteristics of the diagnosis, however there is debate concerned with an official separate diagnosis for sensory processing disorders (APA, 2013; WHO, 2015; Zero to Three, 2016). The *DSM-5* does not recognize sensory processing disorder as a separate diagnosis, but rather sensory processing issues may be included as aspects of other diagnoses (such as ASD) or may be included in an unspecified diagnosis category/code (APA, 2013). *DC:0-5*, unlike the *DSM-5*, does include sensory processing disorders as specific and separate diagnoses (Zero to Three, 2016). *DC:0-5* (Zero to Three, 2016) included sensory over-responsivity disorder, sensory under-responsivity disorder, and other sensory processing disorders as diagnoses within the sensory processing disorders category. It is important to note that the *DSM-5* is the gold standard for diagnostic criteria (though *DC:0-5* was created as a companion to the *DSM-5* for infants and young children), and the lack of an official sensory processing disorder classification within the *DSM-5* suggests that there is more research that needs to occur on the subject to determine if there is justification for a separate sensory processing disorder classification (APA, 2013; Zero to Three, 2016). Though the *DSM-5* does not recognize sensory processing disorders, the International Classification of Diseases, Tenth Revisions, Clinical Modification (*ICD-10-CM*), the global standard for coding health information developed by the World Health Organization (WHO), attempts to provide a diagnostic code related to sensory processing disorders: code F88 (WHO, 2015). The *ICD-10-CM* code F88 encompasses a phrase

"sensory integration disorder" within Global Developmental Delay and Intellectual Disabilities as a way for therapists, physicians, etc., to provide insurance with a billable code (justification for services). It should be noted that sensory processing disorder is not an official diagnostic code within the *ICD-10-CM* (WHO, 2015). The *DSM-5, DC:0-5,* and *ICD-10-CM,* all exist for varying reasons (*DSM-5* and *DC:0-5* provide clinical diagnostic criteria, and *ICD* to assist healthcare providers across the globe with medical charting and billing) with various degrees of inclusion for sensory processing issues. However, the *DSM-5* and *ICD-10* are the leading experts and gold standards for diagnostic purposes, and their exclusion of a separate sensory processing disorder diagnosis made it clear that there is a need for increased research on sensory processing and related diagnoses to help determine if sensory processing issues may be their own diagnoses or if sensory processing issues will remain aspects of specific diagnoses (such as ASD) (APA, 2013; WHO, 2015; Zero to Three, 2016).

Transitions

Children with ASD may have difficulty transitioning between activities for various reasons (following routines/schedules or liking certain activities more), which can lead children to act negatively during transition times to avoid or delay transitioning (Sterling-Turner & Jordan, 2007; Schmit et al., 2000). It is important that teachers, instructors, therapists, etc., identify effective interventions to decrease negative behaviors during transitions time to maximize learning time (including treatment/therapy), opportunities, and outcomes (Lequia et al., 2012).

Types of Transitions

Transitioning refer to moving from one activity to another in daily life or regularly occurring (horizontal transition), as well as referring to significant life changes from schools, hospitals/care environments, or moving from the school environment to adult community life (vertical transitions) (Kagan, 1992; Polloway et al., 2001; Stoner et al., 2007). The body of literature related to transitions historically focused on vertical transitions rather than horizontal transitions; however, more research surrounding horizontal transitions has occurred in recent time as more policies have been created and more emphasis placed on horizontal transitions (Rosenkoetter et al., 2001).

Horizontal transitions are generally considered to be more difficult than vertical transitions for children with transition difficulty, which may be attributed to horizontal transitions being less predictable as compared to vertical transitions that are planned/practiced for days, weeks, and months in advance (Kagan, 1992; Polloway et al., 2001; Stoner et al., 2007). The continual and prolonged discussion, planning, and practice of vertical transitions, such as moving from elementary to middle school, allows children and their support teams to be as prepared as possible for the upcoming change, rather than typically unannounced/unplanned changes in daily routine and schedules for horizontal transitions (Kagan, 1992; Polloway et al., 2001; Stoner et al., 2007). Though the body of literature is primarily focused on vertical transitions, this literature review and study focused on horizontal transitions that occur in daily life. This study investigated transitioning after therapy sessions that occur on a regular basis (not focused on significant life changes, such as moving from elementary to middle school), which indicated this study was analyzing horizontal transitions (Olive, 2004; Schmit et al.,

2000). Horizontal transitions throughout the day may take up as much as 25% of the day, placing a large amount of time and importance on horizonal transitions for daily life (Olive, 2004; Schmit et al., 2000).

Difficulties with Transitions

There can be many reasons children have difficulties transitioning and have difficult behaviors for parents/caregivers, teachers, therapists, etc., to manage during transition times; however, exact reasons for transition difficulty are not fully know. Flannery's and Horner's (1994) predictability hypothesis is often the most cited explanation for transition difficulty. Flannery and Horner (1994) believed that individuals with ASD need greater predictability in their environments than individuals without ASD, which means changes in routine or unplanned changes in activities may be distressing, resulting in transition difficulty (Sterling-Turner & Jordan, 2007). The predictability hypothesis also implied that individuals with ASD may not be fully aware of naturally occurring cues that signal an upcoming change (transition), and that lack of awareness combined with the characteristics of ASD may result in increased problem behaviors during transition times (APA, 2013; Flannery & Horner, 1994; Sterling-Turner & Jordan, 2007).

Flannery and Horner (1994) found that manipulating environmental cues/events so that the consequence of a behavior are reinforced can increase the likelihood of desired behavior (decrease transition difficulty) due to the transition being more predictable and less aversive. This could mean if a therapist, teacher, parent, etc., repeatedly prefaced transitions with an environmental signal (cue), such as time announcements,

ending/goodbye routine, or other type of sensory stimuli, a more predictable routine and less difficult behaviors at transition times may occur.

Other researchers conducted research to determine if the difficulty experienced during transitions was related to the child's ASD diagnosis or if the difficulty was related to the activities the child engaged in, suggesting that transition difficulty may be due to "preferedness" (liking) of some activities more than other activities (Bitsika & Sharpley, 2019). The researchers analyzed physiological responses (heart rate) of children with ASD to determine if there was a possible link between transition distress and preferedness of activities. When transitioning from a non-preferred task to a preferred task, or from a preferred task to a differing preferred task, there was little change in the heart rate of children with ASD. There was however a significant increase in heart rate when transitioning from a preferred task to a non-preferred task, which may indicate that preferring certain activities over others may influence transition distress.

Transition Interventions and Strategies

Past research indicated that transition aids that include verbal and visual cues of upcoming transitions may be beneficial to decrease negative behaviors at transitions times (Buschbaker & Fox, 2003; Dooley et al., 2001; Register & Humpal, 2007; Schreibman et al., 2000). Visual interventions for transitions include pictures and videos to give students cues of upcoming transitions (Buschbaker & Fox, 2003). Pictures can be a schedule of the day or activity (i.e. getting ready for recess includes pictures of tying shoes, putting on jacket, and lining up with peers), or utilizing communication aids, such as Picture Exchange Communication Systems (PECS), that allow children to visually see a representation of the schedule to ease transition time (Buschbaker & Fox, 2003; Dooley

et al., 2001). An example of visual transition strategies included an intervention called social stories, which are short written descriptions and directions of transitions that included picture visual aids to ease transition difficulty (Kuttler et al., 1998). Verbal strategies to ease transitions included the teacher, instructor, therapist, etc., talking to the child to prepare them for transitions (i.e. verbal "warnings" of time left at activity, statements of "after this activity we will move on to another activity", etc.) and can include sounds from songs or tones to alert (cue) children of transitions (Kuttler et al., 1998; Register & Humpal, 2007).

Transition interventions, such as videos, can involve both visual and verbal (auditory) cuing, that visually show and verbally discuss the upcoming task to children (Schreibman et al., 2000). The use of video priming, children viewing videos of upcoming transitions, has been shown to decrease negative behaviors during transitions in children with ASD, and may be generalized to other or new settings (Schreibman et al., 2000). The intervention TEACCH (Treatment and Education of Autistic and related Communication-handicapped Children) is a conceptual model to help children with ASD of varying ages and functioning levels reach their highest level of functioning, and had been used to decrease transition difficulty (Mesibov & Shea, 2011). TEACCH utilized schedules and sequencing, as well as visual and auditory cues (timer sounds, pictures, etc.) to aid in transition times. Within TEACCH, it is also important that there is designated time at the end of activities that allows children to establish a routine of free time (leisure) or to check the schedule of activities.

There are numerous interventions that may impact transition difficulty, and it is clear that many interventions relied on sensory stimulation to some degree through

utilization of sounds (bells/times, vocal, etc.) and visual input from pictures, videos, or similar mechanisms as tools to increase transition compliance (Buschbaker & Fox, 2003; Dooley et al., 2001; Kuttler et al., 1998; Mesibov & Shea, 2011; Register & Humpal, 2007; Schreibman et al., 2000).

Recreational Therapy

Recreational Therapy (RT) is a therapy that utilizes recreation and activity-based interventions "to restore, remediate and rehabilitate a person's level of functioning and independent in life activities to promote health and wellness as well as reduce or eliminate the activity limitations and restrictions to participate in life situations caused by an illness or disabling condition," according to the American Therapeutic Recreation Association (ATRA), the national RT association in the United States (ATRA, n.d.).

At the core of RT is the use of recreation and leisure-based activities, also called interventions, to help patients achieve optimal health. Interventions used in RT treatment range from expressive activities (such as using arts and crafts), sports, gardening, leisure education, and more, to improve patients' functioning in many domains of life (Porter & Burlingame, 2006). Interventions focus on the skills that patients need improvement on for increased life functioning and QOL. In the case of children with ASD who have difficulty during transition times, RT can utilize intervention strategies, such as sensory stimulation, to help patients improve their ability to move from one task to another with less difficulty.

Warm-Water Therapy

Warm-water therapy utilizes a heated pool where the therapist leads the patient through various interventions to help increase the patient's functioning. Benefits of

utilizing aquatic-based instead of land-based interventions have long been researched, with one of the main advantages of aquatic-based interventions being that an aquatic environment allows for difficult tasks to be completed that are not easily completed or completed at all on land (the water negating the effects of gravity) (Sherril, 2004). The natural buoyance of water specifically allows people with disabilities to perform movements that would be difficult or impossible for them to currently complete on land (Stan, 2012). Other benefits of warm-water therapy include pain relief and relaxation due to thermal energy transfer, weightlessness from buoyancy and hydrostatic pressure, water providing support and resistance simultaneously from the viscosity and cohesion of the water, as well as offloading of body weight, increased muscle blood flow, decrease joint compression with movement, and more (Becker, 2004).

The water and pool environment also act as sensory stimuli in warm-water therapy. The water touches the skin and creates hydrostatic pressure on the body (tactile), the feeling of touching the bottom and walls of the pool (tactile), the water temperature (thermoception), water turbulence/currents (tactile and vestibular), the water surface constantly moving (visual), the sound of water moving/splashing (auditory), inner ear pressure changes from swimming underwater (vestibular), how the body moves and where body parts are in relation to other body parts in the water (proprioception), etc., all act as stimuli on the senses for people with and without disabilities (Campion, 1995).

Sensory Stimulation Interventions

Sensory stimulation interventions range widely depending on the sense(s) that are being targeted in the intervention, such as interventions involving music and sounds for auditory stimulation, various objects ranging in smoothness and roughness for tactile

stimulation, pressure place on the body from massage or other anatomical manipulation, and so on. One of the most widely used sensory stimulation interventions for transitions is the use of a sound (i.e. bell or chime) and/or music to alert children of coming changes in their activities (transitions), such as verbally announcing time left in activities or use of specific songs to signal transition time (Register & Humpal, 2007). The use of preplanned songs and other sound stimuli are effective strategies to prepare young children for transitioning between activities in preschool, pre-kindergarten, and kindergarten settings (Register & Humpal, 2007).

Quality of Life and Transition Time Difficulty

Quality of Life (QOL) can be difficult to define due to the many areas of life that QOL and QOL research encompasses. The WHO defines QOL as an "individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns," (WHO, p. 1, 1997). More specifically in healthcare, there is health-related quality of life (HRQOL) concerned with the impact of disease/disability and the following treatment effects on the domains of life (Varni et al., 1999). There is little published research pertaining specifically to QOL and transition difficulty related to ASD diagnosis, while there is anecdotal discussion on the improvements in QOL with transition difficulty decreasing.

Difficulty during transitions may raise the child's negative emotions, such as stress, anxiety, and fear, which could impact QOL (Banda et al., 2009; Stoner et al., 2007). As a child becomes more agitated during transition times, then their QOL could be negatively affected and the opposite could be true if a child is less agitated during transition times potentially leading to positive impact on QOL. Transition difficulty could

result in little participation in activities, which can slow learning progress in classrooms (Banda et al., 2009). The same parallel can be drawn to therapy, given that in therapy patients are learning/relearning skills, and slowing the progression of therapy can

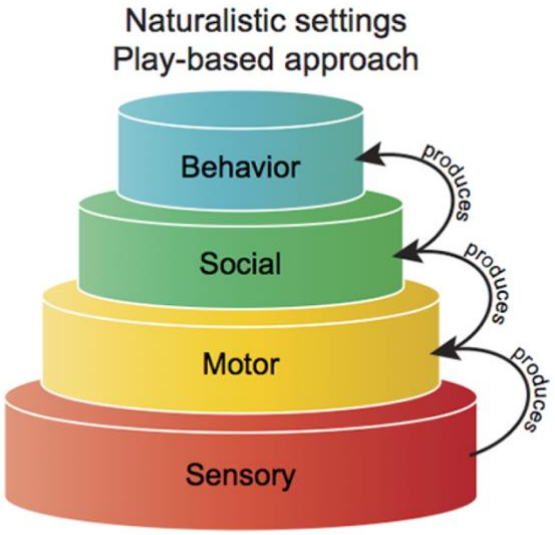

Figure 1. Sensory integration/processing leading to change (Camarata et al., 2020).

potentially impact QOL, as there may be little to no improvement on QOL if treatment is not progressing. Transitions account for 25% of the day, making up a large portion of children's lives (Olive, 2004; Schmit et al., 2000). Children who have difficulty transitioning between tasks may take longer to transition, thus taking up more of the day, and may display negative behaviors and experience negative emotions. One-fourth of the day or more could be spent focused on the negative emotions associated with transitions, thus negatively impacting QOL.

Children who have sensory processing difficulties may have deficits in their motor skills, which can lead to social and behavior deficits and overall negative QOL impacts (see Figure 1) (Camarata et al., 2020). If a child is having difficulty regulating sensory stimuli within their environment, they will have difficulty interpreting the

stimuli, which can lead to physical (motor) symptoms, such as decreased ability to perform multistep task and sequencing, poor coordination, and general clumsiness (see Table 1) (Camarata et al., 2020). The motor symptoms the child experiences can lead to social and behavioral impacts as well, such as anxiety, tearfulness, anger, aggression, poor impulse control, social isolation, and decreased relationships with peers and adults (Camarata et al., 2020). This could mean that if a child is having difficulties processing sensory changes at transitions times, then there may be impacts on their physical (motor), social, mental and emotional domains of life (manifesting as behaviors). Overall if a child is having difficulties processing sensory stimuli there could be negative impacts to the child's QOL. Decreasing transition difficulty with sensory stimulation interventions could improve the quality of treatment and overall QOL of the child.

Table 1. Social and behavioral effects of sensory disruptions (Camarata et al., 2020).

Dimensions	Behaviors observed
Sensory symptoms Results in ↓	Difficulty regulating sensory input: over or under responsivity (Tactile, Movement, Taste, Smell, Auditory, or Visual stimuli); difficulty interpreting internal sensations (body awareness, interoception), and difficulty discriminating external sensations (from the environment).
Motor symptoms Results in ↓	Poor coordination, Clumsiness, Awkwardness, Poor posture, Limited planning and sequencing of motor skills; Inability to perform multistep tasks.
Behavioral symptoms Results in ↓	Aggression, Anger, Dysregulation, Tearfulness, Withdrawal. Anxiety, Poor attention, Hyperactivity, Poor impulse control.
Social symptoms	Social isolation, Withdrawal, Poor social relationships with peers and adults, Discomfort in social situations.

Theoretical Perspective

The theoretical perspectives utilized in this study were Flannery's and Horner's (1994) predictability hypothesis and Sensory Integration Theory (Ayers, 1979). Flannery and Horner (1994) believed that individuals with ASD need greater predictability in their environments than individuals without ASD. This means that changes in routine or unplanned changes in activities may be distressing and result in transition difficulty (Flannery & Horner, 1994; Sterling-Turner & Jordan, 2007). The predictability hypothesis also believed that individuals with ASD may not be fully aware of naturally occurring cues that signal an upcoming change (transition), and the lack of awareness combined with the characteristics of ASD may result in increased problem behaviors during transition times (APA, 2013; Flannery & Horner, 1994; Sterling-Turner & Jordan, 2007).

In their studies, Flannery and Horner (1994) found that manipulating environmental cues/events so that the consequence of a behavior are reinforced increased the likelihood of desired behavior (decrease transition difficulty) due to the transition being more predictable and less aversive. This means that if a therapist, teacher, parent, etc., repeatedly prefaced transitions with an environmental signal (cue), such as time announcements, ending/goodbye routine, or other type of sensory stimuli, that it could lead to a more predictable routine and less difficult behaviors at transition times.

Sensory Integration Theory was pioneered by Dr. Jean Ayers, who established a therapeutic approach for effective sensory integration for development (Ayers, 1979). Sensory Integration Theory believes that if sensory stimuli is effectively integrated (modulated and discriminated), then this process can help lead to successful development

(Ayers, 1979). Modulation refers to children's abilities to appropriately respond to sensory stimuli (without either over or under responsive behaviors), while discrimination refers to children's abilities to perceive and utilize sensations for adaptive behaviors (such as walking, reading, writing, social skills, etc.) (Ayers, 1979; American Occupational Therapy Association, 2008). The ability to appropriately integrate sensory stimuli allows children to be able to respond appropriately to situations, as well as to learn and develop in all domains of life. From Sensory Integration Theory, the Pyramid of Learning was created (Ayers, 1979; Williams & Shellenberger, 1996).

The Pyramid of Learning (see Figure 2) is a conceptual model that illustrates the importance of the sensory systems to learning (Williams & Shellenberger, 1996). The Pyramid of Learning, much like Sensory Integration Theory, believes that the sensory system is the foundation for successful development (a bottom-up approach) (Williams & Shellenberger, 1996). The Pyramid of Learning believes that learning is incremental, building upon the sensory systems to help children learn about themselves and the world (Williams & Shellenberger, 1996). The bottom-up approach of the Pyramid of Learning means that children need to successfully master the basics/precursors of skills to set a strong foundation for achievement of higher level skills (Williams & Shellenberger, 1996).

At the base of the Pyramid of Learning is the central nervous system, encompassing seven sensory systems (tactile, vestibular, proprioception, olfactory, visual, auditory, and gustatory) (Williams & Shellenberger, 1996).Within the sensory systems layer, children must learn about their senses, taking in sensory stimuli to begin to learn about themselves and eventually the environment around them. The next layer is

sensory motor development encompassing postural security, awareness of two sides of the body, motor planning, body scheme, reflux maturity, and ability to screen input. Sensory motor development allows children to begin to utilize their senses to aid in

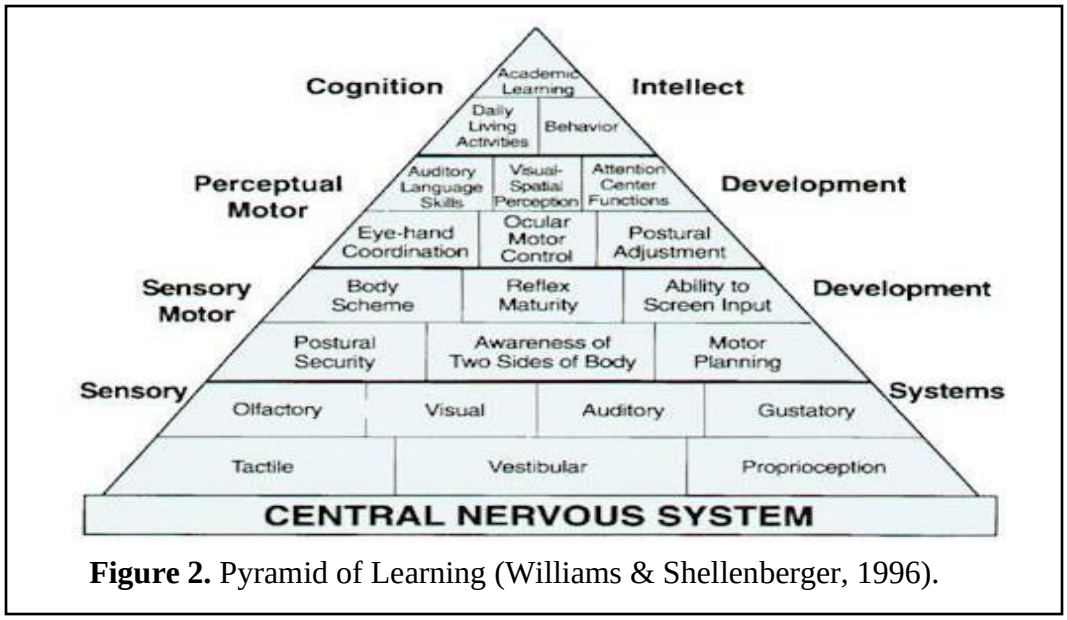

Figure 2. Pyramid of Learning (Williams & Shellenberger, 1996).

acquiring basic physical developmental skills. The next layer above sensory motor development is perceptual motor development, which allows children to connect what they have learned about their environment from their senses (perception) into more complex motor skills (Williams & Shellenberger, 1996). The perceptual motor development layer of the Pyramid of Learning encompasses eye-hand coordination, ocular motor control, postural adjustment, auditory language skills, visual spatial perception, and attention center functions. The final and highest layer of the Pyramid of Learning is cognition and intellect, which encompasses daily living activities, behavior, and academic learning. The final layer of the Pyramid of Learning is focused on cognitive development related to learning after successful acquisition of all previous layers and pieces (skills) (Williams & Shellenberger, 1996). In order for higher level learning to occur, children must first learn about themselves, their senses (including

modulation and discrimination), and how to integrate (utilize) their senses for mastery of skills in all domains of life (Williams & Shellenberger, 1996).

The Pyramid of Learning and Sensory Integration Theory allow therapists to understand and utilize sensory integration and sensory stimulation interventions to benefit children's development. As an example that relates to this study, if a child is learning to swim, meaning kicking with both legs and paddling with both arms simultaneously (bilateral integration awareness of two sides of the body and body scheme), but that child has not mastered vestibular and/or proprioceptive sensations, then the child is not likely to be successful at learning to swim. The child would be in the sensory systems layer of the Pyramid of Learning, which means the therapist would need to further individualize interventions to allow the child to learn about their vestibular and proprioceptive senses first before proceeding to the higher-level skill of swimming with bilateral utilization.

Flannery and Horner hypothesis and Sensory Integration Theory with the Pyramid of Learning allows therapists working with children with ASD a way to understand transition difficulties (Ayers, 1979; Flannery & Horner, 1994; Williams & Shellenberger, 1996). If a child is having difficulty transitioning, then they may not have fully mastered one or more of their senses to understand environmental cues for transitions (commonly visual and auditory cues) (Ayers, 1979; Flannery & Horner, 1994; Williams & Shellenberger, 1996). This allows therapist to utilize sensory stimulation interventions to help children transition with less difficulty, leading to children learning about their senses, how to regulate their senses, and learning about cues to transition from the activity.

CHAPTER III

METHODOLOGY

Research Design

To investigate the efficacy of sensory stimulation interventions on the transitions between activities of children diagnosed with Autism Spectrum Disorder (ASD), a retrospective single-subject research design was utilized to conduct research of one participant, approved by Oklahoma State University Institutional Review Board (study number IRB-21-78). The study followed an A-B design, with A representing the non-treatment phase (baseline) and B representing the treatment phase (receiving sensory stimulation interventions) (Mills & Gay, 2015).

Single-Subject Research Design

Single-Subject research designs allow for quantitative research to extensively analyze the behavior of the participant(s) (Price et al., 2015). The term single-subject design sounds as though the research only includes one participant, however single-subject research designs can involve up to 10 participants. Single-subject research studies are utilized to study behavior change of an individual from treatment, with each participant acting as their own control group (Mills & Gay, 2015). Single-subject research differs from the case study and case report approaches to research, which allow for qualitative and quantitative analyses, whereas single-subject relies on quantitative

and quantitative analysis, whereas single-subject relies on quantitative analysis (Price et al., 2015).

Single-subject research must follow the single-variable rule that during each phase of research only one variable should be manipulated (Mills & Gay, 2015). Single-subject research includes three assumptions (Price et al., 2015). The first assumption is it important to focus on individual behavior rather than individual differences being unrepresented. The second assumption of single-subject research is that it is important to discover if there is a possibility of causal relationships by manipulating the independent variable, controlling extraneous variables, and carefully measuring the dependent variable. The third assumption of single-subject research is the importance of studying the strong and consistent effects of treatment that have biological and social importance. Each of these assumptions places the importance in the thorough understanding and analysis of individual participant's data (behaviors) to determine the efficacy of treatment.

Within healthcare there are situations when research is conducted with participants from limited populations, which can indicate that the diagnosis is rare or limited, the age group is limited, and/or that there is a general lack of research in that specific area of healthcare (Portney & Watkins, 2017). Research of diagnoses with limited populations can rely on single-subject and case report or case study designs, given that the research will involve a limited number of participants. Healthcare research involves specific criteria (diagnoses, ages, cognitive skills, etc.), as other studies do, however within healthcare research this can greatly limit number of participants who

participate in the study, which is an indicator for single-subject research designs to be utilized (Price et al., 2015).

Data analysis within single-subject research designs includes visual inspection of graphed results, with researchers conducting analyzing to determine if there was clinical significance and/or statistical significance (Mills & Gay, 2015). Though statistical significance is typically the standard of analysis, within single-subject designs and healthcare related research, clinical significance may be used to determine if the behavior change after treatment was significant for individual participants that may not be statistically significant or vice versa. Single-subject research designs may use *t* and *F* tests, however the use of statistical tests of significance for single-subject designs is highly debated and have not historically been widely utilized within single-subject designs (Mills & Gay, 2015).

The use of single-subject designs is not new and was utilized in foundational research in healthcare related fields. Skinner's theory of operant conditioning, as well as applied behavioral analysis (ABA) research utilized single-subject designs, and research within psychology continues to use single-subject research designs (Price et al., 2015). Single-subject research allows for a deep understanding of the unique aspects of individuals and their treatment, which is imperative to healthcare research and the patients that it will benefit.

Data collection for this study included observational data collected during the child's Oklahoma State University (OSU) Warm-Water Therapy sessions that occurred once per week, held at Total Health Aquatics in Stillwater, Oklahoma. The study consisted of 16-weeks of observations of the child's behavior before, during, and after

transitioning to exit the pool to end their treatment session. Baseline measurements from observations were collected for 2-weeks prior to the treatment phase of the study, with the following 14-weeks consisting of the treatment phase of the study (the child receiving sensory stimulation interventions), for a total of 16 observations. The aim of this study was to understand the impact of sensory stimulation interventions on transition behaviors of children with ASD.

This study focused on sensory stimulation intervention through warm-water therapy from sensory input from aquatic jets that produce currents and bubbles in the warm-water pool, to examine the impact of sensory stimulation interventions on transition. The participant (child) was guided through sensory stimulation interventions by a therapist to prepare the participant for horizontal transition time. The therapist led the child through tactile proprioceptive, and vestibular sensations involving the aquatic water jets. The therapist instructed and helped the child to touch/feel the bubbles/current produced by the aquatic water jets with their hands, on their stomach, feet, and back, which provided simultaneous vestibular, proprioceptive, and tactile stimuli.

Participant

For this study, data collection utilized purposive or purposeful sampling due to the need to seek out a child (individual younger than 18-years old) who had been diagnosed with ASD, had difficulties with transitioning between activities, and who also participated in RT through OSU's Warm-Water Therapy Laboratory. Ideally maximal variation sampling would be utilized, however due to the limited number of children that met the criteria within the Stillwater, Oklahoma community the study reflected a single-subject research design. The participant was a 6-year old boy, diagnosed with ASD, who

had difficulty transitioning and received RT through OSU's Warm-Water Therapy Laboratory. The participant also received Occupational Therapy and Physical Therapy services at the time of the study approximately once per week for 30 to 60 minutes.

Data Collection

Procedures for data collection included signing of consent forms, observing the child during their regularly scheduled weekly therapy sessions, and ensuring accurate recording of observations before, during, and after transitions. When the child was identified as a potential participant, the research team then approached the parent during the child's regularly scheduled therapy session to explain the research and participation process to aid the parent's understanding before signing informed consent forms. After informed consent was obtained the research team observed the child during their scheduled weekly warm-water therapy sessions, focused specifically on observing the child in the minutes leading up to, during, and after exiting the pool at the end of their session (transitioning to leave the facility).

In the last 5-minutes of the child's session, the child was led through sensory stimulation interventions by the therapist to prepare the child for transition time. The therapist led the child through tactile, proprioceptive, and vestibular sensations involving the aquatic water jets. The therapist instructed and helped the child to touch/feel the "bubbles" produced by the aquatic water jets with their hands, on their stomach, feet, and back, which provided simultaneous vestibular, proprioceptive, and tactile stimuli. After sensory stimulation interventions, the child was then be instructed that their sessions was completed and it was time to exit the pool. The observers (raters) were close in proximity to observe the child's behavior, but not so close in proximity as to interfere with the

child's therapy/interventions and transition. The observations occurred for 16-weeks, once per week for 16 total observations, with two observers (raters) per observation. The first 2-weeks consisted of observations before, during, and after transitioning to exit the pool to gain baseline data (without sensory stimulation interventions), followed by 14-weeks of observations with sensory stimulation interventions.

Instrument

To record the observational data, an observation tool (table) developed by the research team was utilized to record the qualitative information (such as behaviors, demeanor, etc.) and the quantitative aspects (number of outburst and duration of outbursts) of the observations. There was not a standardized observation for transition behaviors at the time of the study (Booren et al., 2012; Hollingshead, 2013). For the quantitative aspects of the observation, the observer (rater) recorded the frequency (number) of the child's outbursts with tally-marks, as well as the duration of outbursts in seconds and minutes (if applicable) (see Appendix A). For the qualitative information of the observation, the observer (rater) recorded descriptive information, such as affect (facial expression and emotion), if the child was cooperative or defiant, etc., in relation to their sensory stimulation intervention utilizing the aquatic water jets and transitioning (exiting the pool/ending therapy session).

Data Analysis

The study focused on transition behaviors, however it is also necessary to include demographic information to provide further analysis between sex, age, specific diagnoses, etc. To prepare the quantitative data, numeric values were assigned to each response in Excel and SPSS, for the frequency (number) and duration of outbursts. Data

was checked for possible data entry errors and was analyzed in Excel and SPSS. Though statistical significance is typically the standard of analysis, within single-subject design research, clinical significance can be used to determine if the behavior change after treatment was significant for individual participants that may not be statistically significant or vice versa. Single-subject research designs may utilize statistical tests of significance (such as *t* test, *F* tests, and ANOVA), however the use of statistical tests of significance for single-subject designs is highly debated and historically have not been widely utilized within single-subject designs (Mills & Gay, 2015).

Coding into Excel and SPSS

Frequency and duration of outbursts were coded, with an established codebook for variables. Frequency directly correspond to the tally-marks (number) of outbursts recorded during transition time (i.e. five tally-marks on the observation tool will correspond to the numeric value "5" in Excel and SPSS). Duration in seconds and minutes was transformed to time in seconds, and correspond to the duration written on the observation tool, with >15 seconds corresponding to "1" in Excel and SPSS, 16-30 seconds corresponding to "2" in Excel and SPSS, 31-45 seconds corresponding to "3" in Excel and SPSS, 46-60 seconds corresponding to "4" in Excel and SPSS, 61-75 seconds corresponding to "5" in Excel and SPSS, and so on until the maximum duration of outbursts observed was reached.

Qualitative information taken from observations were placed into predetermined categories for future use and possible comparisons to quantitative data collected. Categories included: cooperative, moderately cooperative, uncooperative, negative disposition (sad, angry, upset, etc.), positive disposition (happy, pleasant, etc.), and other

categories that were uncovered during analysis. The qualitative information gathered in this study may be utilized to inform future studies and/or to make comments/comparisons to quantitative data.

Efficacy of Sensory Stimulation Interventions

To determine if the sensory stimulation intervention was or was not effective in reducing negative behaviors at transition times, the researcher utilized clinical significance and statistical significance. Within single-subject research designs, data analysis and interpretation relies on clinical significance more than statistical significance (Price et al., 2015). Statistical significance within single-subject research designs is debated given the small sample size of the research and individual nature of single-subject designs (Price et al., 2015). If the child had a significant reduction, decreasing 50% or more, in frequency and duration of negative behaviors at transition time, the sensory stimulation interventions would be deemed as clinically significant and an effective intervention. If the child's behaviors worsened (increase frequency and duration of negative behaviors) or remained the same at transition times, then the sensory stimulation intervention would be deemed as clinically non-significant (ineffective).

CHAPTER IV

FINDINGS

Introduction

The purpose of the study was to examine the impact of RT through sensory stimulation interventions for children with ASD, who had difficulties with transitioning between activities. The analysis for this study utilized clinical and statistical significance to determine if treatment was clinically significant and interrater reliability (kappa) to determine agreement amongst raters. This study followed a single-subject A-B research design, with A representing the non-treatment phase (baseline) and B representing the treatment phase (receiving sensory stimulation interventions) (Mills & Gay, 2015).

Demographics

This study involved one participant, a 6 year old child diagnosed with ASD, who had difficulty transitioning and received RT through OSU's Warm-Water Therapy Laboratory. The participant also received Occupational Therapy and Physical Therapy services at time of the study approximately once per week for 30 to 60 minutes. The participant attended RT sessions once per week for 30 minutes, with the final five minutes of session utilized for sensory stimulation interventions. The following data was collected from 16 RT sessions.

Findings

Interrater Reliability: Kappa

To determine interrater reliability, Cohen's Kappa was utilized. The data was divided into two halves: the first half consisting of raters 1 and 2 for the first 8 sessions (sessions 1 through 8), and the second half consisting of raters 3 and 4 for the last 8 sessions (sessions 9 through 16). Cohen's Kappa was utilized with a confidence interval of 95% to determine interrater reliability of recorded duration and frequency of negative behaviors during transition times.

Overall, raters 1 and 2 had less agreement of duration and frequency, while raters 3 and 4 had stronger agreement of duration and frequency (see Table 2). Cohen's Kappa was reported as $\kappa = .286$ (fair agreement) with $p < .05$, indicating that there was significant agreement between raters 1 and 2 for duration of negative behaviors observed. Cohen's Kappa was reported as $\kappa = .186$ (poor agreement) with $p < .05$, indicating that there was significant agreement between raters 1 and 2 for frequency of negative behaviors observed. For raters 3 and 4, Cohen's Kappa was reported as $\kappa = .692$ (substantial agreement), $p < .05$ for duration of negative behaviors observed, and $\kappa = .704$ (substantial agreement), $p < .05$ for frequency of negative behaviors observed.

Table 2
Interrater Reliability, Cohen's Kappa

	Cohen's Kappa, κ	**P-Value, *p***
Raters 1 and 2 Duration	.286	$p < .05$
Raters 1 and 2 Frequency	.186	$p < .05$
Raters 3 and 4 Duration	.692	$p < .05$
Raters 3 and 4 Frequency	.704	$p < .05$

Though raters 1 and 2 had less agreement than raters 3 and 4, Kappa is based on exact agreement, meaning there is not any inclusion for "close" agreement (data points that are close together would still not be counted as agreement, no matter how close those points may be to each other) (Portney & Watkins, 2000). The "exactness" of Kappa means that if raters 1 and 2 rated frequency as 5 and 6 respectively, this would not count as agreement though the frequencies recorded are numerically close in value (there is not any value given to being in the same "ballpark"). The small sample size (8 sessions each for each set of raters) could influence results due to kappa being based on proportions, meaning any discrepancies in agreement of smaller sample sizes may cause more variation in Kappa analysis than larger sample sizes (Portney & Watkins, 2000). Another possible reason for less agreement between raters 1 and 2 as compared to raters 3 and 4 could be related to the greater variability of frequency and duration observed during their observations (see Table 3). The more categories utilized will lead to generally decreased levels of agreement due to more categories being present.

Table 3

Descriptive Statistics of Recorded Observations

	Minimum Frequency	Maximum Frequency	Average Frequency	Average Frequency of Rater Pairs	Minimum Duration	Maximum Duration	Average Duration	Average Duration of Rater Pairs
Rater 1	1	12	5.125	5.0625	15	240	97.5	86.25
Rater 2	1	9	5		15	150	75	
Rater 3	0	6	0.875	0.6875	0	60	9.375	6.5625
Rater 4	0	3	0.5		0	15	3.75	

Possible other reasons for less agreement of raters 1 and 2 compared to raters 3 and 4 could relate to raters 3 and 4 having more well-rounded explanations/trainings of negative behaviors at transitions times, and raters 3 and 4 observing during sessions with

less negative behaviors (duration and frequency) than raters 1 and 2 (more negative behaviors means more possible variations in observation).

Hypotheses

The aim of this study was to understand the impact of sensory stimulation interventions on transition behaviors of children with ASD. This study collected quantitative data to analyze the hypotheses.

Hypothesis I

The null for hypothesis I stated the child with ASD will not have decreased frequency of negative behaviors during transitions time after RT treatment utilizing sensory stimulation interventions, while the alterative hypothesis stated the child with ASD will have decreased frequency of negative behaviors during transitions time after RT treatment utilizing sensory stimulation interventions. A decrease in frequency of

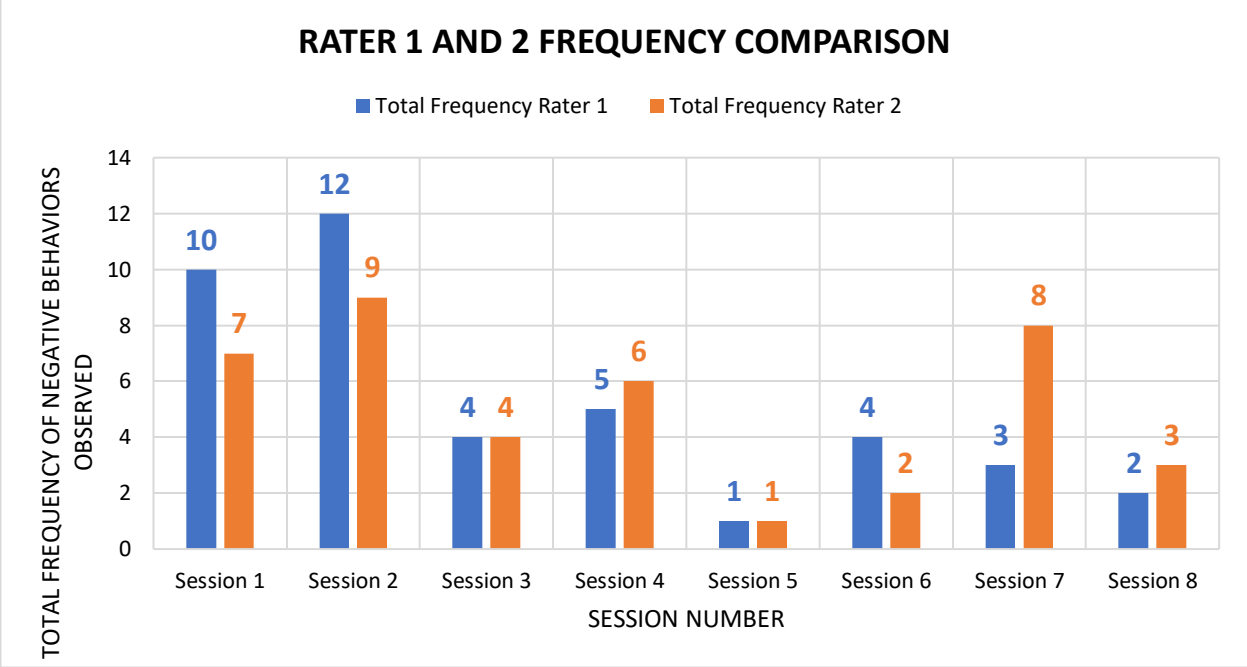

Figure 3. Comparison of Frequency of Negative Behaviors Observed by Raters 1 and 2

negative behaviors during transitions time after RT treatment utilizing sensory stimulation interventions was observed (see Figure 3 and Figure 4), which means null hypothesis I is rejected.

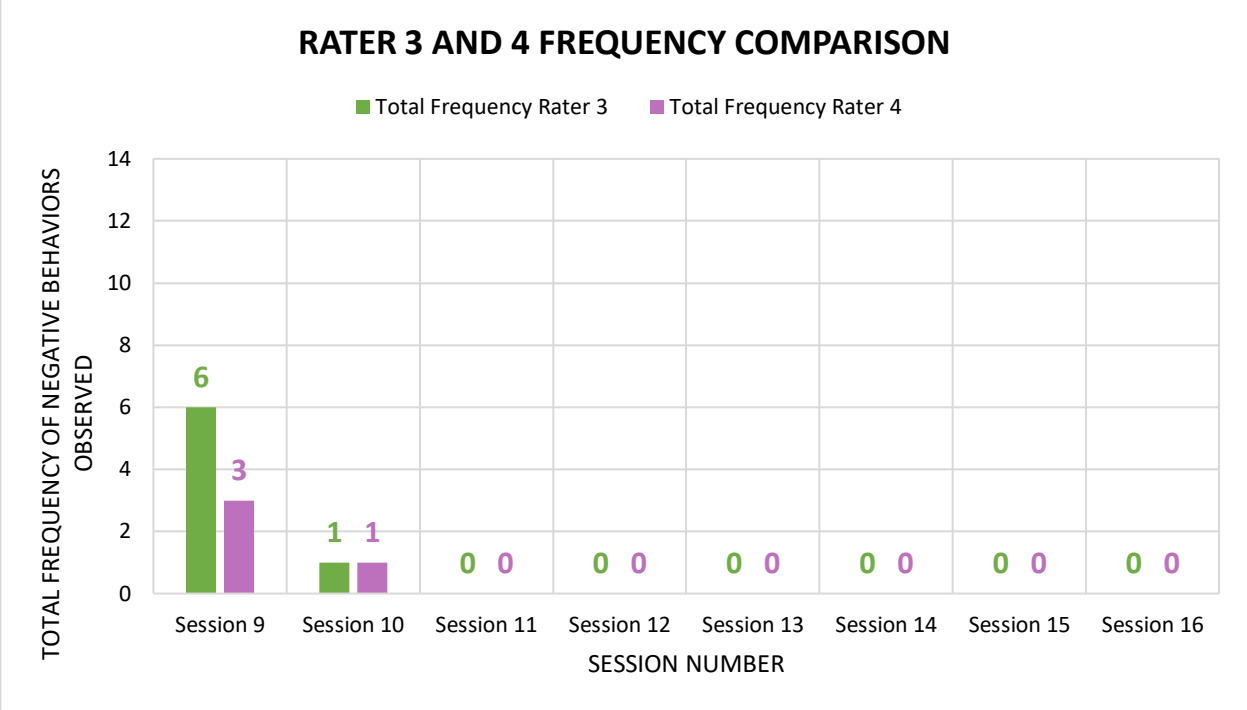

Figure 4. Comparison of Frequency of Negative Behaviors Observed by Raters 3 and 4

Hypothesis II

The null for hypothesis II stated the child with ASD will have decreased time of negative behaviors during transitions time after RT treatment utilizing sensory stimulation interventions, while the alternative hypothesis stated the child with ASD will have decreased time of negative behaviors during transitions time after RT treatment utilizing sensory stimulation interventions. There was a decrease in duration of negative behaviors during transitions time after RT treatment utilizing sensory stimulation interventions (see Figure 5 and Figure 6), which means null hypothesis II is rejected.

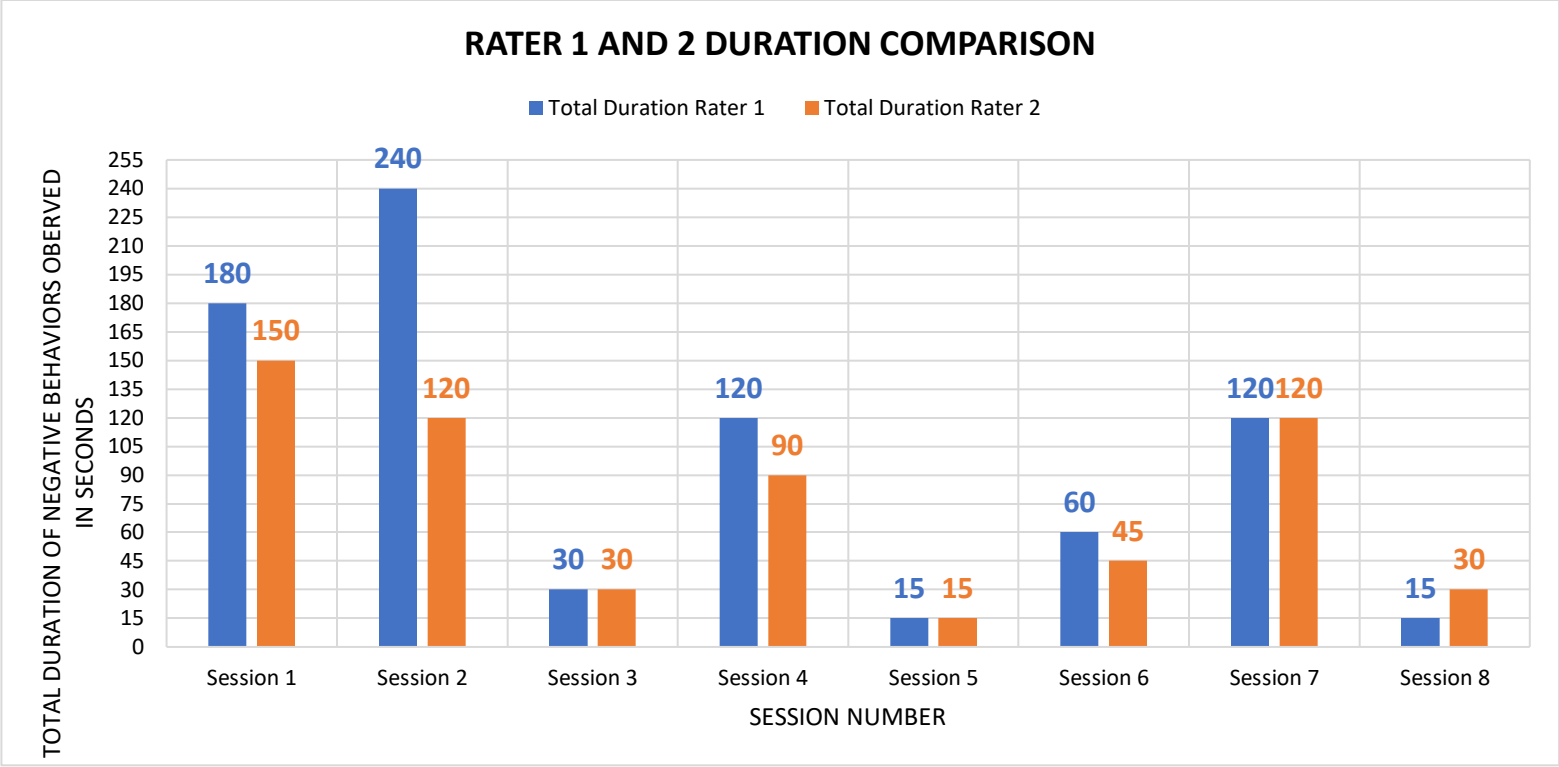

Figure 5. Comparison of Duration of Negative Behaviors Observed by Raters 1 and 2

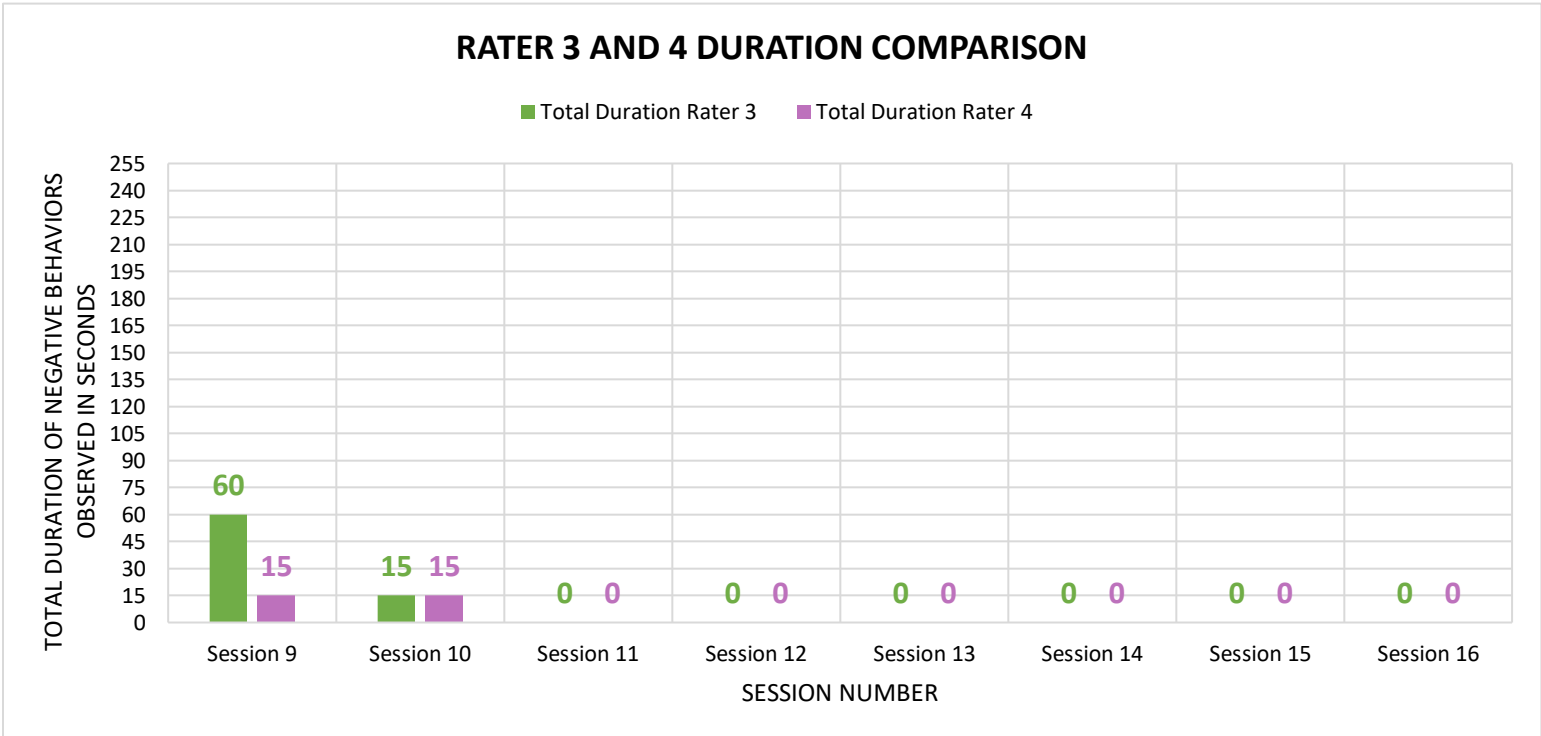

Figure 6. Comparison of Duration of Negative Behaviors Observed by Raters 3 and 4

CHAPTER V

DISCUSSION

Introduction

The purpose of this study was to gain understanding of the impact of RT for children with ASD, who have difficulties with transitioning between activities through sensory stimulation interventions. Quantitative data indicates that sensory stimulation interventions can decrease transition difficulty during transition times for children with ASD.

Significance of the Study and Practical Implications

The implications of this study allow for further insight into possible ways to decrease transition difficulty for children with ASD. Transitions account for 25% of the day, making up a large portion of children's lives (Olive, 2004; Schmit et al., 2000). Children who have difficulty transitioning between tasks may take longer to transition, thus taking up more of the day, and may display negative behaviors and experience negative emotions. One-fourth of the day or more could be spent focused on the negative emotions associated with transitions, thus negatively impacting QOL. If practitioners, teachers, parents, caregivers, etc. can find ways to decrease negative transitions, then there could be a positive impact on QOL by decreasing time spent in negative experiences from transitions. Sensory stimulation interventions may be an intervention

utilized to decrease transition difficulty, as evidenced in this study. This study focused on sensory stimulations interventions in an aquatic environment, providing insight that proprioceptive, tactile, vestibular, etc., sensory stimulation interventions can be beneficial to decrease transition difficulty. This could transfer to out-of-water/land-based environments (classrooms, therapy rooms, public places, etc.), with the utilization of a sensory stimulation interventions that are appropriate for land-based environments (such as self-massage, deep pressure therapy, and other proprioceptive, etc. stimulation).

Future Directions

This study focused on one specific participant, which could have led to a limited view and generalizability of transition difficulty of children with ASD and the impact sensory stimulation interventions had on their transition difficulty. Future studies should aim to increase sample size for generalizability to the population of children diagnosed with ASD who have difficulty transitioning. Future studies could also increase baseline observation duration to ensure a full understanding of participant(s) baseline behaviors and have comparable amount baseline data to treatment data, as well as implementing more raters (observers) and possible video recording of transitions. This study utilized an A-B single-subject research design of baseline phase followed by treatment phase. Future studies could implement other single-subject research designs (A-B-A, A-B-A-B, etc.) to determine the efficacy of sensory stimulation interventions on participant's transitions, as this could help control for the routine variable of receiving treatment possibly helping decrease transition difficulty rather than the intervention itself decreasing transition difficulty.

To gain more insight into QOL and transition difficulty, future studies should aim to utilize a standardized QOL measurement and qualitative interviews of parents, caregivers, teachers, etc., to determine the impact of transitions (both positive and negative) on the child's QOL and potentially the family's QOL. Future studies may also utilize mixed methods designs to provide well-rounded insight into the topic. The qualitative information gathered in this study may be utilized to inform future studies and/or to make comments/comparisons to quantitative data.

Conclusion

Autism Spectrum Disorder can have numerous impacts on children's overall functioning, which indicates that extensive research and investigation is necessary to fully understand the complexities of ASD. This study was a single-subject AB design focused on a single participant with results indicating that sensory stimulation interventions can decrease transition difficulties. This study adds to the limited research pertaining to difficulties that children with ASD experience during horizontal transitions. Children spend a large amount of their days transitioning and all researchers, practitioners, etc., should aim to continue researching sensory stimulation interventions and possible other interventions to alleviate negative transition experiences to improve transitions and possibly improve QOL.

REFERENCES

American Occupational Therapy Association. (2008). Frequently asked questions about Ayers sensory integration. AOTA.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (5th ed.).* American Psychiatric Association.

American Therapeutic Recreation Association. (n.d.). *What is RT/TR?* Retrieved October 8, 2017, from https://www.atra-online.com/page/AboutRecTherapy

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

Banda, D., Grimmet, E., & Hart, S. (2009). Helping students with Autism Spectrum Disorders in general education classrooms manage transition issues. *Teaching Exceptional Children, 41*(4), 16-21.

Bestbier, L., & Williams, T. I. (2017). The immediate effects of deep pressure on young people with Autism and severe intellectual difficulties: Demonstrating individual differences. *Occupational Therapy International*, 7534972. https://doi.org/10.1155/2017/7534972

Bitsika, V., & Sharpley, C. F. (2019). The effects of 'preferedness of task' on stress, emotion, and behaviors responses to forced activity transitions in boys with ASD. *International Journal of Developmental Neuroscience, 75,* 36-43. https://doi.org/10.1016/j.ijdevneu.2019.04.003

Booren, L. M., Downer, J. T., & Vitiello, V. E. (2012). Observations of children's interactions with teachers, peers, and tasks across preschool classroom activity settings. *Early Education and Development*, *23*(4), 517–538. https://doi.org/10.1080/10409289.2010.548767

Bower, H.M. (1967) Sensory stimulation and the treatment of senile dementia. *The Medical Journal of Australia, 1,* 1113-1119.

Buschbaker, P.W., & Fox,L. (2003). Understanding and intervening with the challenging behavior of young children with Autism Spectrum Disorder. *Language, Speech, and Hearing Services in Schools, 34*, 217-227.

Camarata, S., Miller, L.J., & Wallace, M.T. (2020). Evaluating sensory integration/sensory processing treatment: Issues and analysis. *Frontiers in Integration Neuroscience, 14*. https://doi.org/10.3389/fnint.2020.556660

Campion, M. (1995). *Hydrotherapy in Pediatrics*. Aspen Systems Corporation.

Case-Smith, J., Weaver, L. L., & Fristad, M. A. (2015). A systematic review of sensory processing interventions for children with autism spectrum disorders. *Autism: The International Journal of Research and Practice*, *19*(2), 133–148. https://doi.org/10.1177/1362361313517762

Dooley, P., Wilczenski, F. L., & Torem, C. (2001). Using an activity schedule to smooth school transitions. *Journal of Positive Behavior Interventions, 3*(1), 57-61.

Flannery, K., & Horner, R. (1994). The relationship between predictability and problem behavior for students with severe disabilities. *Journal of Behavioral Education, 4*, 157-176.

Gross, J. J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology, 2*, 271–299.

Hollingshead, B. K. (2013). Observational study and treatment of problem behavior associated with transitions of two elementary school children with disabilities. *Utah State University.* https://digitalcommons.usu.edu/gradreports/323

Individuals with Disabilities Education Act of 1990, 20 U.S.C. §§ 300.8 (2004).

Kagan, S. L. (1992). The strategic importance of linkages and the transition between early childhood programs and early elementary school. In *Sticking together: Strengthening linkages and the transition between early childhood education and early elementary school (summary of a National Policy Forum).* U. S. Department of Education.

Kazdan, A. E. (1999). The meanings and measurement of clinical significance. *Journal of Consulting and Clinical Psychology, 67*(3), 332-339.

Kuttler, S., Myles, B. S., & Carlson, J. K. (1998). The use of social stories to reduce precursors to tantrum behavior in a student with Autism. *Focus on Autism and Other Developmental Disabilities, 13*(3), 176-182, https://doi.org/10.1177/108835769801300306

Leekam, S. R., Nieto, C., Libby, S. J., Wing, L., & Gould, J. (2007). Describing the sensory abnormalities of children and adults with autism. *J. Autism Develop. Disorders, 37*(5), 894910.

Lequia, J, Machalicek, W., & Rispoli, M. (2012). Effects of activity schedules on challenging behavior exhibited in children with autism spectrum disorders: A systematic review. *Research in Autism Spectrum Disorders, 6*, 480–492.

Lovaas, O. I., Litrownik, A., & Mann, R. (1971). Response latencies to auditory stimuli in autistic children engaged in self-stimulatory behavior. *Behaviour Research and Therapy, 9,* 39-49.

Luczynski, K., & Rodriguez, N. (2015) Assessment and treatment of problem behavior associated with transitions. In F.D. DiGennaro & D.D. Reed (Eds.), *Autism*

service delivery: Autism and child psychopathology series. Springer. https://doi.org/10.1007/978-1-4939-2656-5_5

Mastergeorge, A. M., & Paschall, K. W. (2018). The impact of primary relationships in early experiences in toddlerhood: 12 to 18 months. In A.S. Morris and A.C. Williamson (Eds.) *Building early social and emotional relationships with infants and toddlers.* Springer. https://doi.org/10.1007/978-3-030-03110-7_5

Mesibov, G.B., & Shea V. (2011) TEACCH. In J.S. Kreutzer, J. DeLuca, & B. Caplan (Eds.) *Encyclopedia of clinical neuropsychology*. Springer. https://doi.org/10.1007/978-0-387-79948-3_1611

Mills, G. E., & Gay, L. R. (2015). *Educational research: Competencies for analysis and applications* (11th ed.). Pearson.

Norberg, A., Melin, E., & Asplund, K. (1986). Reactions to music, touch and object presentation in the final stage of dementia. An exploratory study. *International Journal of Nursing Studies, 23*, 315-23.

Olive, M. (2004). Effective strategies during transitions. *Beyond Behavior*, Fall, 11-16.

Paire, J.A., & Karney, R.J., (1984). The effectiveness of sensory stimulation for geropsychiatric inpatients. *American Journal of Occupational Therapy, 38*, 505-509.

Piaget, J. (1971). The theory of stages in cognitive development. In D. R. Green, M. P. Ford, & G. B. *Flamer, Measurement and Piaget*. McGraw-Hill.

Polloway, E. A., Patton, J. R., & Serna, L. (2001). *Strategies for teaching learners with special needs.* Merrill Prentice Hall.

Porter, H., & Burlingame, J. (2006). *Recreational therapy handbook of practice: ICF-based diagnosis and treatment.* Idyll Arbor.

Portney, L.G., & Watkins, M.P. (2000). Foundations of clinical research: Applications to practice (2nd ed.). Prentice Hall.

Portney, L.G., & Watkins, M.P. (Eds.). (2017). Single-subject designs. In *Foundations of Clinical Research: Applications to Practice (3rd ed.). McGraw Hill.* https://fadavispt.mhmedical.com/content.aspx?bookid=1987&sectionid=149503753

Price, P., Jhangiani, R., & Chiang, I. (2015). *Research methods of psychology: Canadian edition (2nd ed.).* BCcampus. https://opentextbc.ca/researchmethods/

Register, D., & Humpal, M. (2007). Using musical transitions in early childhood classrooms: Three case examples. *Music Therapy Perspectives, 25*, 25-31.

Richman, J. C. (1969). Sensory training for geriatric patients. *American Journal of Occupational Therapy, 23*, 254-257.

Risley, T. (1968). The effects and side effects of the use of punishment with an autistic child. *Journal of Applied Behavior Analysis, 1*, 21-34

Rosenkoetter, S. E., Whaley, K. T., Hains, A. H., & Pierce, L. (2001). The evolution of transition policy for young children with special needs and their families: Past, present, and future. *Topics in Early Childhood Special Education*, 21(1), 3-15.

Runco, M. A., Charlop, M. H., & Schreibman, L. (1986). The occurrence of autistic children's self-stimulation as a function of familiar versus unfamiliar stimulus conditions. *Journal of Autism and Developmental Disorders, 16*(1), 31-44.

Schreibman, L., Whalen, C., & Stahmer, A. C. (2000). The use of video priming to reduce disruptive behavior in children with Autism. *Journal of Positive Behavior Interventions, 2*(1), 3-11.

Schmit, J., Alper, S., Raschke, D., & Ryndak, D. (2000). Effects of using a photographic curing package during routine transitions with a child who has autism. *Mental Retardation, 38*, 131-137.

Sherril, C. (2004). *Adapted physical activity, recreation, and sport: Crossdisciplinary and lifespan* (6th ed.). McCraw-Hill.

Stan, A. (2012). The benefits of participation in aquatic activities for people with disabilities. *Medicina Sportiva, 8*(1), 1737-1742.

Sterling-Turner, H., & Jordan, S. (2007). Interventions addressing transition difficulties for individuals with Autism. *Psychology in the Schools*, *44*(7), 681-690. https://doi.org/10.1002/pits

Stoner, J. B., Angell, M. E., House, J. J., & Bock, S. J. (2007). Transitions: Perspectives from parents of young children with Autism Spectrum Disorder (ASD). *Journal of Developmental and Physical Disabilities*, *19*(1), 23-39. https://doi.org/10.1007/s10882-007-9034-z

Tomchek, S. D., & W. Dunn, W. (2007). Sensory processing in children with and without autism: A comparative study using the short sensory profile. *American Journal Occupational Therapy*, *61*(2),190-200.

Varni, J., Seid, M., & Rode, C. (1999). The PedsQL: Measurement model for the pediatric quality of life inventory. *Med Care*, 37(2), 126-39. https://doi.org/10.1097/00005650-199902000-00003

Williams, M. S., & Shellenberger, S. (1996)."How does your engine run?" A leader's guide to the alert program for self-regulation. TherapyWorks, Inc., 1996.

World Health Organization. (1997). *WHOQOL: Measuring quality of life*. WHO.

World Health Organization. (2015). International classification of diseases, clinical modification (10th ed.) https://icd.who.int/browse10/2015/en#/

Zero to Three. (2016). *DC: 0-5: Diagnostic classification of mental health and developmental disorders of infancy and early childhood.* Zero to Three.

APPENDIX A

Date: _____
Participant Code: _____
Observer: _____

Sensory Stimulation and Transitions in Pediatric Populations with Disabilities
Transition Observation Measures

Behavior Before Transition (Note behavior before transition: i.e. compliant, non-compliant, calm, upset, etc.)	
Behavior During Transition (Note behavior during transition: i.e. compliant, non-compliant, calm, upset, etc.)	
Behavior After Transition (Note behavior after transition: i.e. compliant, non-compliant, calm, upset, etc.)	
Frequency (number) of negative behaviors during and after transition (such as outbursts, crying, screaming, resisting exiting the pool, irritability, oppositional behaviors, etc.). Please tally each separate incident of negative behavior.	
Duration of negative behaviors during and after transition. Please note in seconds and minutes the duration of negative behaviors.	

VITA

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