

5-2016

The Use of Weighted Vests with Students who have Autism : A Review of Literature

Breanna L. Martins

St. Cloud State University, breanna_martins@rdale.org

Follow this and additional works at: http://repository.stcloudstate.edu/sped_etds

Recommended Citation

Martins, Breanna L., "The Use of Weighted Vests with Students who have Autism : A Review of Literature" (2016). *Culminating Projects in Special Education*. Paper 19.

This Starred Paper is brought to you for free and open access by the Department of Special Education at theRepository at St. Cloud State. It has been accepted for inclusion in Culminating Projects in Special Education by an authorized administrator of theRepository at St. Cloud State. For more information, please contact kewing@stcloudstate.edu.

**The Use of Weighted Vests with Students who have Autism:
A Review of the Literature**

by

Breanna Martins

A Starred Paper

Submitted to the Graduate Faculty of

St. Cloud State University

In Partial Fulfillment of the Requirements

For the Degree

Master of Science in

Special Education

April, 2016

Starred Paper Committee:

Mary Beth Noll

Bradley Kaffar

Theresa Estrem

Table of Contents

	Page
List of Tables	3
Chapter	
1. Introduction.....	4
ASD Diagnostic Information	4
Educational Services for Students with Autism Spectrum Disorder	6
Sensory Deficits	7
Weighted Vests	7
Research Question	8
Focus of Paper.....	8
Importance of Topic.....	9
Definition of Key Terms.....	9
2. Review of the Literature	11
Literature Review.....	11
3. Conclusions and Recommendations	38
Conclusion	38
Recommendations for Future Research	39
Limitations	40
Implications for Current Practice.....	40
Summary.....	41
References.....	42

List of Tables

Table	Page
1. Duration of Focused Attention.....	13
2. Mean Number of Distractions.....	14
3. Duration of Self-Stimulating Behavior.....	14
4. Attention-to-Task and Stereotypic Behaviors by Condition.....	18
5. Average Attention-to-Task Behavior in Seconds.....	20
6. Summary of Participant Characteristics.....	29
7. Data Summary.....	30
8. Objective and Subjective Data Summary.....	33
9. Summary of Chapter 2 Findings.....	36

Chapter 1: Introduction

Autism Spectrum Disorder (ASD) is a disorder that is defined by impairments in language, impairments in social skills, and stereotypical or restricted patterns of interest, behaviors, or activities (American Psychological Association [APA], 2000). Individuals with ASD often engage in stereotypical behavior such as body rocking, hand flapping, and object manipulation. They are observed to engage in mild to severe behaviors that include self-injurious behaviors, aggression, and running aimlessly (Centers for Disease Control [CDC], 2015). According to Case-Smith and Bryan (1999), children with ASD engage in such stereotypical movements in an attempt to regulate sensory input (Case-Smith & Bryan 1999).

Occupational therapist Jean Ayers first proposed the sensory integration theory that attributed learning and behavioral challenges to a dysfunction in processing sensory information from areas of the brain (Cox, Gast, Luscre, & Ayres, 2009; Davis et al., 2013). Sensory integration therapy uses sensory experiences to help individuals respond and adapt to sensory input and focuses on the three largest sensory systems in the body: proprioceptive, vestibular, and tactile (Cox et al., 2009). In recent years, weighted vests have been used as one form of sensory integration therapy. The purpose of this paper was to examine the literature that evaluates the effectiveness of weighted vests in improving behavioral outcomes for children with ASD.

ASD Diagnostic Information

The term *autism* comes from the Greek word *autos* that means *self*, and it describes conditions in which a person is removed from social interactions (WebMD, 2015). It was not until 1943 that Leo Kanner formally identified the characteristics of ASD after studying 11

children with social interaction impairments, sensitivity to stimuli, eating problems, and speech impairments (Davis et al., 2013).

In 2000, the American Psychiatric Association (APA) included children and youth with ASD under the umbrella of *Pervasive Developmental Disorders (PDD)*. The *Diagnostic and Statistical Manual of Mental Disorders IV-Text Revision (DSM-IV-TR; APA, 2000)* identified five disorders that were included in the PDD category: Autistic Disorder, Asperger's Disorder, PDD-NOS, Rett's Disorder, and Childhood Disintegrative Disorder (CDC, 2015). Prior to 2000, less specificity was provided.

The fifth edition of the DSM was published in May of 2013. One of the most significant changes in the DSM-5 was that the specific subcategories were replaced with one umbrella term of *Autism Spectrum Disorder* (Harker & Stone, 2014). The DSM-5 categorizes ASD into three severity levels: Level 3 describes individuals who require *very substantial support*, Level 2 describes individuals who require *substantial support*, and Level 1 describes individuals who require *support* (CDC, 2015).

Today, the CDC estimates that 1 in 68 children have been identified with ASD (CDC, 2015). Autism spectrum disorder occurs in all racial, ethnic, and socioeconomic groups, but occurs five times more frequently in boys than girls (CDC, 2015). The prevalence of ASD has increased 123% since 2002 (CDC, 2015). Some attribute this growth to changes in diagnostic criteria and diagnostic substitution (King & Bearman, 2009). Studies have shown that increased ASD rates are also accompanied by declines in prevalence of mental retardation (MR) and other developmental disabilities (King & Bearman, 2009).

Educational Services for Students with Autism Spectrum Disorder

Students with a medical diagnosis of ASD typically receive special educational services, although special educational criteria and medical criteria are different. If a student has a medical diagnosis of ASD, the student does not automatically receive educational services. Instead, a multidisciplinary team conducts a comprehensive evaluation that consists of assessments, observations, developmental information, behavior information, review of educational history, and documentation of evidence over time. To qualify for educational services, a student's educational evaluation must be conducted by multidisciplinary team and show evidence of qualitative impairments in social interaction, qualitative impairments in communication, and restricted, repetitive, or stereotypical patterns of behaviors, interests, and activities (Minnesota Department of Education, 2015).

Prior to the passage of P.L. 94-142 in 1975, students with ASD did not have access to free and appropriate special education services. Initially, P.L. 94-142 provided access to school services under the category of *Emotional Disturbance*. Recognizing the inappropriateness of serving students with ASD in this educational category, students with ASD began to be served in the category of *Other Health Impairments*, although some with more serious cognitive impairments were also served in the category of *Mental Retardation* (Triano, 2000). When the Individuals with Disabilities Education Act (IDEA) was passed in 1990, a new educational category of *Autism Spectrum Disorder* was created.

Typical service delivery for students with ASD requires a multidisciplinary team approach. Because individuals with ASD typically have significant sensory needs, the team usually includes an occupational therapist (OT). The OT collaborates with families and

professionals to identify factors that inhibit performance and adapts activities, materials, and environmental conditions so children can participate to the maximum extent possible in a range of settings (Scott, 2011). Occupational therapists provide interventions that help an individual “respond to information coming through the senses, and intervention may include developmental activities, sensory integration or sensory processing, and play activities” (Scott, 2011, p. 1).

Sensory Deficits

Sensory integration is the body’s ability to perceive, interpret and produce a response to sensory input (Schaaf & Miller, 2005). Individuals with a sensory deficit are believed to have trouble receiving appropriate sensory information from processing areas of the brain, causing impaired behaviors and abnormal responses to ordinary sensory experiences in the environment (Cox et al., 2009; Davis et al., 2013). The sensory therapy developed by Jean Ayers uses controlled, therapeutic sensory experiences to help an individual respond adaptively to sensory input (Cox et al., 2009; Davis et al., 2013). Weighted vests are one type of intervention used to address the proprioceptive, vestibular, and tactile sensory needs of individuals diagnosed with ASD (Kane, Luiselli, Dearborn, & Young, 2005).

Weighted Vests

A weighted vest is a close-fitting garment in which small weights are placed into pockets or interior slits (Davis et al., 2013). Theoretically, weighted vests provide proprioception to an individual, which in turn is purported to provide calming input to the central nervous system and the production of the neurotransmitters serotonin and dopamine (Honaker & Rossi, 2005).

Although weighted vests have become a rather common treatment for children with ASD, OTs continue to struggle with the practice because there are no protocols or guidelines for their use (Reichow, Barton, Sewell, Good, & Wolery, 2010). Olson and Moulton (2004) reported that

occupational therapists lack sufficient knowledge and information about weighted vests to make appropriate decisions regarding the weight of the vests and the length of time an individual should wear the vest.

Research Question

One research question is investigated in this review of literature: Are weighted vests effective in decreasing stereotypic and challenging behaviors and increasing attention to task in children with ASD?

Focus of Paper

The 10 quantitative research studies I review in Chapter 2 were published between 2001 and 2013. The studies included participants diagnosed with ASD who ranged from 2 to 11 years of age. Although weighted vests have been used with other disabilities such as attention deficit disorders, this research is beyond the scope of this paper. Studies that evaluated the use of weighted vests were conducted in both educational and clinical settings located in the United States and investigated its effects on both stereotypic behavior, disruptive behaviors, and task engagement. I am using the term ASD because it is what the DSM-5 uses.

I located studies by using the Academic Search Premier, ERIC, and PsycINFO databases. Several keywords and combinations of keywords were used to locate and identify relevant literature, including *weighted vests*, *weighted blankets*, *autism*, *sensory integration*, *occupational therapy*, *effects of weighted vests*, *snug vest*, *challenging behavior*, *aggression*, *self-injurious behavior*. I also examined the tables of contents of two academic journals: *Focus on Autism and Other Developmental Disabilities* and *Autism*.

Importance of Topic

Autism spectrum disorders constitute the fastest growing developmental disability in the United States (CDC, 2015). Meeting the needs of students with ASD can be challenging. As the number of students being identified with ASD increases so does the need for evidence-based practices. Deciding what interventions to implement and what strategies are the best can be confusing. The ASD community is prone to a variety of fad interventions. It is important that teachers be knowledgeable about what strategies and interventions are evidence based (Marder & Fraser 2012). As a special education teacher, when I use evidence-based practices, I know I am using practices that have been researched and scientifically supported.

Definition of Key Terms

Applied Behavior Analysis (ABA) refers to the process of systematically applying interventions based upon the principles of learning theory to improve socially significant behaviors and to demonstrate that the interventions employed are responsible for the improvement in behavior (APA, 2000).

Autism spectrum disorder is a neurobiological disorder that is characterized by the qualitative impairments in language, qualitative impairments in social skills, and stereotypical or restricted patterns of interest, behaviors, or activities (APA, 2000).

Diagnostic substitution refers to and when an individual is diagnosed with one condition at one time and subsequently with another condition at another point in time (King & Bearman, 2009).

Evidence-based practices are the integration of the best available research with clinical expertise in the context of patient characteristics, culture and preferences (APA, 2000).

Least-to-most prompting refers to a strategy used after a student has learned a skill. Prompts are faded away in order to decrease prompt dependency (BBB Autism Support Network, 2002).

Percent of non-overlapping data (PND) support visual data analyses and provide an objective interpretation of the results. A PND score of 90% and above is interpreted as very effective, 79-90% is interpreted as effective, 50-78% is interpreted to have a questionable effect, and any PND score of 50% or below is considered ineffective (Hodgetts, Magill-Evans, & Misiakzek, 2010).

Proprioceptive processing is related to the senses of joints and muscles (Schaaf & Miller, 2005).

Self-injurious behaviors are behaviors initiated by an individual that result in physical harm to the individual (Schaaf & Miller, 2005).

Self-stimulating behaviors is “repetitive bodily movement which serves no apparent purpose in the external environment” (Harris & Wolchick, 1979).

Tactile processing relates to an individual’s movement and sense of balance (Schaaf & Miller, 2005).

Vestibular processing relates to an individual’s movement and sense of balance (Schaaf & Miller, 2005).

Chapter 2: Review of the Literature

This paper reviews literature that investigates whether weighted vests affect behavioral outcomes for children with autism spectrum disorders (ASD). In this chapter I review 10 studies that determine if weighted vests decrease stereotypic behaviors and increase attention-to-task behaviors in children with ASD. Studies are presented in ascending chronological order.

Literature Review

Fertel-Daly, Bedell, and Hinojosa (2001) examined the effectiveness of using a weighted vest to increase preschool children's attention to a fine-motor task and decrease their self-stimulating behaviors. The five participants were between the ages of 2 and 4 years and were diagnosed with pervasive developmental disorder (PDD) at the beginning of the study and with ASD by the completion of the study. All the participants attended a preschool program 5 days a week for 3 hours a day. The study was conducted in a self-contained classroom with six children, one teacher, and six assistants. Each participant worked one-on-one with an assistant during fine-motor activities.

Participant 1 was a 2-year, 7-month-old girl who weighed 25.5 pounds. She was nonverbal and required assistance to walk. She displayed self-stimulatory behaviors that included biting, staring at her hands, and repetitive verbal humming. She was observed to throw objects off the table and throw herself out of her chair when required to complete a fine-motor activity.

Participant 2 was a 2-year, 10-month-old boy who weighed 32 pounds. He engaged in a few self-stimulating behaviors that included hand biting and pervasive humming and singing. He was able to remain seated during a fine-motor activity, but he required multiple cues to attend to the task. He was very easily distracted by auditory stimuli within his surroundings.

Participant 3 was a 3-year, 1-month-old boy who weighed 37 pounds. He showed preference toward gross-motor rather than fine-motor activities. He often looked away from tasks and toward auditory and visual stimuli and required continual prompts and redirections to engage in fine-motor activities. He also exhibited frustration and tantrums when an activity became difficult. The participant often twirled objects, rolled his eyes, repetitively clicked his tongue, and sang the same phrases. He made brief eye contact when his name was called but was not able to sustain eye contact.

Participant 4 was a 4-year, 9-month-old girl who weighed 33 pounds. She exhibited self-stimulating behaviors that included rocking, twirling, tapping objects, and repetitive verbal chanting when a task was presented. When presented with a task, she often had tantrums, threw herself on the floor, or turned her head away from the activity. She was also easily distracted by background noise and visual stimuli. She required physical prompting to remain seated during a fine-motor task.

Participant 5 was a 2-year, 10-month-old boy who weighed 27 pounds. He was observed to independently sit at a table and enjoy fine-motor activities, but would not play with materials appropriately. He twirled the task materials and required redirection to attend to the task as directed. He spontaneously made eye contact and made simple phrases when he wanted something. He was also easily distracted by auditory and visual stimuli.

An ABA single subject design was implemented to examine the effectiveness of wearing a weighted vest. The first author recorded the duration of focused attention to task, number of distractions, and duration and type of self-stimulating behavior during a 5-min fine-motor activity 15 times over 6 weeks. The interobserver agreement for number of distractions was

100% and 97% for the duration of focused attention and duration and type of self-stimulating behaviors.

A multi-pocket denim vest was sized to fit each participant. Each vest had four pockets, two in the front and two in the back with a .25 pound weight in each pocket. During the intervention phase, participants wore the vest for 2 hours after they arrived at school.

Table 1 represents the mean number of seconds each participant exhibited focused attention for each 5-min observation. The results indicated that focused attention increased during the intervention phase but was not sustained when the weighted vest was removed. All five participants showed a decrease in focused attention during the withdrawal phase.

Table 1

Duration of Focused Attention

	MEAN SECONDS OF FOCUSED ATTENTION		
	Baseline - No Vest(A)	Intervention (B)	Withdrawal - No Vest (A)
Participant 1	55.4	66.8	43.4
Participant 2	84.5	97.6	64
Participant 3	115	140	105.8
Participant 4	65.4	101.8	44.6
Participant 5	95.2	131.8	92.2

Table 2 represents the mean number of distractions each participant exhibited during each 5-min observation. All participants decreased the mean number of distractions from baseline to intervention, which increased during the withdrawal phase when the weighted vest was removed. Participant 1, who was the smallest participant in the study, showed the most decrease in number of distractions. The authors noted that this could have been an indication that the largest participant could have benefited from more weight in the vest.

Table 2**Mean Number of Distractions**

	BASELINE - NO VEST (A)	INTERVENTION (B)	WITHDRAWAL - NO VEST (A)
Participant 1	27.4	11.2	15.8
Participant 2	17.6	7.2	10.4
Participant 3	17.2	7.2	11.2
Participant 4	17.4	6.8	9.6
Participant 5	14.2	3.8	5.2

Table 3 represents the mean number of seconds each participant exhibited self-stimulating behaviors during each 5-min observation. Four participants decreased the duration of self-stimulating behaviors during the intervention phase. The weighted vest did not appear to have an impact on the duration of self-stimulating behavior for Participant 1. The authors noted that the behaviors changed and became less self-abusive for this participant. When the weighted vest was removed, self-stimulating behavior increased for all participants, but the self-stimulatory behaviors of Participants 3, 4, and 5 did not reach the initial baseline levels. Participant 4's behaviors decreased more dramatically than the other participants.

Table 3**Duration of Self-Stimulating Behavior**

MEAN SECONDS OF SELF-STIMULATING BEHAVIORS			
	Baseline - No Vest (A)	Intervention (B)	Withdrawal - No Vest (A)
Participant 1	16.6	22.2	34.8
Participant 2	8.2	5.2	22.4
Participant 3	17.6	8.6	10.2
Participant 4	227.6	99	75.8
Participant 5	61.6	19.2	16.2

The results of this study showed that wearing a weighted vest had a positive effect on all five participants in the areas of focused attention and number of distractions. Four of the

participants showed a decrease in the duration of self-stimulating behaviors during the intervention phase. Ferttel-Daly et al. (2001) noted that the participants' parents and teachers reported positive effects from wearing the weighted vest. They observed that participants stayed in their seats longer, decreased aggressive behaviors, reduced self-stimulating behaviors, and improved their upright sitting posture. The authors noted the use of an ABA design instead of a multiple baseline design was a significant limitation because some behaviors did not exhibit reversibility or did not return to baseline after the intervention phase.

Carter (2005) examined the function of self-injurious behaviors (SIB) of Gagan, a 4-year-old boy diagnosed with ASD. The procedure was conducted in an attempt to identify the function of the SIB in the presence of a sinus infection. The analysis also evaluated the effects of a weighted vest on the occurrences of SIB when a sinus infection was present and when one was not present. An alternating treatment functional analysis of self-injurious behaviors was used.

Gagan attended a public preschool classroom for children with special needs and functioned at the profound level of adapted behaviors. He was nonverbal and communicated using short screams and humming. A review of documentation noted a history of maladaptive behaviors that included self-injury, spitting, and running.

The functional analysis took place in Gagan's preschool classroom while other students were present. The classroom was situated so that Gagan could not access or view the other students. Self-injurious behavior was defined as hitting head with hand, hitting head against object or person, and slapping the backside of hand against object such as floor or table. The weighted vest weighed 3 pounds, which was 7.5% of Gagan's weight. Data were collected

using a 10-s interval recording system. Interobserver agreement was calculated at a mean of 94%.

Multiple conditions were used during this analysis. The alone condition consisted of Gagan being by himself. The no-interaction condition consisted of the researcher being present but providing no interaction. The attention condition consisted of having a researcher nearby and within eyesight of Gagan but not interacting with him unless he engaged in SIB (at which time the researcher delivered a verbal reprimand for 5 s). The demand condition involved the researcher delivering a demand to work on a task every 30 s using a least-to-most intrusive prompt hierarchy of verbalization, gesture, and physical assistance. If Gagan engaged in SIB during this point, the demand was terminated until the next scheduled demand delivery. The play condition consisted of having tangible items available throughout the session and the researcher interacting with Gagan at least every 30 s. Each condition was 5-min in duration and was conducted once daily for 72 days.

Carter (2005) provided a graph and anecdotal narration of the results. The graph represented the percent of intervals Gagan exhibited SIB within each condition. The anecdotal data indicated Gagan engaged in low to zero levels of SIB across all conditions with the presence of the weighted vest and without a weighted vest. The author concluded that the presence of the weighted vest did not affect the level of Gagan's SIB, although no data were provided in the study. The limitations identified in this study are the lack of a sensory defect diagnosis, the absence of a trained occupational therapist to administer the weighted vest intervention, and the lack of specific data.

Kane et al. (2004) evaluated the effectiveness of wearing a weighted vest as an intervention for children with ASD and PDD. This study included two boys and two girl's ages

8-11 years who displayed “repetitive, invariant, and perseverative motor responses” (Kane et al., 2004, p. 20). Jerry, Elise, and Eileen were diagnosed with ASD, and Norman was diagnosed with PDD/NOS. Previous evaluations by occupational therapists suggested that each participant had sensory integration needs.

The children were all enrolled in a private school classroom that included four to six students with developmental disabilities, a teacher, and multiple classroom assistants. Three conditions were observed during 10-min observation sessions: baseline (no vest), weighted vest, and vest with no weight. A counterbalance order was used as a baseline for the study. Elise and Norman’s sequence was baseline, weighted vest, and vest with no weights. Jerry and Eileen’s conditions were baseline, vest with no weight, and weighted vest. During the different phases of the study, the participants were provided with familiar objects within their classroom. During the baseline phase, the children were presented with an object and given a verbal direction (e.g., “Look at the book”), and then the therapist moved away. The other phases of the study were presented in exactly the same way as the baseline phase, with the exception of putting the vest on 1 min prior to the session. Each participant wore 5% of his or her body weight in their weighted vest.

Ten 1-min intervals were used during each of the conditions. During an interval, any occurrence of stereotypical behavior was recorded, and attention to task was recorded if it occurred for a minimum of 10 s. Table 4 presents data regarding the percent of intervals in which stereotypic behavior and attention to task occurred.

Table 4**Attention-to-Task and Stereotypic Behaviors by Condition**

	BASELINE (NO VEST)		WEIGHTED VEST		NO WEIGHTED VEST	
	Stereotypy	Attention to Task	Stereotypy	Attention to Task	Stereotypy	Attention to Task
Norman	92.5%	35%	93%	17.5%	92.5%	20%
Eileen	2.5%	90%	0%	76%	0%	73%
Elise	100%	12.5%	100%	0%	100%	0%
Jerry	22.5%	5%	55.3%	63%	97.5%	60%

Norman's behaviors showed consistently elevated occurrences of stereotypic behaviors at baseline, which did not change much during the three conditions. Attention-to-task behavior was recorded at 35% during the baseline phase and decreased when he wore the weighted vest (20%) and when he wore the vest without weights (17.5%).

Eileen displayed stereotypic behaviors 2.5% of the time during the baseline phase and no behaviors when she wore the vest with and without weights. She displayed attention to task 90% during baseline, which decreased to 76% with the weighted vest and 73% when wearing the vest without weights.

Elise was observed to show stereotypic behavior 100% of the time during all three phases. She attended to task 12.5% of the time when wearing no vest, even though she simultaneously engaged in stereotypy. She did not attend to task at all during the weighted and no-weighted vest conditions.

Jerry displayed stereotypic behavior 22.5% during the baseline phase, and his stereotypic behaviors decreased to 5% when he wore the vest with no weights. When he wore the vest with weights, his stereotypic behavior increased above the baseline to 63%. His attention-to-task behavior increased from a baseline of 60% to 97.5% when he wore the vest without weights. When he wore the vest with weights his attention to task decreased by 4.7% to 55.3%.

Kane et al. (2004) concluded the use of a weighted vest was not an effective way to decrease stereotypic behaviors and improve attention to task in children with ASD. The researchers noted that the data for three participants suggested that wearing a weighted vest with or without weights possibly had a negative influence on attention-to-task and stereotypic behaviors.

Myles et al. (2004) conducted three independent single-subject case studies to examine the effects of the use of weighted vests to improve attending skills in children with ASD.

Case Study 1. Darci was a 5-year, 7-month old girl who functioned at a developmental age of 20 months and had relative strengths in the areas of fine motor and gross motor. Darci was nonverbal and used an augmentative communication system. Off-task behaviors included vocalizations not related to the task, hand flapping, tensing her body and looking intensely at her hands, being out of her chair, and looking away from the learning materials. A variety of sensory-based interventions had been used to reduce Darci's self-stimulatory behaviors and increase her attention-to-task behavior. These included a chew necklace she wore around her neck, a sensory diet implemented throughout her day, a stress ball to squeeze, and a t-stool on which she could sit. A functional behavior analysis revealed Darci's need for deep pressure input.

Darci was provided a denim vest that held 10% of her body weight in weight. Duration recording was used to gather data on the time that Darci spent attending to the one-on-one instruction and group activities. ABAB design was used to evaluate the use of the weighted vest. Interobserver reliability was calculated at a mean of 98%.

In a one-on-one setting, Darci's off-task behavior increased when wearing the vest during the first intervention phase but decreased to below-baseline performance during the second

intervention phase. In a group setting, off-task behavior increased by 5 s during the first intervention phase, but decreased to 11 s during the second intervention phase, which was below the first baseline level. Data are presented in Table 5.

Table 5

Average Attention-to-Task Behavior in Seconds

	BASELINE	INTERVENTION	BASELINE	INTERVENTION
One-on-one	259.75	270.76	264.67	246.76
Group	172	177	188	161

Case Study 2. Sam was a 3-year, 6-month old boy who was nonverbal, and his communication abilities were primarily only to communicate his wants and needs. Sam showed minimal attention to task by continually removing himself from his designated areas. A variety of interventions had been attempted to reduce Sam's off task behavior. These included frequent breaks, holding tactile and oral materials, moving the spot where he sat, and changing the chair in which he sat. A functional assessment indicated that Sam appeared to be overstimulated during small-group activities and that he may be avoiding the activity to seek calm.

Sam was provided a vest made out of cotton that was equivalent to 5% of his body weight. Duration recording was used to record on-task behavior during a 15-min circle time activity.

During the first baseline phase Sam was observed to be on task for an average of 72 s. When the weighted vest was present the first time, the average increased to 237 s. On-task behavior decreased during the second baseline and increased to 321 s during the second intervention phase.

Case Study 3. Carlton was a 4-year, 11-month old boy who functioned at a developmental age of 22 months and demonstrated low verbal skills. He engaged in several deep

pressure, touch-seeking behaviors while in circle time: (a) lying on the floor, (b) leaning to side onto extended arm, (c) leaning back or forth onto both of his hands, (d) resting his chin in his hands with arm flexed and elbow resting on the floor or on his legs, and (e) sitting on one or both hands. Carlton had used a variety of other sensory integrations techniques, but nothing was implemented consistently.

During the 15-min baseline phase, the adults were asked not to talk to Carlton and to ignore his attempts to seek deep pressure. During the intervention phase, the weighted vest containing 5% of Carlton's body weight was worn for 30 min prior to circle time and then removed when circle time started, as was the case in the baseline phase. Interobserver reliability was recorded at an average of 100%.

During the first baseline phase Carlton sought deep pressure an average of 146 times. When the weighted vest was introduced, the average dropped to 61.75 times. During the second baseline phase the average number of time Carlton sought deep pressure was 190 and then decreased during the intervention phase to 53.50 times.

In Case Study 1, the use of the weighted vest did not appear to increase Darci's attention-to-task behavior. In Case Study 2, the weighted vest showed to be a relatively effective intervention. In Case Study 3, Carlton's deep pressure-seeking behaviors substantially decreased when the weighted vest was worn.

Myles et al. (2004) noted the single-subject designs permitted individual assessment of treatments and interventions. They emphasized the importance of considering the diversity among individuals with ASD, specifically as it relates to individual sensory systems. A factor that limits the interpretations of this study relates to the short intervention phases.

Cox et al. (2009) examined the impact of weighted vests on the amount of time students with ASD engaged in appropriate behavior. The three students, ages 5-9 years, received special education services for ASD and speech-language impairment in a self-contained classroom in a suburban school. Participant 1 did not have any functional language, engaged in excessive vocal behavior that was believed to be self-stimulatory, and demonstrated hand flapping, rocking, and repetitive toy play. Participant 2 also had no functional language but hummed, whistled, and spoke in chattering-type manner that appeared to be self-stimulating. He exhibited aggression toward others (scratching, hair pulling, hitting, and biting) and engaged in self-injurious behaviors (biting, self-pinching). Participant 3 had no oral language and engaged in a variety of behaviors that appeared to be self-stimulating (moaning, rocking, hand flapping, and jumping). He exhibited aggression toward others (biting, scratching, and hair pulling) and engaged in self-injurious behaviors (knee biting and leg scratching).

An alternating treatment design was used to examine the duration of appropriate in-seat behavior under three conditions that were altered throughout the day: (a) no-weighted vest, (b) vest with no weights, and (c) weighted vest (5% of body weight). None of the students had ever worn a weighted vest prior to the study.

The three students were observed during their routine group circle time. The observers collected data after viewing each of the 34-35 videotaped sessions using a 10-s interval recording system to track the appropriate in-seat behavior. Mean interobserver agreement was calculated to be 94.7%.

Results indicated all three conditions had a similar effect on in-seat behavior. This was evident in the high percentage of overlap reported among all three conditions with all three participants. The mean percentage of overlap was 69%, the median percentage of overlap was

70%, and the range was 20-100%. These data suggest all three conditions had a similar effect on appropriate in-seat behavior.

When the authors determined that that the weighted vests did not have an impact on in-seat behavior, non-contingent reinforcements (NCRs) were applied as an additional intervention. The NCRs were objects identified as preferred for each individual student. The items included a piece of ribbon, a plastic spider, a small board book, a photo of the teacher, an empty water bottle and a chew tube. When NCRs were applied, no data overlap occurred.

The authors of this study found that NCR resulted in higher levels of in-seat behavior and that weighted vests were not effective. Thus, this study supported the use of NCR as opposed to weighted vests as a means of increasing the length of time of appropriate in-seat behavior.

Several limitations were identified during the course of this study. The target behavior was difficult to quantify, and observer bias could have affected results. Also, practitioners may define appropriate in-seat behavior differently, which can affect the external validity of the findings.

Quigley, Peterson, Frieder, and Peterson (2010) evaluated the effects of a weighted vest on the problem behavior of children with a diagnosis of ASD, Asperger's syndrome, or Pervasive Development Disorder (PDD). Stuart was a 6-year-old boy whose target behaviors included leaving the work area, destruction of property, throwing items, hitting, and screaming. Morty was a 12-year-old boy whose target behaviors included screaming, hand biting, hitting, and kicking. Ishmael was a 4-year-old boy whose target behaviors included screaming, leaving the work area, hitting, kicking, and biting. A brief functional behavior interview was completed to determine the target behaviors, preferences of the child, pertinent medical information, and

demographics. Preferred educational activities and toys were determined during the parent interview.

A mixed multi-element design embedded within each phase within an overall reversal design was implemented to examine the effects of wearing weighted vests on target behaviors across four conditions: escape, tangible, attention, and free-play. This multi-element design was implemented to examine the effects of multiple treatments (i.e., positive reinforcement conditions, negative reinforcement conditions and control conditions) separated across the different stimulus conditions. For each condition, children participated in videotaped sessions in an empty children's classroom at a university. The room contained tables, chairs, shelves with toys and educational tasks, teacher materials, and a camera on a tripod. Three trained observers recorded target aggressive and disruptive behaviors using a 10-s partial interval recording. The mean interobserver agreement for all sessions was 89%.

Following the functional behavior interview, the initial phase was implemented. During this phase, Stuart and Ishmael wore a vest with no weights in it. Contingent escape, contingent tangible, contingent attentions and free-play conditions were implemented to evaluate the function of the target behaviors. Marty did not wear a vest during baseline because he would not comply with putting on and keeping on the vest at the time.

Two types of weighted vests were used during the course of this study. A smaller weighted vest that was used for the younger children was made of cotton and was worn similar to a shirt. The vest had pockets in the front and in the back that allowed for weights to be deposited into them. A second, larger vest was worn by the older child and was a commercially made fitness vest that had 20 pockets for weight placement.

During the 0% vest phase, Stuart displayed elevated levels of target behavior during the escape and tangible conditions, he displayed higher levels of target behaviors when compared to the attention conditions. During the free-play and attention conditions, target problem behavior never occurred. While wearing the vest containing 10% of his body weight, Stuart's target behaviors during the escape and tangible conditions remained elevated, although problem behaviors during the tangible condition occurred at a higher rate than compared to the vest with no-weight phase. During both phases, Stuart's rate of target behavior continued to be fairly consistent. A slight increase in target behaviors was seen during the escape and tangible conditions across all phases

Ishmael demonstrated elevated levels of target behaviors in the escape and tangible conditions during the two no-weight phases when compared to the attention and free-play conditions. His target behaviors remained at 0% during the free play and attention conditions. During the first vest with 5% total body weight phases, Ishmael's target behaviors were elevated during the escape and tangible, while his problem behaviors remained at 0% during free play. During the second vest with 5% of total body weight phase, and increase in problem behaviors were observed during the escape and tangible conditions, while problem behavior remained at 0% of intervals during free play. During both of the vest with 10% total body weight phase, Ishmael's target behaviors were also elevated during the escape and tangible, while his problem behaviors stayed at 0% during free play.

During the no-vest phase, Morty's target behaviors never occurred during the free-play, attention, and tangible conditions. While wearing the vest with 10% of his body weight, Morty's target behaviors remained elevated during the escape conditions but remained at 0% during the free-play condition. The overall range of target behaviors increased during the escape condition

when the vest was removed, but during free play the frequency remained at 0%. Target behaviors remained stable during the second weighted vest phase (escape = 29%, free play = 8%). Morty also showed a slight upward trend in target behaviors across all phases.

These results demonstrate that target behaviors did not decrease for any of the three participants when wearing weighted vests. The researchers concluded the 5% and 10% weighted vests had no effect on decreasing target behaviors. Instead, they observed an increased trend in target behaviors during the study. The two limitations to this study were the lack of formal diagnosis of sensory deficits that specifically warrant a weighted vest and the absence of a trained occupational therapist to administer the interventions.

Reichow et al. (2010) examined the use of weighted vests on the task engagement of individuals with ASD. The three children with ASD selected for this study attended a university affiliated, inclusive early childhood center. All three children required one-on-one assistance with activities and making transitions. Tommy was a 5-year-old boy who displayed limited functional communication and imitated one-word utterances. Tommy's behaviors were stereotypic and rigid, and he engaged in activities for less time than his peers- typically 10 of the 25 one-min sessions. He infrequently attempted to interact socially and often escaped small-group activities. Bert was a 4-year-old boy with a developmental delay who was nonverbal but often responded to social or communicative intents by pointing or using non-speech vocalizations. Sam was a 5-year-old boy who exhibited lower levels of engagement and often needed redirection to remain engaged. Sam vocalized using two-three word utterances to make requests.

An alternating treatment design was used to evaluate the effects of wearing a weighted vest on the students' engagement. Three conditions were evaluated during morning table time

activities: (a) weighted vest, which consisted of 5% of the child's weight; (b) vest with no weight, which consisted of foam balls placed in the pockets of the vest; and (c) no vest. Each condition was assigned randomly over the 5 consecutive school days, and each condition was observed twice over those 5 days. Sessions were videotaped, and data were collected using 10 s momentary time samples during the first 10 min of the activity. To ensure a double blind study, the authors analyzing the data were not present when the vest was placed on the child. The mean interobserver agreement was calculated at 90% across all participants.

Five categories of behavior were coded while reviewing the videotaped session: (a) engagement, (b) non-engagement, (c) stereotypic behaviors, (d) problem behaviors, and (e) unable to see the child. The percentage of intervals noted as engaged had a similar decreasing trend for all three conditions, which indicated the weighted vest was not functionally related to engagement. The data suggests that the weighted vest was functionally related to increases in problem behavior because the percentage of intervals noted as problem behavior was greater when Tommy was wearing the weighted vest. Data also reveal a possible functional relationship between stereotypic behaviors and wearing the weighted vest, because the stereotypic behavior was lowest when the weighted vest was worn. Bert and Sam showed no systematic differences in engagement, stereotypic behaviors, or problem behaviors over all three conditions.

To assess social validity, 23 graduate students completed a questionnaire after viewing the observational video clips. The students perceived a decreased amount of stereotypic behavior for Tommy when he was wearing the weighted vest and thought that Bert had higher levels of stereotypic behavior while wearing the vest.

The findings of this study can be interpreted to conclude that weighted vests were not an effective intervention for increasing engagement for the three participants. The authors concluded the use of a weighted vest had no functional relation to changes in Bert's or Sam's behavior. Their level of engagement was not dependent upon wearing a vest; they were just as likely to engage in the activity when they did or did not wear the vest. One limitation of this study was that the inclusion criteria were narrow and probably do not represent the entire population of children diagnosed with ASD.

Hodgetts et al. (2010) investigated the effects of weighted vests on stereotypic behaviors in preschool and elementary aged children with ASD. They also tested the effects of weighted vests on heart rate.

The participants in this study were five boys and one girl between the ages of 4 and 10 years. Inclusion criteria were used to select the participants for this study that consisted of a confirmed diagnosis of ASD, attention-to-task difficulties, and a sensory modulation dysfunction as identified by a total score more than 2 standard deviations below the mean. Five children were nonverbal and one had delayed echolalia, but limited or no functional language.

This study was located in each child's self-contained classroom, which was specific to children with ASD. Each child was observed at the same time of day during his or her typical classroom fine-motor table-top activity. A commercially purchased weighted vest had two pockets for weights in the front and two in the back. The weights were made out of steel shots and placed in leather pouches. Each participant wore a vest with 5% of his or her body weight, except for Jack and Ian, who wore 10% per their parent's request. For the baseline phase, identical pouches containing small Styrofoam balls were used. Raters could not tell if a vest was

weighted based on appearance. Heart rate data was collected using a Polar Vantage XL heart rate monitor.

Stereotypic behaviors were defined as repetitive movements or behaviors that did not appear to serve an adaptive function. Identified target behaviors are defined in Table 6 for each participant.

Table 6

Summary of Participant Characteristics

	AGE	STEREOTYPIC BEHAVIOR	HEART RATE
Adam	8-0	Flicking Objects	Measured
Bobby	6-6	Hand and finger mannerisms, Flicking objects	Measured
Connor	10-1	Delayed echolalia	Not Measured
Hailey	3-11	Hand and finger mannerisms, spinning objects	Measured
Ian	5-6	Hand and finger mannerisms, flicking objects	Measured
Jack	6-4	Rocking, hand flapping	Not Measured

A withdrawal design was used in this study because it allowed for replication of effects within and across participants. Phase A consisted of 1 week without the vest. The authors monitored heart rate only to see if the equipment alone would affect the participant's behavior. Phase A was followed by Phase B (vest with no weights) for 2 weeks and Phase C (weighted vest) for 2 weeks. During Phase B and Phase C each participant wore their vest for about 20 min each day, at approximately the same times of day.

Each child was videoed individually three times during Phase A and five times during Phases B and C. However, only two videos were obtained for Hailey and Ian during Phase A. The primary rater, blinded to the treatment condition, used continuous 13-s interval observation to collect stereotypic behavior data. Interrater reliability averaged 74%, and treatment fidelity averaged 90%. Child and aide absences contributed the most to lack of fidelity.

Visual analyses were used to interpret behavioral data. Percent of non-overlapping (PND) data were used to support visual analysis and provide an objective interpretation of the results and are presented in Table 7. The standard deviation of each child's heart rate was calculated each day to determine if there was a difference in the variability of heart rate between baseline and treatment phases. Heart rate data are also shown in Table 7.

Table 7

Data Summary

	Change in Stereotypic Behavior	Average Percentage of Intervals Stereotyped Behavior	Change in Heart Rate Between Weighted and Unweighted phases	Average Heart Rate per Phase
Adam	No effect	No weight – 27% Weight - 20%	Increased 7 bpm PDN=70%	No weight – 104 Weight -111
Bobby	No effect	No Weight- 34% Weight – 32%	No effect PDN=10%	No weight –111 Weight -111
Connor	Decrease of 18%	No Weight-35% Weight – 17%	n/a	n/a
Hailey	No effect	No Weight- 11% Weight – 19%	No effect PDN=20%	No weight – 108 Weight - 111
Ian	No effect	No Weight- 26% Weight – 21%	No effect PDN=10%	No weight – 117 Weight - 119
Jack	No effect	No Weight- 43% Weight – 38%	n/a	n/a

Hodgetts et al. (2010) did not see a decrease in stereotyped behaviors in participants when wearing a weighted vest. The graphed data and PND statistics suggest the weighted vest did not decrease stereotyped behaviors but may have decreased Connor's verbal stereotyped behaviors. Data indicated that the weighted vest was associated with increasing heart rate in Adam, but based on visual analysis this effect was small. Weighted vests did not decrease heart rate variability.

A major limitation cited in this study was that a functional analysis of behaviors was not conducted. Therefore, it was not possible to determine the purpose of each child's behaviors.

Another limitation concerned the phase lengths which were established in accordance with school time constraints.

Hodgetts et al. (2011) investigated the effects of weighted vests on classroom behavior in children with ASD. They hypothesized that touch-pressure sensory input through a weighted vest would decrease off-task behavior and increase sitting time. They also hypothesized that teachers and educational assistants would view weighted vests as a tool to improve outcomes for students with autism.

This study consisted of 10 students between the ages of 3-10 years who were diagnosed with ASD and sensory modulation dysfunction. Six of the participants attended a preschool for children with developmental disabilities, three attended an elementary school program designed for students with ASD, and one participant was in a mainstream kindergarten class with the support of an aide.

The experiment took place in each participant's self-contained classroom, with the exception of the kindergartener who was in the kindergarten classroom during the experiment. Each of the participants were observed during the same time of day during a fine-motor table top activity. These activities were typical of students' class routines.

Three phases were implemented in this experiment: Phase A consisted of 1 week without the vest, Phase B consisted of 2 weeks with the student wearing the vest with no weights, and Phase C consisted of the student wearing a weighted vest with 5% of their body weight for 2 weeks. Each participant was videotaped individually during the table-top activity during all three phases to record off-task behavior using a 15-s interval recording system.

The primary observer was blinded to the treatment condition. A second observer was used to determine interrater reliability coefficients, which ranged from 68% to 90% and were

determined to be in the *good to excellent* category. Classroom aides also collected treatment fidelity data, which averaged 86% for nine participants and 55% for one participant. Student or aide absence was the most common reason for not wearing the vest, which disrupted the treatment fidelity.

Teacher impressions of restlessness, impulsivity, and emotional liability were measured at the end of each B and C phase using the 10-item *Conners' Global Index-Teacher* (CGI-T; Conners, 1997). *T*-scores higher than 65 were indicative of a clinically significant problem, and *t*-score changes of five or more points were viewed as significant treatment effects. After the study, all teacher and aides were asked to provide subjective impressions about the effects of the weighted vest for the children with whom they worked with throughout the study.

Visual data inspection and PND scores were used to analyze data. Results indicated that the weighted vest had no effect on sitting time for any of the eight participants. The weighted vest was effective in decreasing off-task behavior for Adam, Connor, and Evan, but was ineffective in decreasing off-task behavior for Bobby, Fabian, Grace, and Hailey. Overall, off-task behaviors showed considerable variability within and between phases for many of the participants. Specific data are presented in Table 8.

Table 8 also includes teacher behavior ratings, which did not align with data obtained from video observations of behavior. The CGI-T indicated improvements during weighted conditions for 45% of B and C phases. Although observational data showed that all participants had difficulty attending to task, this was not reflected in the CGI-T scores for four of the participants. David was the only participant for whom the CGI-T score corresponded with his behavioral results across all four phases.

Table 8**Objective and Subjective Data Summary**

	Average % of off-task intervals	Subjective Data: Was the weighted vest effective?	Subjective Data: For what purpose was the weighted vest effective?	Subjective Data: Should the weighted vest continue to be used?
Adam	No Vest: 72% Weight: 50%	Sometimes	Focus	Maybe
Bobby	No Vest: 80% Weight: 74%	Sometimes	Calm, Focus	Maybe
Connor	No Vest: 78% Weight: 52%	Yes	Calm, Focus	Yes
David	No Vest: 58% Weight: 43%	Yes	Sit better	Yes
Evan	No Vest: 69% Weight: 33%	Yes	Focus	Yes
Fabian	No Vest: 50% Weight: 60%	Sometimes	Focus	Maybe
Grace	No Vest: 60% Weight: 65%	Sometimes	Focus	Yes
Hailey	No Vest: 90% Weight: 95%	Yes	Wait and listen	Yes
Ian	No Vest: 80% Weight: 53%	Yes	Focus, more vocalizations	Yes
Jack	No Vest: 74% Weight: 60%	Yes	Sit better	Yes

When the authors examined all data sources, no participant showed positive effects across all indicators, but six participants (Adam, Connor, David, Evan, Ian, and Jack) showed positive effects across multiple indicators. Specifically, it appears that the off-task behavior of three participants decreased while wearing the weighted vest.

Several limitations were identified within this study. One limitation is that teachers were blinded to the treatment condition, but aides were not. This enabled the aides to directly relate

perceived outcomes to the weighted vest. Also, the participants of this study were quite homogeneous related to language levels, adaptive functioning, and cognitive abilities. This study also did not include a variety of data sources to capture the potential impact of weighted vests. The time constraints of the school district also limited findings because in some cases the authors switched phases prior to achieving stability during Phase B. The time constraint also put limitations on phase A, during which only two or three data points were taken.

Davis et al. (2013) examined the effects of long-term wear of weighted vests on Ashton, a 9-year-old Hispanic male who was aggressive and self-injurious and who scored in the severe range on the *Childhood Autism Rating Scale, Second Edition* (Schopler, Van Bourgondien, Wellman, & Love, 2010). Ashton had no verbal language and rarely vocalized, instead communicating primarily via behaviors and occasional gestures. He attended a self-contained special education classroom in a public school for 100% of his day.

The target behavior for this study was biting, which was both aggressive and self-injurious. Psychology graduate students collected data using a 10-s partial-interval procedure. Interobserver agreement was calculated at 96.3%.

All sessions were conducted in a small room within Ashton's special education classroom. The floor and walls were padded to prevent injury for students who engaged in challenging and destructive behavior. All data sessions were conducted in the afternoon, which allowed Ashton to wear the vest for 4 hours prior to each session, although he did not wear the weighted vest during the work sessions. Five sessions were conducted each day two or three times a week, depending on the participant's availability.

A counterbalanced design was embedded within an ABAB design to examine the influence of the weighted vest on challenging behavior. Two phases were conducted with the

weighted vest and two without the vest. Within each phase, four treatment conditions were alternated: demand, tangible, play, and alone. Vest wearing was not associated with any of the treatment conditions. That is, he sometimes wore the vest and sometimes did not. Data were reported only with regard to vest wearing, not treatment condition.

Data revealed the level of challenging behavior remained relatively stable across all phases of the study. Results showed that during the first no-vest phase, Ashton exhibited challenging behavior a mean of 12.2% of intervals. During the next weighted-vest phase, Ashton's challenging behavior increased to a mean of 20.4% of intervals. During the second no-vest phase, Ashton's challenging behavior increased to a mean of 29.8% of intervals. During the final weighted-vest phase, challenging behaviors decreased to a mean of 19% of intervals. Therefore, challenging behavior increased during the first weighted phase and decreased during the second weighted phase.

The authors concluded the weighted vest had no substantial effect on Ashton's challenging behaviors. However, they noted several limitations associated with this study. Specifically, because the observer was not blinded to the conditions of the phases of study, bias could have inadvertently occurred. In addition, the target behaviors were not measured during typical classroom activities, and a formal assessment of sensory needs was not conducted.

Summary

The 10 studies in this chapter evaluated whether weighted vests decreased stereotypic behaviors and increased attention-to-task behaviors in children with ASD. Table 9 presents a summary of these findings, which are discussed in Chapter 3.

Table 9**Summary of Chapter 2 Findings**

AUTHORS	PARTICIPANTS	PROCEDURES	FINDINGS
Fertel-Daly, Bedell, & Hinojosa (2001)	Three males and two females ages 2-4 with a diagnosis of PDD.	An ABA design was implemented: baseline, intervention (wearing a weighted vest), and post intervention. Data were collected while observing behavior during a 5-min motor activity after 1.5 hours of implementation.	Moderate effects were observed. All participants exhibited a decrease in the number of distractions and an increase in focused attention while wearing the vests.
Carter (2004)	4-year-old boy with a diagnosis of ASD	Alternating treatment functional analysis of SIB was used. 10-s partial interval recording was used	Weighted vest did not affect the levels of SIB in child.
Kane, Luiselli, Dearborn, & Young (2004)	Four children ages 8-11 years old: three children with ASD and one with PDD-NOS	Stereotypical behavior and attention to task were observed during 10-min sessions with the use of weighted vests, vests with no weights and no vest for the 10-11 sessions.	The use of weighted vests neither minimized stereotypical behaviors nor increased attention to task with the four children in this study.
Myles, Simpson, Carlson, Laurant, Gentry, Cook, et al. (2004)	Three students ages 3-5 years old with a diagnosis of ASD.	An ABAB design was implemented: On task behavior and duration of self-stimulation during activities were observed during base line and intervention.	No significant change was reported in two students, and the other students' mean time spent self-stimming was decreased from 19%-6%.
Cox, Gast, Luscre & Ayres (2009)	Three children 5-9 years old with ASD	A 10-s interval recording system was used to observe the three conditions: no vest, vest with no weights, and weighted vest.	Weighted vest, non-weighted vest, and no vest all had a similar effect on appropriate in-seat behavior.
Quigley, Peterson, Frieder, & Peterson (2010)	Four participants ages 4-12 with PDD	A 10-s partial interval recording system was used to observe the three conditions: no vest, vest with no weights, and weighted vest.	Problem behaviors were unresponsive to the weighted vest.
Reichow, Barton, Sewell, Good, & Wolery (2010)	Three children ages 4 and 5: 2 children with ASD and 1 with developmental delays	A 10-s momentary time sample was used to observe the three conditions: no vest, vest with no weights, and weighted vest.	Mixed effects were observed in one child, and the others had a few problem or stereotypic behaviors.
Hodgetts, Magill-Evans, & Misiakzek (2010)	8 boys and 2 girls between the ages of 3-10 years.	A multi element design was embedded in a withdrawn design under three conditions: without vest, vest with no weights, and vest with 5-10% of body weight.	No participant showed positive effects across all indicators, but six participants showed mixed results, with positive effects across multiple indicators. In 3 participants it appeared that the weighted vest had some effect in decreasing off-task behavior.

Table 9 (continued)

AUTHORS	PARTICIPANTS	PROCEDURES	FINDINGS
Hodgetts, Magill-Evans, & Misiakzek (2011)	5 boys and 1 girl ages 4-10 years	Heart rate data and behavior data were recorded in 5-s intervals during three phases: no vest, vest with Styrofoam balls, and weighted vest.	Stereotypic behaviors or heart rate did not decrease for any of the participant. Heart rate increased for one participant. One participant showed a decrease in verbal stereotypy.
Davis et al. (2013)	9-year-old male student with severe ASD	A multi-element design was embedded with an ABAB design (Weighted vest, no vest).	Results suggested the use of a weighted vest had no effect on challenging behavior.

Chapter 3: Conclusions and Recommendations

Children with autism spectrum disorders (ASD) have a number of sensory impairments that affect their ability to regulate their behaviors. Wearing a weighted vest has been viewed as one way to address sensory issues. The purpose of this starred paper was to evaluate if weighted vests are effective in decreasing stereotypic and challenging behaviors and increasing attention to task in children with ASD. Chapter 1 provided historical and theoretical information on this topic, and Chapter 2 presented a review of 10 studies that were conducted to examine the effects of weighted vests. In this chapter I discuss the findings of these studies, present recommendations for future research, and discuss implications for current practice.

Conclusion

The majority of the studies in Chapter 2 found no conclusive evidence that wearing a weighted vest has a positive effect on children's behavior. All of the studies were single subject designs, which is deemed to be appropriate due to the nature of the topic and the diversity of individuals with ASD.

Specifically, studies reported no effect on self-injurious behaviors (Carter, 2004) or aggression toward others (Davis et al., 2013; Hodgetts et al., 2010; Quigley et al., 2010). Two studies showed no effect on stereotypic behavior (Hodgetts et al., 2011; Kane et al., 2004). Three studies showed no effect on task engagement (Kane et al., 2004; Myles et al., 2004; Reichow et al., 2010). Cox et al. (2009) found no effect on in-seat behavior.

Two studies showed wearing a vest resulted in an increase in attention to task behavior (Fertel-Daly et al., 2001; Myles et al., 2004). Fertel-Daly et al. also found that wearing a vest decreased self-stimulatory behavior. Myles et al. (2004) found vest wearing decreased a child's pressure-seeking behavior.

Seven of the studies used weighted vests that contained 5% of the participant's body weight (Cox et al., 2009; Hodgetts et al., 2010; Hodgetts et al., 2011; Kane et al., 2004; Myles et al., 2004; Quigley et al., 2010; Reichow et al., 2010). Myles et al. and Quigley et al. used 5% of body weight for two participants and 10% of the body weight for the other participant. No effects were associated with different weights.

In two studies, the participant wore the weighted vest prior to the task and not during the task (Davis et al., 2013; Myles et al., 2004). The participant in the Myles et al. study showed a decrease in deep pressure-seeking behaviors. The participant in the Davis et al. study showed no substantial decrease in challenging behaviors.

Recommendations for Future Research

The use of weighted vests needs to be defined clearly and evaluated systematically for each participant. A functional analysis of the target behaviors should occur, desired outcomes should be defined, and outcomes should be systematically monitored. Continual data collection must occur and be continually monitored.

Future research needs to be conducted to establish recommended practices for how to use a weighted vest. Specifically, research needs to be conducted to determine the optimal amount of weight to be added to the vest because there are not standard guidelines for using weighted vests. The desired outcomes related to the use of weighted vests have been inconsistent across studies. The effects of wearing a weighted vest are unknown and all change in behavior should be measured in every study completed on the use of weighted vests.

Future studies should examine more closely issues related to effectiveness and non-effectiveness. Weighted vests do appear to decrease targeted behaviors in some students, but it does not work for the majority of students. What are the student characteristics associated with

effectiveness? Is it age, severity of behavior, the participant's weight, degree of sensory involvement, ASD characteristics, or other factors?

In my experience, some students with autism have verbalized the desire to have a weighted vest. Perhaps these are students who are higher functioning, and these students were not included in the studies I reviewed. It would be interesting to interview higher-functioning students to determine their perceptions of wearing weighted items.

Limitations

Although study limitations were identified in Chapter 2, it is important to address one major overall study limitation. Specifically, functional analyses were not conducted in these studies, which is critically important. If the target behavior is not related to a sensory need, it makes no sense to use the sensory intervention of a weighted vest. Future studies must address this issue, and trained occupational therapists should administer the intervention.

Implications for Current Practice

Teachers and educational teams must carefully evaluate the multitude of interventions that are purported to be effective in managing the challenging behaviors of students with ASD. Teachers are handed everything from trampolines, music therapy programs, and weighted vests, but are often not provided with implementation guidelines. Many times teachers simply “wing it” and hope for a positive effect to happen.

When I discussed my findings with our team's occupational therapist and other colleagues, they were shocked at the research that negates the use of weighted vests. They were not aware of the research and its findings. Even though educators must implement evidence-based interventions, the continued use of weighted vests suggests that research is not guiding our practice. Instead, we are following the current fad intervention.

After examining all of the above studies and knowing that there are a very limited number of studies, I do not feel enough research is conducted on weighted vests and how to use them appropriately. I currently do not have any students on my caseload with ASD, but if I were to use weighted vests in the future, I would be very systematic when using them. I would conduct a functional analysis prior to the use of a weighted vest and define objectives. I would collect evidence that demonstrates whether or not the weighted vest is successful in addressing the target behavior. Again, it may work for one student, but not for others.

Summary

With the legal and ethical responsibility to implement evidence-based practices, teachers and service providers have the responsibility to use interventions that are supported by research. Overall, weighted vests were not an effective treatment for the majority of students with ASD in the studies I reviewed. Educators and services providers should be cautious about their adoption of weighted vests and when they are used, and data must be collected to determine their effectiveness.

References

- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed. Text Revision). Washington DC: Author.
- BBB Autism Support Network. (2002). *Prompting and fading*. Retrieved from http://www.bbbautism.com/prompting_and_fading.htm.
- Carter, S. L. (2005). An empirical analysis of the effects of a possible sinus infection and weighted vest on functional analysis outcomes of self-injury exhibited by a child with autism. *Journal of Early Intervention and Intensive Behavior Interventions*, 2, 252-258.
- Case-Smith, J., & Bryan, T.(1999). The effects of occupational therapy with sensory integration emphasis on preschool age children with autism. *American Journal of Occupational Therapy*, 53, 489-497.
- Centers for Disease Control and Prevention. (2015). *Autism. Frequently asked questions: Prevalence*. Retrieved from <http://www.cdc.gov/ncbddd/autism/faq-prevalence.html>.
- Cox, A., Gast, D., Luscre, D., & Ayres, K. (2009). The effects of weighted vests on appropriate in-seat behaviors of elementary-age students with autism and severe to profound intellectual disabilities. *Focus on Autism and Other Developmental Disabilities*, 24, 17-26.
- Davis, T., Dacus, S., Strickland, E., Copeland, D., Chan, J., Blenden, K., ...Christian, K. (2013). The effects of a weighted vest on aggressive and self-injurious behaviors in a child with autism. *Developmental Neurorehabilitation*, 16, 210-215.
- Fertel-Daly, D., Bedell, G., & Hinojosa, J. (2001). Effects of a weighted vest on attention to task and self-stimulatory behaviors in preschoolers with pervasive development disorder. *The American Journal of Occupational Therapy*, 55, 629-640.

- Harker, C. M., & Stone, W. L. (2014). *Comparison of the diagnostic criteria for autism spectrum disorder across DSM-5, DSM-IV-TR, and the Individuals with Disabilities Education Act (IDEA) definition of autism*. Retrieved from <http://iris.peabody.vanderbilt.edu/wp-content/uploads/2014/09/ASD-Comparison-0922141.pdf>.
- Harris, S. L., & Wolcicj, S. A. (1979). Suppression of self-stimulation: Three alternative strategies. *Journal of Applied Behavior Analysis, 12*, 185-198.
- Hodgetts, S., Magill-Evans, J., & Misiaszek, J. (2010). Weighted vests, stereotypical behaviors and arousal in children with autism. *Journal of Autism and Developmental Disorders, 41*, 805-814.
- Hodgetts, S., Magill-Evans, J., & Misiaszek, J. (2011). Effects of weighted vests on classroom behavior for children with autism and cognitive impairments. *Research in Autism Spectrum Disorder, 5*, 495-505.
- Honaker, D., & Rossi, L. M. (2005). Proprioception and participation at school: Are weighted vests effective? *Sensory Integration Special Interest Section Quarterly, 23*, 1-9.
- Kane, A., Luiselli, J., Dearborn, S., & Young, N. (2005). Wearing a weighted vest as intervention for children with autism/pervasive developmental disorder. *The Science Review of Mental Health Practice, 3*, 19-24.
- King, M., & Bearman, P. (2009). Diagnostic change and the increased prevalence of autism. *International Journal of Epidemiology, 7*, 1224-1234.
- Marder, T., & Fraser, D. (2012). Evidence-based practices for special education teacher with autism. *New Horizons for Learning Journal*, Retrieved from <http://education.jhu.edu/PD/newhorizons/Journals/specialedjournal/MarderandFraser>.

- Minnesota Department of Education. (2015). *Autism spectrum disorder*. Retrieved from <http://education.state.mn.us/MDE/EdExc/SpecEdClass/DisabCateg/AutSpecDis/>.
- Myles, B. S., Simpson, R. L., Carlson, J., Laurant, M., Gentry, A. M., Cook, K. T., Earles-Volrath, T. (2004). Examining the effects of the use of weighted vests for addressing behaviors of children with autism spectrum disorders. *Journal of the International Association of Special Education*, 5, 47-59.
- Olson, L. J., & Moulton, H. L. (2004). Use of weighted vests in pediatric occupational therapy practices. *Physical and Occupational Therapy in Pediatrics*, 24, 45-60.
- Quigley, S. P., Peterson, L., Frieder, J. E., Peterson, S. (2010). Effects of a weighted vest on problem behaviors during functional analyses of children with pervasive developmental disorders. *Research in Autism Spectrum Disorders*, 5, 529-538.
- Reichow, B., Barton, E., Sewell, J., Good, L., & Wolery, M. (2010). Effects of weighted vests on the engagement of children with developmental delays and autism. *Focus on Autism and Other Developmental Disabilities*, 25, 1-9.
- Schaaf, R., & Miller, L. (2005). Occupational therapy using a sensory integrative approach for children with developmental disabilities. *Mental Retardation and Developmental Disabilities*, 11, 143-148.
- Schopler, E., Van Bourgondien, M., Wellman, G., & Love, S. (2010). *Childhood autism rating scale* (2nd ed.). Los Angeles, CA: Western Psychological Services.
- Scott, J. (2011). *Occupational therapy's role with autism*. American Occupational Therapy Association. Retrieved from www.aota.org.
- Triano, S. (2000). Categorical eligibilities for special education: The enrichment of the medical model in disability policy. *Disabilities Studies Quarterly*, 20, 1-9.

WebMD. (2015). *Autism spectrum disorder health center*. Retrieved from

<http://www.webmd.com/brain/autism/history-of-autism#1>.