2020

An Evaluation of Sensory Paths as an Antecedent Intervention for Decreasing Off-Task Behavior in Children with Disabilities During Small Group Instruction

Hannah Keene
University of Kentucky, hgi228@uky.edu
Author ORCID Identifier:
https://orcid.org/0000-0001-7373-6842
Digital Object Identifier: https://doi.org/10.13023/etd.2020.105

STUDENT AGREEMENT:

I represent that my thesis or dissertation and abstract are my original work. Proper attribution has been given to all outside sources. I understand that I am solely responsible for obtaining any needed copyright permissions. I have obtained needed written permission statement(s) from the owner(s) of each third-party copyrighted matter to be included in my work, allowing electronic distribution (if such use is not permitted by the fair use doctrine) which will be submitted to UKnowledge as Additional File.

I hereby grant to The University of Kentucky and its agents the irrevocable, non-exclusive, and royalty-free license to archive and make accessible my work in whole or in part in all forms of media, now or hereafter known. I agree that the document mentioned above may be made available immediately for worldwide access unless an embargo applies.

I retain all other ownership rights to the copyright of my work. I also retain the right to use in future works (such as articles or books) all or part of my work. I understand that I am free to register the copyright to my work.

REVIEW, APPROVAL AND ACCEPTANCE

The document mentioned above has been reviewed and accepted by the student's advisor, on behalf of the advisory committee, and by the Director of Graduate Studies (DGS), on behalf of the program; we verify that this is the final, approved version of the student's thesis including all changes required by the advisory committee. The undersigned agree to abide by the statements above.

Hannah Keene, Student

Dr. Justin Lane, Major Professor

Dr. Melinda Ault, Director of Graduate Studies

AN EVALUATION OF SENSORY PATHS AS AN ANTECEDENT INTERVENTION FOR DECREASING OFF-TASK BEHAVIOR IN CHILDREN WITH DISABILITIES DURING SMALL GROUP INSTRUCTION

THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science in the College of Education
at the University of Kentucky

By

Hannah Keene

Lexington, Kentucky

Director: Dr. Justin Lane, Professor of Special Education

Lexington, Kentucky

2020

https://orcid.org/0000-0001-7373-6842

ABSTRACT OF THESIS

AN EVALUATION OF SENSORY PATHS AS AN ANTECEDENT INTERVENTION FOR DECREASING OFF-TASK BEHAVIOR IN CHILDREN WITH DISABILITIES DURING SMALL GROUP INSTRUCTION

The purpose of this study was to evaluate the use of sensory paths as an antecedent intervention to decrease off-task behavior and increase on-task behavior in three elementary-aged participants with disabilities. A withdrawal design was used to evaluate the effectiveness of the intervention. The results are corollary due to the unintentional A-B design (schools closed during this time period). There is some evidence that the sensory path intervention was no more effective in decreasing off-task behavior and increasing on-task behavior than baseline conditions. Future research is needed to further investigate the sensory path intervention.

KEYWORDS: Moderate and severe disabilities, sensory integration, antecedent intervention, disruptive behavior

Hannah Keene

April 24, 2020

AN EVALUATION OF SENSORY PATHS AS AN ANTECEDENT INTERVENTION FOR DECREASING OFF-TASK BEHAVIOR IN CHILDREN WITH DISABILITIES DURING SMALL GROUP INSTRUCTION

By

Hannah Keene

Dr. Justin Lane
Director of Thesis

Dr. Melinda Ault
Director of Graduate Studies

April 24, 2020

TABLE OF CONTENTS

LIST OF FIGURES

Section 1: Introduction

Students receiving special education services typically require adapted and individualized instruction to remediate deficits or delays in socially-meaningful behaviors. While special education teachers are required to provide students access to the general education curriculum, they also are likely to promote adaptive behaviors that are both functional and academic in nature (Polloway et al., 1991). Promoting adaptive behaviors provides the student an opportunity to learn how to function independently, to the fullest extent possible, in typical environments (Ee & Soh, 2005). Students in special education who qualify for services under the Individuals with Disabilities Education Act (IDEA) typically receive 23,940 hours of instruction over 19 years of education (i.e., 7 hr for 180 school days across 19 years). Teachers must take advantage of the limited time they have to teach their students as many adaptive and academic skills as possible.

Research has demonstrated that including children with disabilities in general education classrooms has positive effects for both students with and without disabilities (Copeland & Cosbey, 2008). However, there is a disparity between the charge to include children with disabilities in general education classrooms and their genuine access to the general curriculum (Copeland & Cosbey, 2008). In fact, Dymond and Russell (2004) found that students with severe disabilities in third through fifth grades are less likely to spend time in the general education classroom than students with mild disabilities and are more likely to receive instruction from paraprofessionals rather than a special education teacher (Dymond & Russell, 2004). This is especially concerning given that access to the general curriculum has short- and long-term benefits for students, such as helping to prepare

students to live independent and meaningful lives outside of secondary school (Copeland & Cosbey, 2008).

While each student is unique, students who receive special educational services may display challenges related to learning. Examples of challenges include difficulty generalizing skills to novel environments, the need for multiple opportunities to learn when and how to respond during typical activities, and difficulty developing peer relationships (Copeland & Cosbey, 2008). The presence of challenging behavior can create even more of a barrier to learning. There is an extensive body of research demonstrating effective teaching strategies for students with disabilities who also struggle to retain and generalize new information. Some of these strategies include using multiple exemplars, training in an authentic environment (e.g., community-based instruction), using task analyses, and using visual supports (Copeland & Cosbey, 2008). The extent to which these strategies, and other evidence-based procedures, are implemented in general education classrooms are minimal. General education teachers use some evidence-based strategies but oftentimes do not use individualized strategies such as systematic instruction (e.g., single-prompt interventions, like constant time delay). The teachers report lack of administrative support and time constraints as two primary barriers to implementing research-based strategies (Browder & Cooper-Duffy, 2003).

Considering these factors, many teachers are faced with managing a classroom students who have diverse backgrounds and needs. Students who engage in problem behavior can make this task even more difficult for teachers. There are many reasons students engage in challenging behavior. Those reasons can include attempting to escape a non-preferred task or environment or unsuccessful attempts to clearly communicate a

need (Wood et al., 2018). With these challenges present, Allday et al. (2011) found that a disability label alone can produce lower ratings of students' behavior from preservice teachers.

There are multiple approaches to treating challenging behavior in the classroom setting. The science of Applied Behavior Analysis (ABA) has been used to create a large number of evidence-based interventions, resulting in positive outcomes for students who display challenging behavior. The science of operant (or voluntary) behavior is based on a four-term contingency, described by Skinner, in which antecedent events evoke a response or behavior that is followed by a consequent event (Cooper et al., 2007). Researchers have since conducted experimental analyses of adaptive and maladaptive behavior within the context of this paradigm. Many evidence-based instructional strategies, such functional communication training and antecedent based interventions, are all based on the foundational principles of behavior (The IRIS Center, 2016). Antecedent interventions can be considered preventative interventions. Wood et al. (2018) described three evidence-based antecedent strategies that educators can use to stop problem behavior before it begins. These are pre-session attention, high-probability requesting, and functional communication training. There is a strong evidence-base for the efficacy of these strategies in preventing and managing challenging behavior across a wide range of student ages and abilities. Pre-session attention is an antecedent intervention in which the teacher provides attention prior to instruction to decrease the student's motivation to engage in disruptive behaviors. High-probability requesting aims to increase compliance by rapidly instructing the student to engage in two to three high-probability demands (e.g., "Touch your nose.") immediately followed by a low-

probability demand (e.g., “Do the math problem.”). This strategy increases the rate of reinforcement for compliance which creates a “momentum” of compliant behaviors. Lastly, functional communication training is an evidence-based strategy that teaches a new, functional communicative response to replace challenging behavior in students with intellectual or developmental disabilities.

Another approach for treating challenging behavior, developed in 1972 by A. Jean Ayres, is sensory integration (SI). According to Schaaf and Miller (2005) this theory attempts to explain the potential “relationship between neurological processes of receiving, modulating, and integrating sensory input and the resulting output (i.e., adaptive behavior)” (p. 143). Based on principles of biology, neuroscience, psychology, and education, the theory asserts that when individuals have difficulty processing sensory information properly, their behavior and learning are negatively impacted. There are several tenets of the theory –

> First, sensorimotor development is an important substrate for learning. Second, the interaction of the individual with the environment shapes brain development. Third, the nervous system is capable of change (plasticity). Lastly, meaningful sensory-motor activity is a powerful mediator of plasticity (Schaaf & Miller, 2005, pp. 143-144)

Sensory integration therapy (SIT) includes a variety of concepts for intervening with students. Concepts include the “Active Sensory-Motor Experiences,” “The Just Right Challenge,” “The Adaptive Response,” “Active Participation,” and “Child-Direction.” These concepts seek to provide a student with sensory motor activities that are “rich in tactile, vestibular, and proprioceptive sensations…to tap into the child’s inner

drive to play…in which the child actively pursues achievable challenges." (Schaaf & Miller, 2005, p. 144). Furthermore, Schaaf and Miller (2005) explained how the SI approach seeks to engage the child through child-directed play with different, achievable challenges that are presented in order to promote new adaptive behavior and further the child's sensory development; this approach is "not a substitute for traditional classroom instruction" (p.144), as it does not teach new functional skills, but rather helps the individual better process sensory information, which ideally increases learning and adaptive behavior. In addition to the theory that has been proposed, some individuals with autism spectrum disorder (ASD) report challenges with processing sensory information (Schaaf & Miller, 2005). Proponents of this theory began implementing therapy strategies in practice before significant research was conducted citing newness of the field of occupational therapy and parents seeking intervention as primary causes. The efficacy of SIT is measured by changes in the individual's ability to participate in sensory activities, regulate arousal levels, engage in sensory motor skills, and independently function during daily activities (Schaaf & Miller, 2005).

In response to the SI approach, several empirical studies have been conducted. Barton et al. (2015) conducted a literature review of both group and single-case design research studies that evaluated sensory-based interventions dating back to 1977 when SI theory was initially proposed. After the initial search, 30 studies were included in the review with publications ranging from 1977 to 2013, and compared against contemporary guidelines for methodological rigor and evidence of effectiveness (What Works Clearinghouse, 2013). The results of the review provided limited support for sensory-

based interventions, stating “sensory based treatments are more likely to be ineffective than effective for children with disabilities” (Barton et al., 2015, p. 74)

Devlin et al. (2011) conducted a study that compared the effects of sensory integration therapy (SIT) and a behavioral intervention on rates of challenging behavior (e.g., aggression, self-injurious behavior) in four children between 6 and 11 year of age who were diagnosed with ASD and received school based occupational therapy. Sensory integration therapy was comprised of different combinations of a net swing, trampoline, therapy ball, beanbag, blanket, and a “chewy” tube, with all SIT sessions designed and prescribed by an occupational therapist. Behavioral interventions were designed based on the function of each participant’s challenging behavior. The study was designed using an alternating treatments design. The frequency of challenging behavior was measured throughout the entirety of the school day. Results of the study indicated the behavioral intervention was superior to the SIT in decreasing challenging behavior. In addition to measures of behavior, researchers collected daily saliva samples and analyzed their cortisol levels. Cortisol is often referred to as the “stress hormone” because it is secreted as part of the stress response. Cortisol levels were found to be relatively low across both sensory and behavioral intervention sessions indicating neither treatment produced an increase in biological stress levels.

Bonggat and Hall (2010) examined the effects of an SI intervention in preschool students who were developmentally delayed and who had been evaluated by an occupational therapist as having sensory deficits (e.g., tactile defensiveness). This study compared sensory-based interventions (e.g., brushing, oral swipes, wheelbarrow walking) to an attention control, where the implementors would, instead of providing the sensory

diet, spend the same amount of time engaging in interactive, child-led activities (e.g., puzzles, reading a book). The dependent variables of this study were attention to task and disruptive behavior during independent work stations and one-to-one instruction. Results showed sensory-integration interventions had no greater impact on the students' behaviors than the attention control. The authors noted that teacher attention delivered during one-to-one seemed to have the most impact on the students' behaviors. This study had many implications. Perhaps most importantly, this study gave evidence that positive interactions with rich attention between teachers and students were just as sufficient for decreasing disruptive behaviors and increasing time on task as other sensory-based interventions. Considering the feasibility of and likelihood that teachers are already engaging with their students in positive and engaging ways, this study negates the need for further sensory intervention.

There are several sensory-based interventions that attempt to stimulate vestibular and proprioceptive pathways in the brain to treat challenging behavior. These strategies include weighted vests, therapy balls, therapeutic horseback riding, and therapy cushions (Wan Yunus et al., 2015). Sensory paths are another movement-based strategy that may be recommended for students with an individualized education plan (IEP) according to a Ph.D. level occupational therapist who was consulted on September 17th prior to the study. Sensory paths are a new and emerging trend in schools that seek to increase focus and decrease off-task behavior by allowing students to engage in specific gross motor movements to reduce sensory need without overstimulating the student (thesensorypath.com). Sensory paths were first developed by a retired special education teacher in conjunction with occupational and physical therapists. Sensory paths are made

up of various symbols and shapes that are secured to the floor and wall, where each symbol signals the student to engage in a specific movement with the goal of decreasing sensory need so that the student's cognitive and behavioral functioning are improved (thesensorypath.com). One company, The Sensory Path, has patented sensory paths and currently charges $1,500 per path. Based on a review of the literature, there has yet to be any research that has specifically analyzed the efficacy of sensory paths in achieving the claims asserted by creators of The Sensory Path (e.g., better focus, less off-task behavior).

Due to the mixed nature of the results of applied studies that examined sensory-based interventions, at a minimum, further research is needed to attempt to validate the claims of the SI approach. It is important to empirically evaluate practices that are common in public school settings, including sensory-based interventions. Tzang et al. (2019) reported that despite the limited and inconclusive support for SI therapy, parents of children with disabilities may prefer SI therapy over other commonly recommended behavior management treatments because SI therapy is viewed as a non-stigmatizing strategy with feasible access to occupational therapists through insurance (Tzang et al., 2019).

The purpose of the current study is to evaluate the effects of sensory paths as a sensory-based antecedent intervention to decrease off-task behavior and increase on-task behavior. These behaviors align with the goals of SI therapy as they both reflect independent functioning during school tasks when students engage in them at the appropriate levels (Shaaf & Miller, 2005). This study attempted to determine if sensory

paths were an effective antecedent intervention for decreasing off-task behavior and increasing on-task behavior in students with disabilities during small group instruction.

Section 2: Research Question

Are sensory paths an effective antecedent intervention for decreasing off-task and increasing on-task behavior in children with disabilities during small group academic instruction?

Section 3: Method

Participants

Three elementary-aged participants were recruited for this study. Inclusion was based on the following criteria: (a) children were between 5 and 10 years of age; (b) received special education services, (c) identified by the classroom teacher as a participant who engaged in off-task behavior during small group instruction and for at least 20% of an observation (based on teacher report and observation), and the following prerequisites: (a) displayed gross motor skills that allowed for active participation in the sensory path (i.e., voluntary motor control, ambulatory, able to jump, roll), (b) had functional or corrected visual acuity, and (c) attended school 80% of school days within the last two months. To determine whether a participant met all the prerequisites to be included in the study, the researcher met with the special education teacher to gather information about participants in the classroom who may fit the list of prerequisites. After identifying potential participants (see *Screening* section), the researcher assessed each participant to see whether they were able to engage in various gross motor movements necessary for completing the sensory path. Then the researcher observed each participant to determine if they engaged in off-task behavior for at least 20% of the 10 min observation. After participants were identified, and prior to participation in baseline procedures, parental consent was obtained.

Alex was a 10-year-old male in the fourth grade who was eligible for special education services under the category of autism and spent less than 40% of the school day in the general education classroom. Alex primarily communicated using gestures and three to five word sentences. The Child Autism Rating Scale: 2nd Edition, Standard

Version (CARS2-ST) was used to evaluate characteristics related to Autism in Alex. His raw score corresponded with the "Mild to Moderate Symptoms of Autism Spectrum Disorder" category. The Vineland-III- Domain Level Teacher Rating Form revealed Alex's overall composite score to be well below average. Alex performed below average in all sections of the assessment (i.e., communication, daily living skills, socialization, motor skills). The Stanford Binet Intelligence Scales-Fifth Edition (SBV) was attempted in 2017 but was unable to be completed due to lack of responding by Alex. For this reason, a standard estimated intelligence quotient (IQ) could not be obtained. Some of Alex's strengths included his ability to identify all letters and letter sounds and the ability to write 80% of the alphabet with verbal prompting. He was able to count to 10 fluently and could write numbers 1-10 when verbally prompted. He was able to tell time using analogue and digital clocks. Additionally, Alex would occasionally initiate interactions with his teachers through eye contact, laughter, and one to two word mands. According to his IEP, Alex "demonstrates difficulty with sensory processing and sensory modulation skills." It was also reported that Alex's "sensory processing difficulties have a negative impact on his body regulation skills and his ability to process sensory information."

Claire was a 9-year-old female in the first grade that was eligible for special education services under the multiple disabilities category and spent less than 40% of the school day in the general education classroom. Claire communicated in complete sentences. Diagnoses included, cerebral palsy, attention-deficit/hyperactivity disorder, ASD, and cortical vision impairment. Claire was evaluated using the Vineland Adaptive Behavior Scales, Third Edition Comprehensive Teacher Form, in which her overall composite score was in the well below average range. She scored well below average in

all areas of the assessment (i.e., communication, daily living skills, socialization, motor skills). The SBV assessment was completed in April 2019 and estimated Claire's IQ to be 40 which was three standard deviations below the average. Claire had mastered identifying numbers 1-25 and was currently working on identifying numbers 26-30, tracing lines, and letter sounds. She required hand over hand prompting to write her name. Claire had strong social and communication skills and frequently interacted with others. She also demonstrated advanced play skills that included many different play schemas and imaginary play. She used a visual schedule and was able to complete task demands with support of a token system and earning a preferred reinforcer. According to Claire's IEP, she received school-based occupational therapy services to address delays in areas of fine motor, visual-motor, self-care, sensory, and bilateral coordination. The Sensory Processing Measure indicated Claire had difficulties in behavioral or sensory processing skills.

Landon was a 6-year-old male in kindergarten that was eligible for special education services under the Autism category and spent less than 40% of the school day in the general education classroom. Landon primary communicated by pointing, picture touch, and with one to two word utterances. Landon was also diagnosed with mild intellectual disability. Landon spent the first half of every day at his elementary school and the second half of his day receiving ABA services at a local clinic. For this reason, all of Landon's sessions were conducted during morning small group instruction time. Landon worked well in a one-to-one format. He demonstrated skills in sorting shapes, tracing letters, and identifying some sight words. Landon used a variety of visual supports (e.g., schedule, first/then) and responded well to positive reinforcement. In

addition to special education and ABA services, Landon received occupational therapy, speech therapy, and physical therapy. The Sensory Processing Measure (SPM)- Preschool Form was completed as part of his evaluation in 2017. Results showed Landon was exhibiting behaviors and actions that indicated dysfunction for all areas of sensory processing.

Instructional Setting and Arrangement

Sessions took place across two settings: the special education classroom and the sensory path located in a hallway in a different area of the school. During intervention conditions, the researcher led the participant to the hallway where the participant completed the sensory path. Observation sessions took place in the special education classroom during small group instruction. Small group instruction was defined as at least two participants, including the target participant, present during the instructional session. Small group instructional sessions took place at a table measuring approximately 1.52 meters by 0.91 meters. The special education teacher delivered instruction as she typically would on any goals that were listed on the participant's IEP. Other participants and paraprofessionals were also present in the classroom during observation sessions. The researcher sat within 1.5 meters of the target participant.

Materials/Equipment

The sensory path was purchased from an online retailer and installed by the researcher. In total, the path cost $150. The sensory path was made up of a path of various colorful two-dimensional shapes and symbols (e.g., bear paws, hand prints, spots) that were secured to the hallway floor and wall (Appendix E). The path occupied approximately 4.5 meters of the hallway (including the wall space). The shapes varied in

size ranging from 5 cm x 15 cm to 33 cm x 20 cm. A timer on the researcher's mobile phone was used to allocate the 5 min the participant was able to complete the sensory path and signal the end of the 5-min session. During observation sessions, the researcher used the Countee application to record data on the dependent variables. One use of this application allows data collectors to collect data on multiple target behavior using momentary time sampling (MTS). At the conclusion of a session, the application summarized data into a spreadsheet (sent via email).

Dependent Variables

There were two, mutually exclusive, dependent variables in this study. These were off-task behavior and on-task behavior. This required improved precision of measurement and was possible because of the ability to toggle between codes when observing behavior. The primary dependent variable of this study was the estimated duration of off-task behavior during small group instruction. The duration of off-task behavior was estimated using a momentary time sampling procedure via the Countee application (see Appendix D). Each session consisted of sixty 10 s intervals. At the end of each 10 s interval, the researcher tapped the off-task code if the participant was engaging in behavior that met their individual definition for off-task behavior. Off-task behavior was defined for all participants as engagement in any behaviors unrelated to the assigned task or ongoing activity. In addition to this broad definition, the researcher determined examples and non-examples of on-task behavior for each of the participants through teacher report and direct observations. Examples of off-task behavior for Alex included non-contextual vocalizations, looking away from materials, head on the desk, out of chair without permission, out of arms reach from the materials, leaning chair back

(at least two chair legs off the floor), tapping the table with finger and/or thumb, hitting the table with an open hand, hitting the table with an object, hitting self, and grabbing others. Non-examples included oriented toward materials/instructor, answering questions vocally, arms flat on table, leaves seat with teacher's permission. For Claire, examples included looking away from materials, head on the desk, oriented away from materials/instructor, out of chair without permission, out of arms reach from the table/materials, requesting to stop working (e.g., "I don't want to"), unrelated verbalizations ("hi sunshine"), requesting to go to the bathroom (task avoidance), and touching others without permission. Non-examples included handling fidget toys and looking at someone else who is answering a question. Examples of off-task behavior, for Landon, included looking around the room, head on the desk, engaging with materials inappropriately (pushing away, tossing), out of seat without permission, hands on floor (with bottom still in chair), out of arms reach from materials, and looking away from materials or instructor. Non-examples included following the teacher's instruction to stand, looking at another participant who was answering a question, knocking over blocks when instructed by the teacher. Small group instruction was defined as direct instruction where at least two participants, including the target participant, were present.

The secondary dependent variable of the study was the estimated duration of on-task behavior during small group instruction. The duration of on-task behavior was estimated using a MTS procedure via the Countee application. At the end of each 10 s interval, the researcher tapped the on-task code if the participant was engaging in behavior that met their individual definition for on-task behavior. On-task behavior was defined for all participants as engaging in any behavior for any period of time that

matches the ongoing small group instructional activities or teacher instructions. Examples of on-task behavior for Alex included vocally answering a question (even if an incorrect response), leaving seat with permission, tapping table to point to an answer, tapping instructional materials to answer a question, engaging in the assigned task while looking at the instructor, leaning back in chair with all chair legs on floor. Non-examples included requesting reinforcers (without being asked by teacher), engaging in assigned task but looking at something other than the materials or instructor. Examples of on-task behavior for Claire included talking about a relevant topic, sitting in the chair with feet off the floor, leaning head on arm on the table, oriented toward materials or instructor, vocally answering questions (even if an incorrect response), looking at materials or instructor, and looking at someone else who is answering a question. Non-examples included talking about unrelated topics/people (e.g., preferred toys/people who weren't present), oriented away from instructor or materials, touching another person's chair/wheelchair without permission. Examples of on-task behavior for Landon included being oriented toward materials and/or instructor, sitting in chair with feet off the ground, vocally answering questions (even if incorrect response), raising his hand to answer a question, getting out of his seat to walk to the board, following teacher instructions to leave seat or look away from materials. Non-examples included being oriented away from the instructor and/or materials, hands covering face, sliding under table, and getting out of the chair without teacher permission.

Experimental Design

This study used an A-B-A-B withdrawal design to evaluate the effectiveness of the intervention. The withdrawal design was selected since the target behaviors were

considered reversible behaviors. Additionally, there were not any significant ethical issues related to removing the intervention and the target behaviors did not pose a threat of danger to the target participants or others. The first condition of the withdrawal design was a baseline condition. This design was implemented across all participants. Decisions to proceed to the next condition were determined based on the level, trend, and stability of the data within conditions and data were visually analyzed between conditions (level, trend, stability, overlap, consistency of effect, immediacy of effect). A single A-B-A-B withdrawal design allows for three potential demonstrations of effect. Therefore, with three A-B-A-B designs, there were nine potential demonstrations of effect in this study. Several measures were implemented to strengthen the internal validity of the study. To control for the possibility of sampling bias, all participants who met the inclusion criteria were included in the study. To prevent procedural infidelity and instrumentation effects such as observer drift, the researcher reviewed all procedures and operational definitions with the IOA data collector before each session and condition change. Maturation can be a threat to internal validity when using withdrawal designs. To mitigate this threat, conditions were of sufficient length to establish data patterns but not longer than necessary (Ledford & Gast, 2018).

Screening Procedures

Gross motor movements were selected for screening because they are necessary for completing the sensory path during the intervention conditions. Target participants were screened to determine whether they were able to engage in gross motor movements that would be necessary for navigating the sensory path appropriately. Several physical movements were needed for participants to complete the sensory path. Participants were

required to walk, jump, crawl on their hands and feet, spin, squat, and roll while completing the sensory path (see Appendix A). Participants were vocally directed to demonstrate each motor movement during one session. Further, if a participant needed additional prompting, the researcher provided a model of each movement. Some students required partial physical guidance, provided by the teacher, to engage in the movements. Every participant was able to engage in every movement following a model and, in some cases, partial physical guidance.

General Procedures

During baseline conditions, the participants had no access to the sensory path and were observed in their special education classroom during small group academic instruction for 10 min sessions. During intervention sessions, the researcher and an instructional assistant took the target participant to the sensory path 10 min before small group instruction, a time selected for practical reasons such as transitioning back to the classroom. Only one participant was taken to the path at a time and then immediately observed. This was so there were no lengthy delays between completing the sensory intervention and observation. After completing the sensory path, the participant returned to their special education classroom for small group instruction where their behavior was observed by the researcher for 10 min sessions. Observation sessions occurred four days per week during morning and afternoon instruction times.

Procedures

Baseline procedures. During baseline sessions, the participants did not have access to the sensory path prior to small group instruction time. The researcher observed the target participant in their special education classroom during small group academic

instruction. First, the researcher walked into the classroom and answered any questions from the teacher. No further instructions or prompts were delivered. Using MTS with 10 s intervals, the researcher recorded whether the participant was on- or off-task at the end of each interval for the duration of the observation session. At the end of the session, the number of intervals marked as on task were divided by the total number of intervals to determine the estimated percentage of time the participant was on task (# of intervals on task/total intervals x 100). The same conversion was performed for intervals that were marked off-task. Participants navigated their schedule as usual during the baseline condition.

Intervention procedures. Intervention procedures were identical to baseline procedures with the addition of the sensory path for 5 min prior to small group instruction. About 10 min prior to instructional time, the researcher took the target participant, along with an instructional aide, to the sensory path. A timer was set for 5 min once the participant arrived at the sensory path. The timer was started, and the target participant was allowed 5 min to complete the path. After every 30 s of no or incorrect responding, the researcher provided support for the participant to engage in the sensory path with a verbal prompt (e.g., “Crawl like a bear.”). Participants required extensive verbal prompting during the 5 min sessions. There were no published or known guidelines available for promoting engagement with the sensory path. After the timer expired, the researcher walked with the participant back to their special education classroom to begin instruction and observation. A session initiated when the teacher began small group instruction. Each observation session was 10 min in duration.

Reliability

Reliability and fidelity data were collected by trained graduate students. Reliability observers were trained, didactically and through modeling, to use the Countee application to record behavioral data during in vivo practice observations until at least 80% reliability between observers was met. Interobserver agreement (IOA) and procedural fidelity (PF) data were collected during the first baseline condition for each participant, resulting in 20% of baseline sessions. During IOA sessions, data collectors approximately one meter from one another that they could not see how the other data collector coded intervals, but close enough to the target participant that their behavior was clearly observed. Interobserver agreement was evaluated immediately following the IOA session. Interobserver agreement for Alex during the first baseline condition was 93%. Interobserver agreement for Claire during the first baseline condition was 90%. Lastly, IOA for Landon during the first baseline condition was 97%.

Due to extenuating circumstances described in the results section, IOA was not collected during any sessions for the first intervention condition for Claire. Therefore, the minimum requirement of 20% of sessions with IOA was not met. Interobserver agreement was collected during the first session of the first intervention condition with Alex. This session was likely more susceptible to threats of procedural infidelity and instrumentation (i.e., observer drift). Before the session, the researcher reviewed procedures with the IOA data collector; however, the operational definitions for the target participant were not reviewed. As a result, some observer drift occurred and the IOA fell below the minimum requirement of 80% (i.e., 75%). Had this study continued, the IOA data collector and the researcher would have had a discussion about discrepancies and the

IOA data collector would have been retrained on another day. Interobserver agreement was calculated using point-by-point agreement (i.e., number of agreements divided by the number of agreements plus disagreements multiplied by 100) (Ledford & Gast, 2018).

Procedural fidelity data were collected on the same days as IOA. The PF data collector reported whether the researcher followed all the steps of the baseline and intervention procedures via a dichotomous data sheet (see Appendix B & C). During baseline, the implementor walked to the classroom, answered any teacher questions, provided no further prompting, and observed the target students during small group academic instruction. During intervention, the implementor walked to the classroom, took the target student (along with an aid) to the sensory path 10 min prior to instruction, started a five min timer after arriving at the sensory path, allowed the student to complete the sensory path, provided a verbal prompt (e.g., "Hop like a frog.") every 30 s of no or incorrect responding, returned to the classroom, answered any teacher questions, provided no further prompting, and observed the target student during small group academic instruction. To determine PF, the PF data collector attended at least 20% of all baseline sessions. Procedural fidelity was calculated with the following formula to determine the degree to which the researcher implemented procedures as planned: number of researcher behaviors observed divided by the number of researcher behaviors planned multiplied by 100 (Ledford & Gast, 2018). Procedural fidelity was 100% across all sessions in both baseline and intervention conditions.

Section 4: Results

Data were analyzed using five dimensions of visual analysis specific to single case experimental designs (SCED). Those dimensions included level of data in relation to

the ordinate, trend, stability, overlap in data, and immediacy of effect. The sixth dimension of visual analysis, consistency of effect, could not be determined because there were no instances of intra-participant replication that would serve as comparison to the conditions that were completed.

A within condition analysis was completed for each condition for each participant. That is, the data in each baseline and intervention condition were assessed for level, trend, and stability. Subsequently, a between condition analysis was completed for Alex and Claire, in which the immediacy of effect and overlap in data were assessed across the baseline and intervention conditions. This between condition analysis could not be completed with Landon since no intervention sessions were conducted.

Results of this study are only corollary since the study did not advance enough to include all four planned A-B-A-B conditions and thus, there were no instances of intra-participant replication. However, the data give some indication that the sensory path was no more effective in decreasing off-task behavior and increasing on-task behavior than the absence of the sensory path for the first two participants, Alex and Claire. These results do not extend to the third participant who was not able to advance to the first intervention condition. Condition change criteria were made a priori. Specifically, each condition for each participant would include a minimum of three data points. To change conditions, the data had to display low variability and a zerocelerating or contratherapeutic trend. The level of the data remained at or above that of the inclusion criteria (i.e., minimum 20% off-task behavior during small group instruction).

Initially, Alex displayed a variable pattern of responding during the baseline condition. For this reason, the baseline condition was extended to include four sessions.

The level of off-task behavior was never more than 43% of an observation session; thus, he was always on-task more than he was off-task. However, it is problematic for any student to be off-task at these levels. After four sessions, a contra-therapeutic trend was observed in the data path. It was then determined Alex could move to the first intervention condition in which he accessed the sensory path for 5 min before small group instruction. There was no abrupt or immediate change in the data. Both data points during the intervention condition overlapped with baseline data. There is also not enough data in the first intervention condition to determine trend or stability (Figure 1) which would aid in the visual analysis of a change in the data pattern (i.e., therapeutic trend).

Claire displayed relatively stable data during the first baseline condition. Similar to Alex, Claire was always on-task more than she was off-task. However, the level at which she was off-task was still problematic. Claire demonstrated a relatively stable trend during the first baseline condition. After three sessions, Claire moved into the first intervention condition, where there was no abrupt or immediate change in the data. During the first intervention session, Claire demonstrated slightly lower off-task behavior than displayed during baseline (23%). The second intervention session overlapped with baseline data for both off-task and on-task (33% and 67% respectively). Only two sessions were conducted in the first intervention condition, so trend and stability could not be determined (Figure 2).

As previously noted, all of Landon's sessions had to be conducted during morning instruction. Additionally, Landon was absent for two days during the study. For these reasons, only three sessions of baseline could be completed. Landon's baseline data were somewhat variable along the ordinate, with no identifiable trend (Figure 3). Landon

displayed data that was similar to the other two participants in regard to the level, trend, and stability of his baseline data compared to theirs. The level at which Landon was off-task during instruction was problematic. Data for each participant are graphed below.

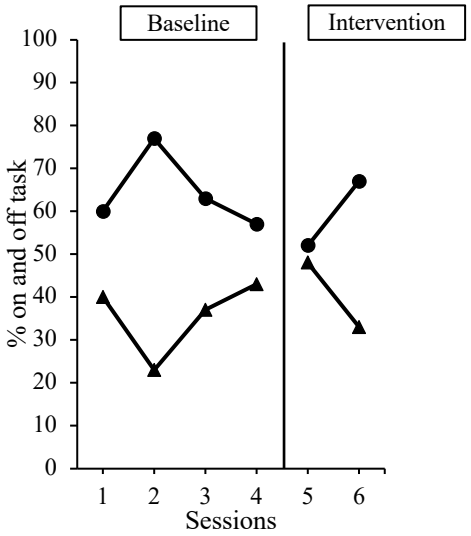


Figure 1. Baseline and intervention results for Alex. Closed circles represent the percentage of intervals on-task. Closed triangles represent the percentage of intervals off-task.

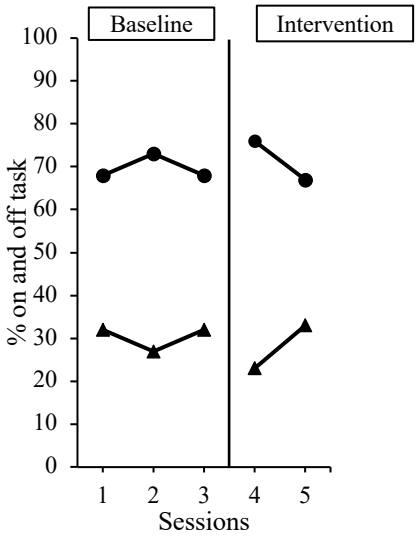


Figure 2. Baseline and intervention results for Claire. Closed circles represent the percentage of intervals on-task. Closed triangles represent the percentage of intervals off-task.

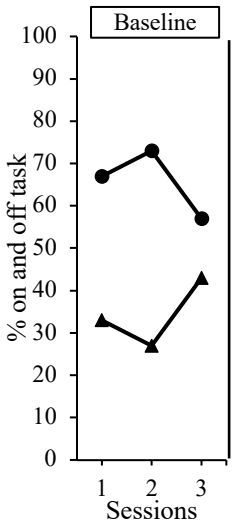


Figure 3. Baseline results for Landon. Closed circles represent the percentage of intervals on-task. Closed triangles represent the percentage of intervals off-task.

Section 5: Discussion

The purpose of this study was to evaluate the effects of a sensory path as an antecedent intervention to decrease off-task behavior and increase on-task behavior during small group academic instruction. Several single case studies have evaluated the SI approach in comparison with a behavioral approach to teaching (Lydon et al., 2017; Devlin et al., 2011). Since the SI approach is typically used with children with ASD, it seems that single case research design may be the most appropriate design considering how single case experimental designs allow for detailed evaluations of performance in children with low incidence disabilities across conditions. Pfeiffer et al., (2011) cites single case design as a limitation to SI research and recommend larger group designs to evaluate the efficacy of the SI approach but also acknowledge that the SI approach is individualized and interactive. Conversely, Lane et al., (2017) content that while "the extent to which findings from SCEDs are generalizable is oftentimes criticized", there is utility in replicating the effect of an intervention within and across participants, which adds greatly to the generality of the findings, rather than with "replication with two groups whose data have been combined" (Lane et al., 2017, p. 2). Group design research that has been conducted to evaluate the SI approach has revealed a number of Type II errors (i.e., false negative) and has not demonstrated statistically significant differences, even though some smaller changes have been achieved (Pfeiffer et al., 2011). Lane at al. (2017) provide guidelines for conducting research in occupational therapy within the standards of single-case experimental designs (Lane et al., 2017).

Sensory paths seem to be an increasingly popular trend in schools. According to the creator of The Sensory Path, use of sensory paths improve students' academic

performance and their willingness to participate in classroom activities by providing proper sensory input (thesensorypath.com). The founder suggests that the research behind sensory paths has been perfected which has led to the marketing of The Sensory Path. Considering that interventions that are based on the SI theory have not yet been deemed an established approach, it may be unethical to be marketing the paths in a way that suggests results are guaranteed. A sensory path from this retailer costs $1,500. It is not uncommon for schools to purchase more than one path for a single school. This cost, for an intervention that has not been proven effective, quickly adds up. It may be more prudent for schools to spend less on sensory-based interventions and in addition, fund behavior consultations for students that the teachers and administrators feel are not performing or participating in classroom activities at acceptable levels.

While any student may participate, sensory paths are often marketed and recommended for children with IEPs, more specifically, children with ASD who are also identified as having a sensory processing disorder. Some students will likely require explicit instruction and prompting to complete the path. A non-controlling prompt was used in this study; however, a modification to include a controlling prompt specific to each participant would have been added had the study continued. One who wishes to introduce a student to a sensory path should plan to provide systematic instruction to teach the student to use the path appropriately.

Based on the existing body of literature, it is anticipated that students are typically engaged for approximately 80% of the school day. This was not true for the participants in this study and was problematic for their learning. In addition to their off-task behavior limiting their opportunities for learning, sensory paths may also inadvertently reinforce

problem behaviors. While this study examined the use of sensory paths as a preventative intervention, they are often employed as consequent interventions. If teachers feel a student is becoming too disruptive, they may send the student to complete the sensory path to regulate their behavior. This could result in an increase in escape-maintained problem behaviors. Additionally, it would be difficult to discern whether positive outcomes of the sensory path were due to appropriate sensory input or if they resulted from access to rich adult attention which could satiate the student's desire to engage in problem behavior to access attention.

Limitations and Conclusions

This study was designed using an A-B-A-B withdrawal design. As a result of the COVID-19 outbreak crisis, this study could not be carried out to the extent that was planned. The school district in which this study was conducted was closed on March 16, 2020 which resulted in the abrupt halt in the progression of this study. Should this study resume, there will be at least a one-month break in the data for each participant contingent upon the reopening date of the school district. Only corollary conclusions are possible at this point (A-B design).

Another limitation of this study involves the lack of IOA and PF data for Claire's intervention sessions. The researcher planned to collect the data at the next session but was unable due to the immediate closure of the school system. Along the same lines, the failure to reach the minimum required 80% for IOA for Alex's intervention session poses a limitation to this study. Reduced IOA indicates the observers may have drifted from the operational definitions established for the participant. In the future, operational definitions will always be reviewed immediately before the start of a session.

To conclude, the SI theory still lacks rigorous evidence to support the efficacy of such interventions. Future research should compare the efficacy and efficiency of function-based antecedent interventions and sensory interventions to determine which intervention is effective and most efficient in decreasing off-task behavior and increasing on-task behavior during small group instruction. Additionally, it is important to include professionals who are knowledgeable about the SI approach whenever possible to ensure interventions are being implemented as intended by proponents of the theory and to avoid questions regarding the validity of the research.

Appendix A: Screening Data Sheet

Date: Participant Initials: Screening session	
Movements	Correct (+) Incorrect (-)
Walk	
Jump	
Squat	
Roll on side	
Crawl on hands and feet	
Spin	
Percent Correct /6 x 100 %	

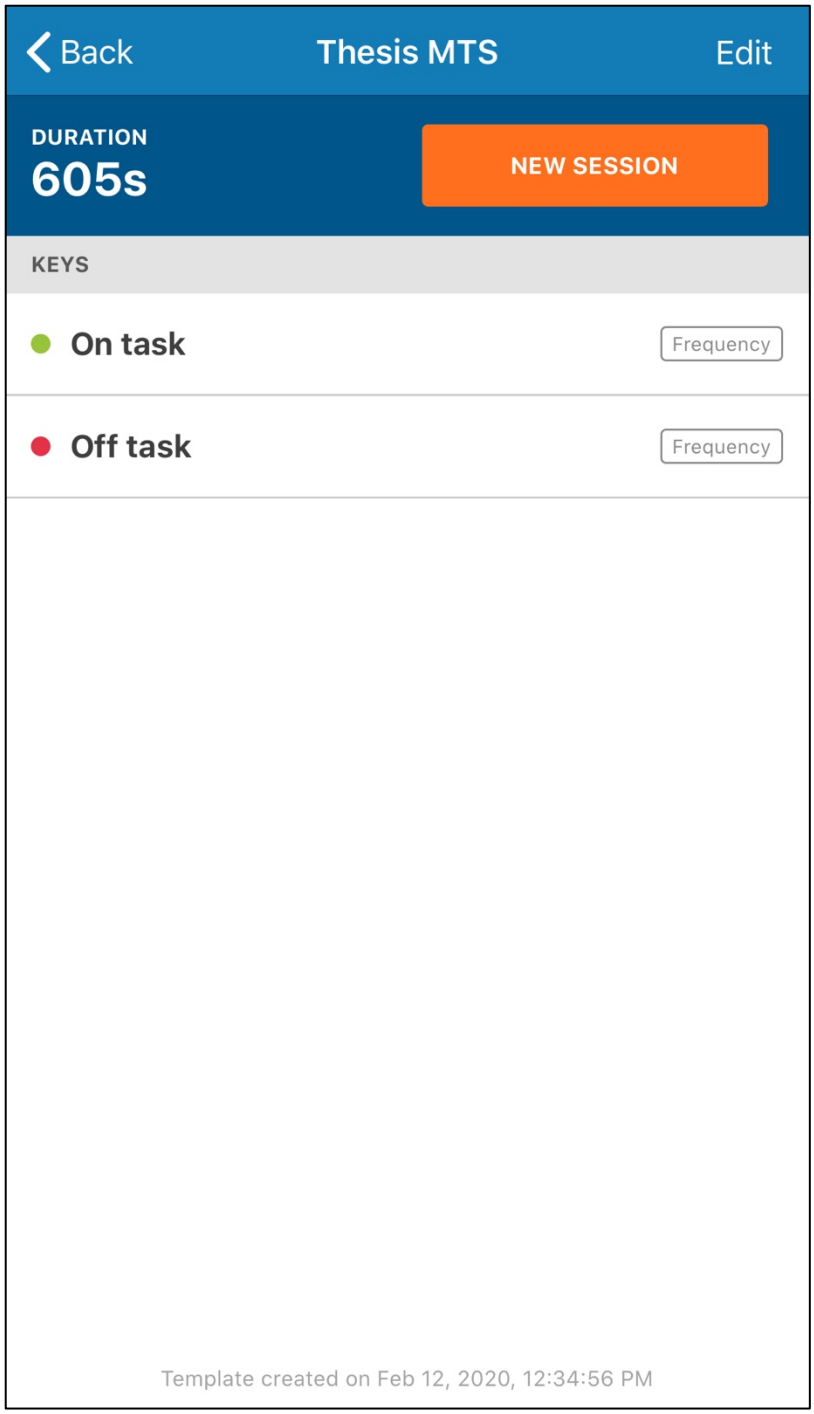
Appendix B: Baseline Procedural Fidelity Data Sheet

Date: Secondary Data Collector: Participant:	
	Correct (+) Incorrect (-)
Did not take student to sensory path	
Provided no prompts	
Observed during academic small group instruction	
	Percent Correct / 3 x 100 %

Appendix C: Intervention Procedural Fidelity Data Sheet

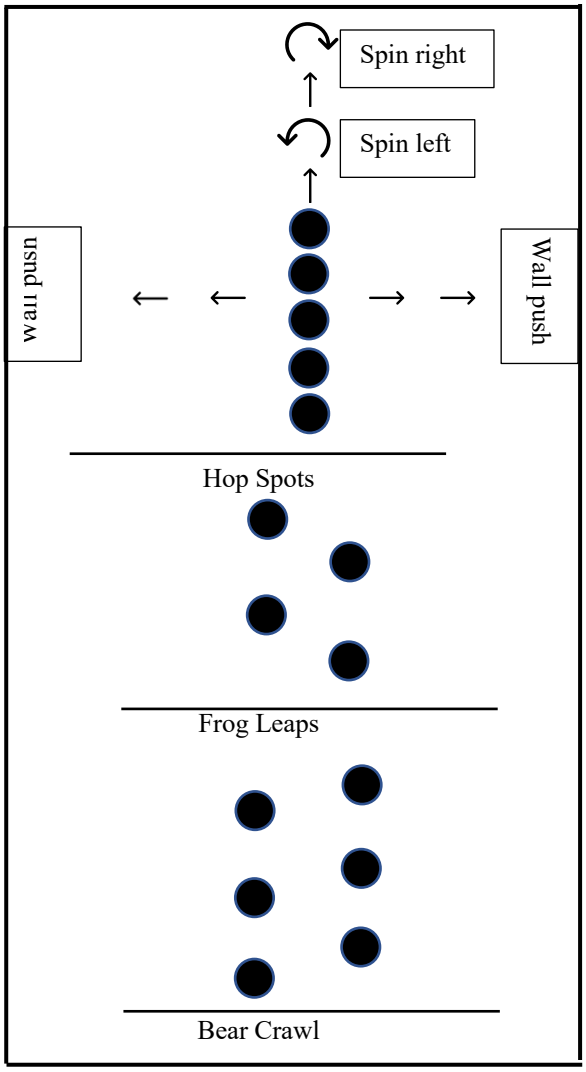
Date: Secondary Data Collector: Participant:	
	Correct (+) Incorrect (-)
Took participant out of class 10 min early	
Walked to sensory path	
Started timer	
Prompted participant to engage in path after 30 s of no activity	
Allowed participant to complete path	
Returned to special education classroom	
Entered classroom	
Answered teacher questions	
Provided no further prompting	
	Percent Correct / 9 x 100 %

Appendix D: Countee Application



Appendix E: Sensory Path Diagram

Finish



Start

References

Allday, R. A., Duhon, G. J., Blackburn-Ellis, S., & Van Dycke, J. L. (2011). The Biasing Effects of Labels on Direct Observation by Preservice Teachers. *Teacher Education and Special Education*, *34*(1), 52–58.

Barton, E., Reichow, B., Schnitz, A., Smith, I., & Sherlock, D. (2015). A systematic review of sensory-based treatments for children with disabilities. *Research in Developmental Disabilities*, *37*, 64-80.

Bonggat, P. W., & Hall, L. J. (2010). Evaluation of the effects of sensory integration-based intervention by a preschool special education teacher. *Education and Training in Autism and Developmental Disabilities*, *45*(2), 294–302.

Browder, D. M., & Cooper-Duffy, K. (2003). Evidence-based practices for students with severe disabilities and the requirement for accountability in "no child left behind." *Journal of Special Education*, *37*(3), 157–163.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied behavior analysis* (2nd ed.). Upper Saddle River, NJ: Merrill

Copeland, S. R., & Cosbey, J. (2008). Making progress in the general curriculum: rethinking effective instructional practices. *Research & Practice for Persons with Severe Disabilities*, *33/34*(4–1), 214–227.

Devlin, S., Healy, O., Leader, G., & Hughes, B. (2011). Comparison of behavioral intervention and sensory-integration therapy in the treatment of challenging behavior. *Journal of Autism and Developmental Disorders*, *41*(10), 1303-1320.

Dymond, S., & Russell, D. (2004). Impact of grade and disability on the instructional context of inclusive classrooms. *Education and Training in Developmental Disabilities, 39*(2), 127-140.

Ee, J., & Soh, K.C. (2005). Teacher perceptions on what a functional curriculum should be for children with special needs. *International Journal of Special Education*, *20*(2), 6–18.

Lane, J.D., Ledford, J. R., & Gast, D. L. (2017). Single-case experimental design: Current standards and applications in occupational therapy. *American Journal of Occupational Therapy*, *71*, 7102300010p1–7102300010p9.

Ledford, J., & Gast, D. (2018). Single case research methodology: Applications in special education and behavioral sciences (3rd ed.). Routledge.

Lydon, H., Healy, O., & Grey, I. (2017). Comparison of behavioral intervention and sensory integration therapy on challenging behavior of children with autism. *Behavioral Interventions*, *32*(4), 297–310.

Pfeiffer, B. A., Koenig, K., Kinnealey, M., Sheppard, M., & Henderson, L. (2011). Effectiveness of sensory integration interventions in children with autism spectrum disorders: A pilot study. *American Journal of Occupational Therapy*, *65*(1), 76–85.

Polloway, E. A., Patton, J. R., Smith, J. D., & Roderique, T. W. (1991). Issues in program design for elementary students with mild retardation: Emphasis on curriculum development. *Education and Training in Mental Retardation, 26,* 142-150.

Schaaf, R. C., & Miller, L. J. (2005). Occupational therapy using a sensory integrative approach for children with developmental disabilities. *Mental Retardation and Developmental Disabilities Research Reviews*, *11*(2), 143–148.

The IRIS Center. (2016). *Autism spectrum disorder (part 2): Evidence-based practices*. Retrieved from https://iris.peabody.vanderbilt.edu/module/asd2/

The Sensory Path. *The Sensory Path*, http://thesensorypath.com/

Tzang, R.-F., Chang, Y.-C., Kao, K.-L., Huang, Y.-H., Huang, H.-C., Wang, Y.-C., Muo, C.-H., Wu, S.-I., Sung, F.-C., & Stewart, R. (2019). Increased risk of developing psychiatric disorders in children with attention deficit and hyperactivity disorder (ADHD) receiving sensory integration therapy: A population-based cohort study. *European Child & Adolescent Psychiatry*, *28*(2), 247–255.

Wan Yunus, F., Liu, K. P., Bissett, M., & Penkala, S. (2015). Sensory-based intervention for children with behavioral problems: A systematic review. *Journal of Autism and Developmental Disorders*, *45*(11), 3565–3579.

What Works Clearinghouse (2020). What works clearinghouse standards handbook (Version 4.1). Retrieved from https://ies.ed.gov/ncee/wwc/Docs/referenceresources/WWC-Standards-Handbook-v4-1-508.pdf

Wood, C. L., Kisinger, K. W., Brosh, C. R., Fisher, L. B., & Muharib, R. (2018). Stopping behavior before it starts: Antecedent interventions for challenging behavior. *Teaching Exceptional Children*, *50*(6), 356–363.

Vita

Hannah Keene

Morehead State University 2014-2018
Bachelor of Science in Psychology
University of Kentucky 2018-2020
Master of Science in Applied Behavior Analysis (expected)